

FOREST TREE INSECT CONTROL

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INSECT	MANAGEMENT RECOMMENDATION	REMARKS AND PRECAUTIONS
Ambrosia beetles in hardwoods	<i>pyrethroids, emamectin benzoate</i>	
in pine	no effective control measures	Secondary invaders of dead or dying pine trees. Applying insecticides will not save the tree.
Aphids	<i>acephate, carbaryl, dimethoate, dinotefuran, esfenvalerate, fipronil, imidacloprid, pyrethrins, thiamethoxam</i>	<i>Acephate</i> can damage red maples during periods of rapid growth.
Bagworm	<i>acephate, bifenthrin, BT, carbaryl, diflubenzuron, domethoate, emamectin benzoate, esfenvalerate, lambda-cyhalothrin</i>	Treat when bagworms are small and repeat applications in 10 days if necessary and specified by the product label.
Boxelder bug	<i>acephate, carbaryl, chlorpyrifos, esfenvalerate,</i>	
Caterpillars	<i>acephate, bifenthrin, BT, carbaryl, chlorpyrifos, diflubenzuron, dimethoate, dinotefuran, emamectin benzoate, esfenvalerate, lambda-cyhalothrin, spinosad, tebufenozide, thiamethoxam, phosmet</i>	Check label for target pest-specific instructions.
leafminers	<i>acephate, carbaryl, chlorpyrifos, diflubenzuron, dimethoate, dinotefuran, emamectin benzoate, esfenvalerate, imidacloprid, spinosad, thiamethoxam, phosmet</i>	Contact insecticides may not reach leafminers in their tunnels and should only be used early in the season. Systemic insecticides should be used if damage is already apparent.
webworms	<i>acephate, bifenthrin, BT, chlorpyrifos, diflubenzuron, emamectin benzoate, esfenvalerate, lambda-cyhalothrin, pyrethrin</i>	Contact insecticides should be applied when caterpillars and webbing are small. Webbing caterpillars can be removed by hand and caterpillars destroyed.
Elm bark beetle	no practical chemical control measures	Maintain tree health to prevent beetle susceptibility.
Emerald ash borer	<i>dinotefuran, emamectin benzoate, imidacloprid, spinosad,</i>	Contact insecticides should be applied to foliage when adult beetles are active. Systemic insecticides should be applied to the trunk or soil, as recommended by the label.
Foliage feeding beetles	<i>chlorpyrifos, spinosad, thiamethoxam</i>	Apply when beetle larvae first appear.
Hardwood borers	<i>chlorpyrifos, dinotefuran, emamectin benzoate, esfenvalerate, imidacloprid, permethrin</i>	Contact insecticides should be applied to trunks when adult beetles are active. Systemic insecticides should be applied to the trunk or soil, as recommended by the label.
Hemlock woolly adelgid	<i>bifenthrin, dinotefuran, imidacloprid, thiamethoxam</i>	Contact insecticides should be applied to foliage when crawlers are present. Systemic insecticides should be applied to the trunk or soil, as recommended by the label. For specific <i>imidacloprid</i> dosing see: www.warnell.uga.edu/sites/default/files/publications/WSFNR-17-01%20Benton_0.pdf

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Lacebugs	<i>acephate, bifenthrin, carbaryl, chlorpyrifos, dinotefuran, esfenvalerate, thiamethoxam</i>	
Pales weevil	<i>lambda-cyhalothrin</i>	Apply early in the spring. Most Pales weevil activity can be reduced by careful timing of seedling planting.
Pine bark beetle		Maintain tree health to prevent beetle susceptibility.
Ips engraver beetles	<i>emamectin benzoate</i>	Systemic treatments may be effective as a preventative in high value trees.
Black turpentine beetle	<i>bifenthrin</i> and <i>chlorpyrifos</i>	Apply contact insecticides to the lower 12 feet of the pine trunk. Repeat applications as specified by the product label.
Southern pine beetle	no chemical recommendation	Contact the Georgia Forestry Commission if you suspect a SPB infestation.
Pine borers	no chemical recommendation	Secondary invaders of dead or dying pine trees. Applying insecticides will not save the tree.
Pine tip moth	<i>acephate, bifenthrin, carbaryl, diflubenzuron, dimethoate, dinotefuran, imidacloprid, lambda-cyhalothrin, spinosad, tebufenozide, fipronil</i>	Contact insecticide applications must be timed to coincide with presence of early instar caterpillars. Systemic insecticides are often applied to seedlings before planting.
Sawflies	<i>acephate, carbaryl, emamectin benzoate, esfenvalerate, imidacloprid, lambda-chalothrin, spinosad, tebufenozide, thiamethoxam</i>	
Scales	<i>acephate, carbaryl, dinotefuran, esfenvalerate</i>	Contact insecticides are most effective when applied to crawlers.
Hard scales (only)	<i>dinotefuran, insecticidal oil</i>	
Soft Scales (only)	<i>bifenthrin, thiamethoxam</i>	

INSECTICIDE ¹	RESTRICTED USE	MOA	LABELED USES	REI (Hours/Days)	MAXIMUM APPLICATION RATE	INSTRUCTIONS	PESTS LISTED ON LABEL
<i>acephate</i>	No	1B	Ornamentals	24 H	Not Listed	0.4–0.8 fl oz of product mixed with water for a 10 gallon dilute solution ²	aphids, bagworms, leafminers, lace bugs, tent caterpillar, tussock moth, gypsy moth, webworms, scales (crawlers), cankerworms, pine tip moth, root weevils, boxelder bugs, budworms, sawflies, elm leaf beetle
<i>bifenazate</i>	No	20D	Christmas Trees	12 H	1 application/yr	1.2–1.6 fl oz of product mixed with water for a 10 gallon dilute solution	numerous spider mite species see label
<i>bifenthrin</i>	No	3A	Ornamentals	not listed	Not Listed	0.54–4.35 fl oz of product mixed with water to a 10 gallon dilute solution ²	bagworm, elm leaf beetles, webworms, gypsy moth, lace bugs, leaf feeding caterpillars, tent caterpillars, adelgids, aphids, soft scales, pine needle scale crawlers, pine tip moth, twig borers, weevils
<i>Bacillus thuringiensis</i> (Bt)	No	11A	Ornamentals	4 H	Not Listed	4 tsp (¾ fl oz) of product mixed with water for a 1 gallon dilute solution	bagworm, spring cankerworm, fall cankerworm, gypsy moth, tent caterpillar, elm spanworm, fall webworm, hemlock looper
<i>carbaryl</i>	No	1A	Ornamentals Trees	12 H	3 qt/A/yr	24–32 fl oz of product mixed with water for a 10 gallon dilute solution ²	bagworm, balsalm twig aphid, boxelder bug, cypress tip moth, Douglas-fir tussock moth, eastern spruce gall adelgid, elm leaf aphid and beetle, european pine shoot moth, gall wasps, lace bugs, pine tip moth, oak leafminers, oak moth, oak skeletonizers, pine looper, pine sawfly, pine spittlebug, pitchpine tip moth, spruce budworm, sawflies, scale insects (crawlers), tent caterpillars, webworms, gypsy moth, engraver beetles, roundheaded pine beetles
<i>chlorpyrifos</i>	Yes	1B	Ornamentals	24 H	1 qt/A/yr	0.8–3.2 fl oz of product mixed with water for a 10 gallon dilute solution ²	adelgids (not HWA), aphids, bagworms, boxelder bugs, cankerworms, webworms, lace bugs, puss caterpillars, sawflies, caterpillars, tent caterpillars, oakworms, foliage feeding beetles, borers, leafminers
<i>cyflumetofen</i>	No	25A	Forests Nurseries Ornamentals Plantations	12 H	minimum—100 gal solution/A maximum seasonal rate—27.4 fl oz of concentrate product per growing cycle, maximum of two applications/yr	0.137 fl oz of product mixed with water for a 10 gallon dilute solution	numerous spider mite species—see label
<i>diflubenzuron</i>	Yes	15	Forests Ornamentals Christmas Trees	12 H	Number of applications per crop listed on the label	0.5–4 fl oz of product mixed with water for a 5–30 gallon dilute solution ²	bagworms, budworms, cankerworms, gypsy moth, hemlock looper, leafminers, oakworms, pine shoot moth, pine tip moth, sawflies, tent caterpillars, tussock moths, webworms, root weevils, terminal weevils

- Carefully read all product labels to ensure use of the appropriate active ingredient.
- Rate depends on target pest. Consult product label.
- Rate depends on number of trees per acre—see label for specific instructions.

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INSECTICIDE ¹	RESTRICTED USE	MOA	LABELED USES	REI (Hours/Days)	MAXIMUM APPLICATION RATE	INSTRUCTIONS	PESTS LISTED ON LABEL
<i>dimethoate</i>	Yes	1B	Ornamentals Christmas Trees Seed Orchards	10 D	2 pts/A/application and 6 pts/A/yr	Specific application instructions based on target pest—consult product label	aphids, bagworm, leafminers, scales, European pine shoot moths, pine tip moth, leaf beetles, Hackberry budgall, nipplegall, psyllid mites *Label lists pests specific to tree species
<i>dinotefuran</i>	No	4A	Ornamentals	12 H	78.9 fl oz of product/A/yr	Soil application: 0.2-0.8 fl oz concentrate per inch of DBH, mix with an appropriate amount of water, consult label for specific mixing instructions	adelgids, flatheaded borers, emerald ash borer, roundheaded borers, scales, whiteflies, lace bug leaf beetles, leafminers, pine tip moth, root weevils, aphids
<i>emamectin benzoate</i> Tree-äge	Yes	6	Trees	N/A	N/A	For trunk injections only: Use as formulated or dilute with 1 part product to 1–3 parts water. ²	pine coneworm, pine cone seed bug, tent caterpillars, western spruce budworm, bagworm, fall webworm, gypsy moth, mimosa webworm, oak worm, tussock moth, leafminers, honeylocust pand bug, pine needle scale, red palm mite, sawfly, clearwing borers, flat-headed borers, round-headed borers, engraver beetle, EAB. Ambrosia beetles, walnut twig beetle, black turpentine beetle (see 2(ee) label).
<i>esfenvalerate</i>	Yes	3A	Ornamentals Trees	not listed	not listed	0.4–0.8 oz mixed with water for a gallon dilute solution	aphids, bagworms, balsalm woolly adelgid, beetles, borers, boxelder bug, caterpillars, gypsy moth, sawflies, lace bugs, leaf miners, pine chafers, pine coreid bugs, scales, spider mites, tent caterpillars, webworms
<i>fenazaquin</i>	No	21A	Christmas Trees	12 H	24 fl oz product/A/yr	1.2–2.4 fl oz mixed with water for a 10 gallon dilute solution	mites
<i>imidacloprid</i>	No	4A	Ornamentals Forests	12 H	1.6 pts concentrate/A/yr	Soil drench: 0.1-0.4 fl oz concentrate per inch DBH. Concentrate should be diluted with water *Rates depend on size of tree—consult the label or see the following document for specific HWA treatment instructions: warnell.uga.edu/sites/default/files/publications/WSFNR-17-01%20Benton_0.pdf	adelgids, aphids, armored scales, flatheaded borer, emerald ash borer, lace bugs, leaf beetles, leafhoppers, leafminers, pine tip moth, roundheaded borers, sawfly larvae, scales, whiteflies
<i>lambda-cyhalothrin</i>	Yes	3A	Nurseries Ornamentals Plantations	24 H	30.72 fl oz or 1.92 pt of product/A/yr	2.56–5.12 fl oz product/A Mix with sufficient amount of water to obtain full coverage.	bagworm, plack pine weevil, elm leaf beetle, gypsy moth, Japanese beetle, June beetles, leaf beetles, leaf rollers, pales weevil pine chafer, pine conelet bug, pine needle scale, pine sawfly, pine tip moth, pine tortoise scale, pine weevils, sawflies, spittlebugs, tent caterpillars, webworms

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<i>permethrin</i>	Yes	3A	Ornamentals	12 H	not listed	3.2–16 fl oz of product mixed with water for a 10 gallon dilute solution ²	clearwing borer, bark beetles, bronze birch borer, flatheaded appletree borer
<i>pyrethrins</i>	No	3A	Ornamentals Trees	not listed	not listed	2.5 fl oz of product mixed with water for a 1 gallon dilute solution	aphids, flea beetle, leafhopper, beetles, webworms
<i>spinosad</i>	No	5	Ornamentals Plantations	4 H	58 fl oz concentrate/A/yr	Ornamentals: 0.6–2.2 fl oz of product mixed with water for a 10 gal dilute solution * Tree farms/plantations: 6–16 fl oz/A	leaf feeding beetles, lepidopterous larvae, sawfly larvae, leafminers, emerald ash borer, pine tip moth, spider mites
<i>spirodiclofen</i>	No	23	Christmas Trees	12 H	24 fl oz/A/yr	1.2–2.4 fl oz of product mixed with water for a 10 gallon dilute solution ²	mites, whiteflies
<i>paraffinic oil/ horticultural oil</i>	No		Forests Ornamentals Trees	4 H	Spray no more than 4 consecutive sprays, not to exceed sprays once every 2 weeks.	Consult label for specific instructions	aphids, scales, spider mites, leafminers, adelgids, sawflies, webworm
<i>tebufenozide</i>	No	18	Christmas Trees	4 H	16 fl oz/A/yr	4–8 oz of product mixed with water for a 10 or 50 gallon dilute solution ²	bagworms, elm spanworm, cankerworms, fall webworm, gypsy moth, hemlock looper, budworm, puss caterpillar, tent caterpillars, pine tip moth, Simmerman pine moth, tussock moth
<i>thiamethoxam</i>	No	4A	Ornamentals	12 H	17 oz by weight/yr for soil applications	Mix 0.07–0.14 oz by weight in a minimum of 16 fl oz water for every inch DBH	adelgids, aphids, lace bugs, flea beetles, Japanese beetle adults, leaf beetles, leafminers, mealybugs, root aphids, rood weevil, sawflies, soft scales, spittle bugs, tent caterpillars, thrips, whiteflies
<i>fipronil</i>	Yes	2B	Christmas Trees Forests	24 H	21 fl oz concentrate/A/yr	0.5–1.0 fl oz mixed with water for a 200–600 fl oz dilute solution ³	Nantucket pine tip moth, pine bark aphid
<i>phosmet</i>	No	1B	Trees	Consult label	No more than 3 applications per growing season	Mix a 1-pound packet with water for a final volume of 110 gallons	birch leaf miner, elm spanworm, spring cankerworm, gypsy moth, Japanese beetle, eastern tent caterpillar

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FOREST HERBICIDES

HERBICIDE	APPLICATION RATE	REI/PHI (Hours or Days)	REMARKS & PRECAUTIONS
HERBICIDES FOR SITE PREPARATION			
<i>sulfometuron methyl</i> + <i>metsulfuron methyl</i> Oust Extra	Broadcast/A 3–4 oz	4 H/ —	Can be tank mixed for site prep for spring 1st year herbaceous weed control. Add 0.25% by volume surfactant for improved control. For loblolly, longleaf and slash pine. Use lower rates on coarse textured loamy sands and sandy loam soils; and higher rates on fine textured sandy clay loam and silty clay loam soils. Do not apply to soils with a pH above 6.2.
<i>sulfometuron methyl</i> Oust XP	Broadcast/A 2–8 oz	4 H/ —	Can be tank mixed commonly at 3–4 oz/A for site prep and applied with <i>glyphosate</i> , <i>triclopyr</i> or <i>imazapyr</i> site preparation herbicides in the late summer after August 15, or fall to provide herbaceous weed control in the following spring growing season. Refer to site preparation labels for appropriate tank mix rates.
<i>glyphosate</i> Rodeo 5.4 lb ai/gal	Broadcast/A 1.5–7.5 qt Spot spray to wet at 0.75–2% and low volume direct spray at 5–10%	4 H/ —	Rodeo is typically used in/near aquatic environments as it has no surfactant. If used for site prep, a nonionic surfactant must be used with Rodeo. For surfactants with more than 50% ai, mix 2 qt surfactant/100 gal of spray solution. For surfactants less than 50% ai mix 4 qt surfactant/100 gal spray solution. Apply to actively growing trees, brush, and weeds after full leaf expansion and before fall color and leaf drop. Aerial broadcast—apply 5–30 gal/A spray volume; ground broadcast—apply 10–60 gal/A spray volume; direct/spot spray—spray to wet foliage.
<i>glyphosate</i> Various trade names 4 lb ai/gal	Broadcast/A 2–10 qt Spot spray to wet at 0.75–2% and low volume direct spray at 5–10%	4 H/ —	Check specific labels for surfactant requirements and mix rates. Do not use this formulation as an over-the-top pine release treatment as damage to desired conifers will occur. Apply to actively growing trees, brush and weeds after full leaf expansion and before fall color and leaf drop. Aerial broadcast—apply 5–30 gal/A spray volume; ground broadcast—apply 10–60 gal/A spray volume; direct/spot spray—spray to wet foliage.
<i>hexazinone</i> Velpar L 2 lb ai/gal	Broadcast/A 4–10 qt	48 H —	Spring application to control hardwoods (from bud break to full leaf expansion). Primarily soil active. Rate/acre based on soil texture: Coarse textured soils: 4–6 qt/ac, medium textured soils 6–8 qt/ac, fine textured soils 8–10 qt/ac. Apply at 10–30 gal/A spray volume. Used primarily on coarse textured soils due to higher rates needed, increased costs on medium and fine textured soils and other labeled herbicide products are available (<i>imazapyr</i> , <i>triclopyr</i> , and <i>glyphosate</i>).
<i>hexazinone</i> Velpar DF 75% ai by weight	Broadcast/A 2.67–6.67 lb/A	48 H —	Spring application to control hardwoods (from bud break to full leaf expansion). Primarily soil active. Rate/acre based on soil texture: Coarse textured soils: 2.67–4.0 lbs/A, medium textured soils 4–5.33lb/A, fine textured soils 5.33–6.67 lb/A. Completely dissolve the dry flowable powder and keep agitated. Apply at 10–30 gal/A spray volume. Used primarily on coarse textured soils due to higher rates needed, increased costs on medium and fine textured soils and other labeled herbicide products are available (<i>imazapyr</i> , <i>triclopyr</i> , and <i>glyphosate</i>).
<i>imazapyr</i> Chopper Gen2, Polaris SP, Rotary 2SL 2 lb ai/gal	Broadcast 32–64 oz/A	12 H —	<i>Imazapyr</i> in the 2 lb/gal ai does have a surfactant in the formulation. Good broad spectrum control of most woody shrubs and trees, grasses, broadleaf weeds, and vines. Will not control blackberry, elms, pines, eastern baccharis, and most legumes. Applied from May–October (prior to hardwood leaf color change). Rate is dependent on application and planting timing. General rules of thumb for wait time between applying Chopper Gen2 (2 lb ai/gal) or Arsenal (4 lb ai/gal) especially on sandy surface textured soils that are well to excessively well drained and lower than normal rainfall after the <i>imazapyr</i> application: wait 3 months to plant after a 48 oz/A Chopper Gen2 or 24 oz/A Arsenal application. Wait 2 months to plant after a 32 oz/A Chopper Gen2 or 16 oz/A Arsenal application.
<i>imazapyr</i> Arsenal, Polaris AC, Imazapyr 4SL 4 lb ai/gal	Broadcast/A 16–32 oz/A	12 H —	<i>Imazapyr</i> products with 4 lb/gal ai do not have a surfactant. For site prep add 0.25% nonionic surfactant, crop oil, or MSO (1% V/V). Good broad spectrum control of most woody shrubs and trees, grasses, broadleaf weeds, and vines. Will not control blackberry, elms, pines, eastern baccharis, and most legumes. Applied from May–October (prior to hardwood leaf color change). Rate is dependent on application and planting timing. General rules of thumb for wait time between applying Chopper Gen2 (2 lb ai/gal) or Arsenal (4 lb ai/gal) especially on sandy surface textured soils that are well to excessively well drained and lower than normal rainfall after the <i>imazapyr</i> application: wait 3 months to plant after a 48 oz/A Chopper Gen2 or 24 oz/A Arsenal application. Wait 2 months to plant after a 32 oz/A Chopper Gen2 or 16 oz/A Arsenal application.
<i>triclopyr ester</i> Garlon 4 Ultra, Element 4, (4 lb/gal ae) Forestry Garlon XRT (6.3 lb/gal ae)	Broadcast 2–3 qt/A	12 H —	<i>Triclopyr</i> is used for control of most woody and hard to control waxy leaf shrubs but will not kill most established grasses. It is usually tank mixed with <i>imazapyr</i> in the flatwoods to control wax myrtle, titi, gallberry, <i>Vacciniums</i> , and other hard to control waxy leaf woody shrubs. Application timing is from mid-July into October. Caution: when temps above 86° F volatilization may cause damage to non-target trees or adjacent crops. Garlon 4 Ultra and Forestry Garlon XRT can injure or kill nearby crops or trees when applied at temps greater than 86 degrees F.

HERBICIDE	APPLICATION RATE	REI/PHI (Hours or Days)	REMARKS & PRECAUTIONS
HERBICIDE TANK MIXES FOR SITE PREPARATION			
<i>triclopyr</i> Garlon 4 Ultra + <i>imazapyr</i> Arsenal AC, Polaris AC, Imazapyr 4 SL	Broadcast/A 1–3 qt + 16–24 oz	12 H/ —	Conifers planted sooner than 2–3 months after treatment may be injured. Garlon 4 Ultra and Forestry Garlon XRT can injure or kill nearby crops or trees when applied at temps greater than 86 degrees F. Caution: when temps above 86° F ester/oil formulation of Garlon volatilization may cause damage to non-target trees or near-by crops. General rules of thumb for wait time between applying Chopper Gen2 (2 lb ai/gal) or Arsenal (4 lb ai/gal) especially on sandy surface textured soils that are well to excessively well drained and lower than normal rainfall after the <i>imazapyr</i> application: wait 3 months to plant after a 48 oz/A Chopper Gen2 or 24 oz/A Arsenal application. Wait 2 months to plant after a 32 oz/A Chopper Gen2 or 16 oz/A Arsenal application.
<i>imazapyr</i> + <i>glyphosate</i> OneStep	Broadcast/A 1 gal	12 H/ —	Premixed blend of 0.625 lb ae <i>imazapyr</i> and 2 lb ai <i>glyphosate</i> (equivalent to 40 oz of Chopper Gen2 herbicide or 20 oz of Arsenal AC Applicators Concentrate herbicide and 2 qt of <i>glyphosate</i>). Apply June 15 through October (prior to leaf drop) for hardwood, grass and briar control. General rules of thumb for wait time between applying Chopper Gen2 (2 lb ai/gal) or Arsenal (4 lb ai/gal) especially on sandy surface textured soils that are well to excessively well drained and lower than normal rainfall after the <i>imazapyr</i> application: wait 3 months to plant after a 48 oz/A Chopper Gen2 or 24 oz/A Arsenal application. Wait 2 months to plant after a 32 oz/A Chopper Gen2 or 16 oz/A Arsenal application.
<i>picloram</i> + 2, 4-D Tordon 101M* + <i>glyphosate</i>	Broadcast/A 6 + 10 qt 3 + 5 qt	48 H/ —	Allow at least 6 months after treatment before planting pines. <i>Picloram</i> is known to leach through soil into groundwater and can contaminate surface water through spray drift. 2,4-D has properties and characteristics associated with chemicals detected in groundwater. 2,4-D can injure or kill nearby crops or trees when applied at temps greater than 85 degrees F. * Restricted use pesticide
<i>picloram</i> + 2,4-D Tordon 101M* + <i>imazapyr</i> Arsenal AC, Polaris AC, Imazapyr 4 SL	Broadcast/A 6–10 qt + 16–24 oz	48 H/ —	Allow at least 6 months after treatment before planting pines. <i>Picloram</i> is known to leach through soil into groundwater and can contaminate surface water through spray drift. 2,4-D has properties and characteristics associated with chemicals detected in groundwater. 2,4-D can injure or kill nearby crops or trees when applied at temps greater than 85 degrees F. * Restricted use pesticide
<i>fosamine</i> Krenite S 4 lb ai/gal + <i>imazapyr</i> Arsenal AC, Polaris AC, Imazapyr 4 SL	Broadcast/A 2–6 qt + 8–20 oz	12 H/ —	Special Local Need 24(c) labeling for pine plantations in the state of Georgia. For control of residual loblolly pine seedlings and hardwoods during site preparation. Controls ash, blackberry, blackgum, black locust, boxelder, cherry, dogwood, elms, oaks, red maple, sassafras, and sourwood. Apply as a foliar spray from mid- to late-summer before hardwood leaf color change occurs. General rules of thumb for wait time between applying Chopper Gen2 (2 lb ai/gal) or Arsenal (4 lb ai/gal) especially on sandy surface textured soils that are well to excessively well drained and lower than normal rainfall after the <i>imazapyr</i> application: wait 3 months to plant after a 48 oz/A Chopper Gen2 or 24 oz/A Arsenal application. Wait 2 months to plant after a 32 oz/A Chopper Gen2 or 16 oz/A Arsenal application.
<i>saflufenacil</i> Detail X	2–6 fl oz/A	12 H —	For control of wilding pines in site preparation. For best wilding pine control apply Detail X herbicide with a <i>glyphosate</i> herbicide + surfactant (MSO at 1% v/v). Treat during active pine growth in late spring to early fall. Apply at least 15 GPA by aerial application and 25 GPA by ground to ensure thorough spray coverage. DO NOT plant tree seedlings within 2 months after herbicide application. Recent research (2015–2020) using 2 oz/ac Detail + <i>glyphosate</i> for volunteer pine control is best applied in July in AL, GA and MS
<i>aminopyralid</i> Milestone 2 lb ae/gal	7 oz/A	48 H/ —	For control of residual pine seedlings, add a nonionic surfactant. Tank mix with other forest herbicides to provide control of woody brush not susceptible to Milestone.
<i>triclopyr</i> Garlon 4 Ultra & generics + <i>picloram</i> + 2,4-D Tordon 101M*	Broadcast/A 2–4 qt + 6–8 qt	48 H/ —	Allow at least 6 months after treatment before planting pines. Garlon 4 Ultra and Forestry Garlon XRT can injure or kill nearby crops or trees when applied at temps greater than 86 degrees F. <i>Picloram</i> is known to leach through soil into groundwater and can contaminate surface water through spray drift. 2,4-D has properties and characteristics associated with chemicals detected in groundwater. 2,4-D can injure or kill nearby crops or trees when applied at temps greater than 85 degrees F. * Restricted use pesticide
<i>triclopyr</i> Garlon 4 Ultra & generics + <i>picloram</i> Tordon K*	Broadcast/A 2–4 qt + 2–2.5 qt	48 H/ —	Allow at least 6 months after treatment before planting pines. Garlon 4 Ultra and Forestry Garlon XRT can injure or kill nearby crops or trees when applied at temps greater than 86 degrees F. <i>Picloram</i> is known to leach through soil into groundwater and can contaminate surface water through spray drift. * Restricted use pesticide

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HERBICIDE	APPLICATION RATE	REI/PHI (Hours or Days)	REMARKS & PRECAUTIONS
HERBICIDE TANK MIXES FOR SITE PREPARATION (continued)			
<i>glyphosate</i> various trade names 4 lb ai/gal + <i>picloram</i> Tordon K*	Broadcast/A 3–5 qt + 2 qt/A	48 H/ —	Woody brush, trees, and herbaceous weeds, mix 2 or more quarts of a nonionic surfactant per 100 gal of spray solutions. Apply tank mix solution at 20–40 gal/A with ground application, or 10–20 gal/A by aerial (helicopter only) application. Allow 6 months after treatment before planting pine seedlings. <i>Picloram</i> is known to leach through soil into groundwater and can contaminate surface water through spray drift. * Restricted use pesticide
<i>glyphosate</i> various trade names 4 lb ai/gal + <i>imazapyr</i> Arsenal AC, Polaris AC, Imazapyr 4 SL	Broadcast/A 3–6 qt + 16–24 oz	12 H/ —	Use lower rates for herbaceous weed control. Higher rates for dense stands or hard to control brush and trees. Use a nonionic surfactant, mix 2 or more quarts of nonionic surfactant per 100 gal spray solution. Ground application-spray 20–40 gal of tank mix per acre; aerial (helicopter application-spray 10–20 gal tank mix/A. Apply after full leaf expansion until start of fall color. General rules of thumb for wait time between applying Chopper Gen2 (2 lb ai/gal) or Arsenal (4 lb ai/gal) especially on sandy surface textured soils that are well to excessively well drained and lower than normal rainfall after the <i>imazapyr</i> application: wait 3 months to plant after a 48 oz/A Chopper Gen2 or 24 oz/A Arsenal application. Wait 2 months to plant after a 32 oz/A Chopper Gen2 or 16 oz/A Arsenal application.
<i>glyphosate</i> various trade names 4 lb ai/gal + <i>sulfometuron methyl</i> Oust Extra	Broadcast/A 2–5 qt + 3–4 oz	4 H/ —	Mix 2 or more quarts nonionic surfactant per 100 gal. of spray solution. Ground application—apply 20–40 gal/A. tank mix; aerial (helicopter) application—apply 10–20 gal/A tank mix. Treat after full leaf expansion until start of fall color. Loblolly and slash pine only. Provides herbaceous weed control in the following spring.
<i>sulfometuron methyl</i> Oust Extra + <i>imazapyr</i> Arsenal AC, Polaris AC, Imazapyr 4 SL	Broadcast/A 3–4 oz + 14–24 oz	12 H/ —	This mix controls cherry, dogwood, elms, oaks (red and water), persimmon, sassafras, sweetgum, and suppresses hickory. Loblolly and slash pines may be transplanted in treated areas in the planting season following application. Provides herbaceous control the following spring.
<i>hexazinone</i> Velpar L + <i>metsulfuron methyl</i> + <i>sulfometuron methyl</i> Oust Extra	Broadcast/A 1–2.5 gal + 3–4 oz	48 H/ —	Apply in late spring to early summer to point of full leaf expansion. Loblolly and slash pines may be transplanted in treated areas in the planting season following application. Velpar rates are dependent on soil texture. Follow label for specific rates on treatment area.
<i>metsulfuron methyl</i> Escort XP + <i>imazapyr</i> Arsenal AC, Polaris AC, Imazapyr 4 SL	Broadcast/A 1–2 oz + 10–24 oz	12 H/ —	Controls ash, black gum, cherry, hawthorn, honeysuckle, hophornbeam, persimmon, oaks (red, white and water), sassafras, sweetgum, and <i>Vacciniums</i> . Suppresses blackberry, dogwood, elms, hickory, and red maple. Loblolly and slash pines may be transplanted in treated areas in the planting season following application.
<i>glyphosate</i> various trade names 4 lb ai/gal + <i>triclopyr</i> Garlon 4 Ultra & other trade names	Broadcast/A 3–5 qt + 1–2 qt	12 H/ —	Mix 2 or more quarts of nonionic surfactant per 100 gal of tank mix. Apply 20–40 gal of tank mix/A by ground application or 10–20 gal/A by helicopter. Treat in late spring through early summer. Garlon 4 Ultra and Forestry Garlon XRT can injure or kill nearby crops or trees when applied at temps greater than 86 degrees F.
<i>hexazinone</i> Velpar L + <i>picloram</i> + 2,4-D Tordon 101M)	Broadcast/A 1–3 gal + 1–2 gal	48 H/ —	Provides increased control of blackgum, pine, sassafras, sourwood, and <i>Prunus</i> spp. Apply in late spring to early summer to point of full leaf expansion. When oak, elm, sweetgum, blackberry and <i>Prunus</i> are predominant, use 1.5–3 gal Velpar + 1 gal Tordon 101M. For blackgum, dogwood, sourwood, and red maple control, use 1–3 gal Velpar + 1.5–2 gal Tordon 101M. <i>Picloram</i> is known to leach through soil into groundwater and can contaminate surface water through spray drift. 2,4-D has properties and characteristics associated with chemicals detected in groundwater. 2,4-D can injure or kill nearby crops or trees when applied at temps greater than 85 degrees F.

HERBICIDE	APPLICATION RATE	REI/PHI (Hours or Days)	REMARKS & PRECAUTIONS
HERBICIDES FOR INJECTION, DIRECTED, & SPOT SPRAY TREATMENTS			
2,4-D Various trade names	Basal spray	12 H/ —	Spray the lower 18–24" of plant stem with undiluted spray. 2,4-D has properties and characteristics associated with chemicals detected in groundwater. 2,4-D can injure or kill nearby crops or trees when applied at temps greater than 85 degrees F.
	Stump treatment	12 H/ —	Spray the bark and root collar area of the stump thoroughly with undiluted spray. 2,4-D has properties and characteristics associated with chemicals detected in groundwater. 2,4-D can injure or kill nearby crops or trees when applied at temps greater than 85 degrees F.
fluroxypyr Vista XRT, Flagstaff 2.8 lb ai/gal	Direct spray 6–23 oz/A or 0.5–1.0% v/v	24 H/ —	May be applied to competing brush and herbaceous weeds in conifer stands. Avoid contact with conifer foliage. Should be applied to actively growing vegetation during the growing season into the fall. Do not add surfactant.
glyphosate Various trade names	Post directed spray 0.5–10% solution	4 H/ —	May be applied as a shielded or directed spray to the base of the trees. DO NOT apply over-the-top of desirable seedlings. Severe injury to trees will occur if the spray contacts the foliage. Use a 0.5% solution for control of annual weeds less than 6" tall (add a nonionic surfactant). A 1–2% solution will control perennial weeds. Use 5% solution for annual and perennial weed control if spray coverage is not complete. Use a 5–10% solution for woody brush and trees. Refer to the label for rates and surfactant recommendations for specific perennial weeds.
hexazinone Velpar L	Basal Soil treatment 2–4 ml/inch DBH	48 H/ —	Apply to root zone of undesirable hardwoods with a handgun application. Use 2–4 ml/inch of tree diameter at breast height on trees to be controlled. Place spots within 3 ft of root collar of trees to be controlled.
hexazinone Velpar L	Injection	48 H/ —	Inject 1 ml of undiluted Velpar L through bark of undesirable trees. Injections should be made at 4" intervals around stem. Treat in summer. Controls black cherry, oaks, red maple, and sweetgum.
imazapyr Various trade names. Arsenal AC, Chopper Gen2, Polaris AC, Polaris SP, Imazapyr 4SL, Rotary 2SL	Cut stump treatment	12 H/ —	Use a diluted solution of 6 oz Arsenal AC or 6–8 oz Chopper Gen2 + 1 gal water and spray or brush onto cambium area inside the bark of freshly cut stump. Check specific herbicide labels for recommended rates. Do not get product on soil if nearby plants are not to be harmed.
	Injection	12 H/ —	Apply 1 ml of diluted solution (see above) at 1" interval cuts through the bark around the tree. Do not allow herbicide to be applied to soil as non-target vegetation can be injured. Do not get product on soil if nearby plants are not to be harmed.
	Hack-n-Squirt or Wide-spaced injection	12 H/ —	Spray or brush a diluted Arsenal AC solution into cuts placed at 2" intervals around the tree. If the concentrated solution (25% Arsenal AC or 50% Chopper Gen2) is used make one cut into the stem for each 3" of tree diameter and spray or brush the concentrated Arsenal AC solution at 1ml/hack into each cut. For example a 3" diameter stem will receive one cut while a 6" diameter stem will receive two cuts. Do not get product on soil if nearby plants are not to be harmed.
picloram + 2,4-D Pathway Tordon RTU	Tree injection	48 H/ —	Apply 1 ml of undiluted Pathway or Tordon RTU through the bark completely around stem at 2–3" intervals. Treatment can be made any season. Do not treat maple during spring sap flow. Dogwood and hickory may require application to continuous overlapping cuts around the stem. Picloram is known to leach through soil into groundwater and can contaminate surface water through spray drift. 2,4-D has properties and characteristics associated with chemicals detected in groundwater. 2,4-D can injure or kill nearby crops or trees when applied at temps greater than 85 degrees F.
	Stump treatment	48 H/ —	Treat the cambium layer just inside of the bark of freshly cut stumps with undiluted Pathway or Tordon RTU. Picloram is known to leach through soil into groundwater and can contaminate surface water through spray drift. 2,4-D has properties and characteristics associated with chemicals detected in groundwater. 2,4-D can injure or kill nearby crops or trees when applied at temps greater than 85 degrees F.
picloram + 2,4-D Tordon 101M*	Tree injection	48 H/ —	Inject ½ ml of undiluted Tordon 101M or 1 ml of diluted (1:1 ratio in water) through the bark of undesirable trees at 3" intervals around the stem. Picloram is known to leach through soil into groundwater and can contaminate surface water through spray drift. 2,4-D has properties and characteristics associated with chemicals detected in groundwater. 2,4-D can injure or kill nearby crops or trees when applied at temps greater than 85 degrees F.
	Stump treatment	48 H/ —	Spray the cambium area inside the bark of freshly cut stumps with undiluted or diluted (1:1) Tordon 101M. Picloram is known to leach through soil into groundwater and can contaminate surface water through spray drift. 2,4-D has properties and characteristics associated with chemicals detected in groundwater. 2,4-D can injure or kill nearby crops or trees when applied at temps greater than 85 degrees F.

FOREST HERBICIDES

HERBICIDE	APPLICATION RATE	REI/PHI (Hours or Days)	REMARKS & PRECAUTIONS				
HERBICIDES FOR INJECTION, DIRECTED, & SPOT SPRAY TREATMENTS (continued)							
<i>triclopyr</i> Garlon XRT, Garlon 4 Ultra, Element 4 & various trade names + Oil	Thinline or streamline	12 H/ —	Tank mix 20–30% Garlon 4 Ultra + 70–80% oil. Apply with a small orifice solid-stream nozzle. Make two streaks across the lower stem of smooth bark hardwoods smaller than 3" in diameter. Application can be made in any season. Garlon 4 Ultra and Forestry Garlon XRT can injure or kill nearby crops or trees when applied at temps greater than 86 degrees F. Generally most effective from 6 weeks prior to leaf expansion until 2 months after.				
<i>triclopyr</i> Garlon 3A	Tree injection Hack & squirt	48 H/ —	Inject or spray ½ ml of undiluted or 1 ml of diluted (1:1 in water) through bark at 3–4" intervals around the stem.				
	Stump treatment	48 H/ —	Spray the cambium area inside the bark of freshly cut stumps with undiluted Garlon 3A.				
<i>triclopyr</i> Pathfinder II 0.75 lb ai/gal	Basal Bark Treatment	12 H/ —	Apply undiluted product in low-pressure spray to stems less than 6" in basal diameter, wetting the lower 12–15" of stems including root collar. Do not spray to the point of runoff. Applications may be made year-round.				
	Stump Treatment	12 H/ —	Apply undiluted product to the cambium area of freshly cut stumps. Also wet sides of stump to root collar, but not to point of runoff. Apply year-round.				
<i>aminopyralid</i> Milestone 2 lb ae/gal	10% v/v in water	48 H/ —	Control of woody species: Cut-stump treatment—apply 10% v/v in water to freshly cut stump; Hack-n-squirt and Frill or Girdle—make cuts overlapping the circumference of the stem and apply 1 ml of a 10% v/v in water into each cut; Basal stem—mix 1–5% Milestone in a basal oil and apply as a 12–15" wide band from above the root collar. (24(c) SLN label for GA).				
HERBICIDES FOR PINE RELEASE FROM HARDWOODS							
<i>triclopyr</i> Garlon 4 Ultra Forestry Garlon XRT	Directed spray	12 H/ —	To release conifers from red maple, sweetgum, oaks and hickory, mix 1–5 gal Garlon 4 Ultra in water to make 100 gal of mix. Add 0.25–0.5% nonionic surfactant or 1% (V/V) MSO or crop oil. Direct spray to foliage of hardwoods using a backpack sprayer with flat fan nozzle. Hardwoods less than 6–8 ft tall are most effectively treated. Treatment can occur any time after hardwoods reach full leaf and before onset of fall color. Direct spray on woody competition keeping off conifer foliage. Garlon 4 Ultra and Forestry Garlon XRT can injure or kill nearby crops or trees when applied at temps greater than 86 degrees F.				
	1–3 qt/A	12 H/ —	Broadcast application for mid-rotation understory brush control in flatwoods pine stands. For control of gallberry and wax myrtle apply 1–3 qt of Garlon 4 Ultra to cover the foliage of understory competition, but DO NOT spray onto pines. Make applications from late summer (August) to fall (before leaf fall). Apply 30 gal/water/A. Garlon 4 Ultra may be tank mixed with Arsenal AC or Escort to increase control of palmetto, titi, fetterbush etc. Garlon 4 Ultra and Forestry Garlon XRT can injure or kill nearby crops or trees when applied at temps greater than 86 degrees F.				
<i>hexazinone</i> Velpar L	Broadcast/A Spot Grid Treatment 2–8 qt	48 H/ —	For control of hardwoods in loblolly, longleaf, slash, shortleaf and Virginia pines. Apply undiluted Velpar L in a grid pattern to established stands 4 years and older on coarse textured soils and 3 years old and older on medium and fine textured soils. Injury may occur if pines are under drought stress. Rate is dependent on soil texture. Velpar is usually not used on medium/fine textured soils due to the higher rate needed, associated higher costs, and other labeled herbicide options are available (<i>imazapyr</i> , <i>triclopyr</i> , and <i>glyphosate</i> with restrictions).				
			SOIL TEXTURE	MILLILITERS/SPOT	GRID (FEET)	QUARTS/ACRE	
			Coarse	0.50 1.2	3 x 4 3 x 6	2* 3	
			Medium	2.0 3.0	4 x 6 5 x 7	3 4	
			Fine	2.0 3.0 3.3	5 x 4 4 x 7 3 x 6	4.5 5 6	
			*Use on deep sand with pine 4 or more years of age.				
			Broadcast/A 2–6 qt	48 H/ —	For control of hardwoods in loblolly, longleaf, slash, shortleaf and Virginia pines at ages 4+ years old on coarse textured soils, or 3+ years old on medium textured soils. Apply when loblolly pine is between flushes or growth spurts and from early spring to early summer when hardwoods are in half leaf to point of full leaf growth. Do not use a surfactant. Some pine mortality may occur, and some pines may show discolored foliage. 1–2 inches of rain are needed for soil activation.		
					SOIL TEXTURE	QUARTS/ACRES	
					Loamy sand, sandy loam	2–3	
					Loam, silt loam, sandy clay loam	2–4	
Silty clay loam, clay loam, sandy clay, silty clay, clay	4.5–6						

HERBICIDE	APPLICATION RATE	REI/PHI (Hours or Days)	REMARKS & PRECAUTIONS
HERBICIDES FOR PINE RELEASE FROM HARDWOODS (continued)			
<i>metsulfuron methyl</i> Escort XP	Broadcast/A 1–4 oz	4 H/ —	Release of loblolly and slash pine from hardwoods and brush. Apply over the top of established trees.
<i>metsulfuron methyl</i> Escort XP + <i>imazapyr</i> Arsenal AC Polaris AC <i>Imazapyr</i> 4 SL	Broadcast/A 1–2 oz + 8–16 oz	12 H/ —	Can be applied in 1-year-old loblolly pine plantations after 15 August as over the top treatment. Controls blackberry, blackgum, elm, cherry, and broadleaf weeds. Apply with 1 qt surfactant in 100 gal in late summer, early fall. Can be applied in slash pine stands from age 2 through 5-years old as over the top application. After age 5-years in slash stands must be applied as a direct spray keeping off pine needles and terminal bud. Use lower rate of Escort and <i>imazapyr</i> in slash stands and do not add surfactant.
<i>metsulfuron methyl</i> Escort XP + <i>sulfometuron methyl</i> Oust XP	Broadcast/A 0.5–1.5 oz + 2–3 oz	4 H/ —	Release of loblolly and slash pine from hardwoods and brush. Treat when pines are at least 3 years old on fine textured soils, 4 years and older on coarse textured soils. Apply from full leaf to just before leaf tissue hardens in the fall.
<i>sulfometuron methyl</i> + <i>metsulfuron methyl</i> Oust Extra	Broadcast/A 2–4 oz	4 H/ —	For release of loblolly and slash pine from hardwood, grass, and broadleaf weeds wt 2–3 oz/A for slash pine and 2–4 oz/A for loblolly pine. For loblolly pine only, 4 oz of Oust Extra + 8–16 oz of Arsenal AC may be used for additional hardwood control.
<i>metsulfuron methyl</i> Escort XP + <i>hexazinone</i> Velpar L	Broadcast/A 1–2 oz + 1.5–6 qt	48 H/ —	Brush and herbaceous weed control in loblolly and slash pine plantations. Do not use a surfactant. Treat when pines are at least 3 years old on fine textured soils, 4 years and older on coarse textured soils.
<i>imazapyr</i> Arsenal AC Polaris AC <i>Imazapyr</i> 4 SL	Broadcast/A 12–20 oz	12 H/ —	Release planted or naturally regenerated loblolly pine in its first growing season. Apply after August 15. Can add 0.25% nonionic surfactant.
	Directed spray 0.75–1.5% solution	12 H/ —	Apply to foliage and buds of undesirable hardwoods competing with pines with a low-volume directed spray. Avoid applying <i>imazapyr</i> to foliage of desirable pines and/or getting solution on the ground. Use a nonionic surfactant at 0.25% by volume.
	Broadcast/A 12–16 oz	12 H/ —	For slash and longleaf pine, broadcast-release treatments over the top of pines to control hardwoods must be made after August 15 and ONLY in stands 2–5 years old. DO NOT use a surfactant and use the lower rate on sandy soils. For slash pine older than 5 years, apply 12–14 oz/A after September 15. DO NOT use a surfactant and use the lower rate on sandy soils.
<i>triclopyr</i> Garlon 3A	Directed spray 1–5%	48 H/ —	To release conifers from red maple, sweetgum, oaks, ash, and hickory, mix 1–5 gal of Garlon 3A in 100 gal water + a nonionic surfactant. Apply as a directed spray to the foliage of weed trees with a backpack sprayer. Treat after hardwoods have leaved out and before fall coloration. Hardwoods less than 6 feet tall are most economically and safely treated. Direct spray away from foliage of desired pines.

FOREST HERBICIDES

HERBICIDE	APPLICATION RATE	REI/PHI (Hours or Days)	REMARKS & PRECAUTIONS
HERBICIDES FOR HERBACEOUS WEED CONTROL IN PINE PLANTATIONS			
<i>atrazine</i> AAtrex Nine-O & other trade names* or AAtrex 4L & other trade names*	Broadcast/A 2.2–4.4 lb Nine/O or 4–8 pt 4L	12 H/ —	For annual broadleaf and grass weed control in loblolly and slash pine plantations. Apply to established trees between fall and early spring. For new transplants apply during or soon after transplanting. * Restricted use pesticide
<i>fluazifop-p-butyl</i> 2 lb ai/gal 24.5% Fusilade DX	Broadcast/A 16–24 oz	12 H/ —	Grass control. Apply to actively growing non-stressed grasses 2–8" tall. Perennial grasses such as bermudagrass may require second application to regrowth. Add 1% crop oil concentrate (2 pt/25 gal) or 0.25% (0.5 pt/25 gal) nonionic surfactant to all applications. Avoid contact with conifer foliage by directing spray.
<i>imazapyr</i> Arsenal AC Polaris AC <i>Imazapyr</i> 4 SL	Broadcast/A 4–10 oz	12 H/ —	For herbaceous weed control in loblolly and Virginia pine plantations use 6–10 oz/A Arsenal AC. In slash and longleaf stands, use 4–6 oz/A without a surfactant. Apply as a broadcast or directed spray. For loblolly pine, a nonionic surfactant may be added at a 0.25% by volume rate. Some pine growth inhibition may occur if treatment is made during active periods of pine growth. Best control is achieved by application to newly emerged weeds.
<i>imazapyr</i> Arsenal AC Polaris AC <i>Imazapyr</i> 4 SL + <i>sulfometuron methyl</i> Oust XP	Broadcast/A 4–6 oz + 2 oz	12 H/ —	To control many broadleaf weeds and suppression of hardwood sprouts in loblolly pine.
<i>metsulfuron methyl</i> Escort XP	Broadcast/A 0.5–1.5 oz	4 H/ —	For blackberry and annual broadleaf weed control in loblolly and slash pine plantations. Do not use a surfactant on trees 1 year old or less. In older trees add 1 qt surfactant/100 gal water. Treat when weeds have reached point of full leaf and before tissue hardens off.
<i>sulfometuron methyl</i> + <i>metsulfuron methyl</i> Oust Extra + <i>imazapyr</i> Arsenal AC Polaris AC <i>Imazapyr</i> 4 SL	Broadcast/A 2–4 oz + 4 oz	12 H/ —	Control of herbaceous weeds (ragweed, dogfennel, panic grass) and suppression of perennial grasses such as bermudagrass and johnsongrass. Loblolly pine: 2–4 oz Oust Extra + 4-6 oz <i>imazapyr</i> /A. Slash pine: 2 oz Oust Extra + 4 oz <i>imazapyr</i> (do not add a surfactant).
<i>aminopyralid</i> Milestone 2 lb ae/gal	7 oz/A	48 H/ —	Control of briars, vines, and broadleaf weeds in LONGLEAF PINE ONLY (24(c) SLN label for GA). Apply over- the-top of newly planted longleaf in the grass stage (some injury to seedlings with active bud/shoot growth). Milestone can be used in longleaf stands into the third growing season. Do not use a surfactant. Can tank mix with up to 5 oz of Arsenal AC (or equivalent product without surfactant) per acre. Applications in late spring to early summer provide best weed control. Later season applications have not been evaluated but are not restricted by the label.

HERBICIDE	APPLICATION RATE	REI/PHI (Hours or Days)	REMARKS & PRECAUTIONS
HERBICIDES FOR HERBACEOUS WEED CONTROL IN PINE PLANTATIONS (CONTINUED)			
<i>clethodim</i> Envoy Plus 0.94 lb ai/gal 12.6%	Broadcast/A 9–16 oz Annual grasses 12–32 oz Perennial grasses	24 H/ —	Apply over the top of pine seedlings for post-emergence control of annual and perennial grasses. This product will not control broadleaves or sedges. Use a crop oil concentrate containing at least 15% emulsifier at 1% v/v (not less than 1 pt/A).
<i>clethodim</i> Arrow 2 EC 2 lb ai/gal 26.4%	6–8 oz/A for annual grasses 8–16 oz/A for perennial grasses	24 H/ —	Post-emergent treatment of grasses. Can be applied over-the-top of pines. Add crop oil concentrate which contains at least 15% emulsifier at 1% v/v (1 qt/25 gal spray solution, but no less than 1 pt/A) or nonionic surfactant at 0.25% v/v (1 qt/100 gal).
<i>sulfometuron methyl</i> Oust XP	Broadcast/A 2–8 oz	4 H/ —	Controls herbaceous weeds in loblolly, slash, longleaf and Virginia pine. Do not use a surfactant. Use broadcast or band application before or just after weed emergence. Check soil pH before application. Reduce rate or do not apply if pH is 6.2 or above.
<i>sulfometuron methyl</i> Oust XP + <i>atrazine</i> Various trade names Nine-O* or 4L*	Broadcast/A 2–4 oz + 2.2–4.4 lb Nine O or 4–8 pts 4L	12 H/ —	Controls annual broadleaf weeds and grasses in loblolly and slash pine plantations. Use higher rate on medium to fine textured soils when organic matter exceeds 2%. Use a minimum of 20 gal of spray mix/A by ground application only as pre-emergence or early post-emergence spray. Check soil pH and soil organic matter before application. Reduce rate or do not apply Oust if pH is 6.2 or above. * Restricted use pesticide
<i>sulfometuron methyl</i> Oust XP + <i>hexazinone</i> Velpar L	Broadcast/A 2–4 oz + 2–3 pt	48 H/ —	For use in loblolly, slash and longleaf pine plantations. Controls grasses and broadleaf weeds. Do not use a surfactant with this tank mix. Make broadcast, band or spot application from late winter to late spring. Do not apply when pines are under stress. Check soil pH and soil organic matter before application. Reduce rate or do not apply Oust if pH is 6.2 or above. If soil organic matter is less than 2% apply only 21 oz of Velpar.
<i>sulfometuron methyl</i> Oust XP + <i>metsulfuron methyl</i> Escort XP	Broadcast/A 2–3 oz + 0.5–1.5 oz	4 H/ —	For control of blackberry and herbaceous weeds in loblolly and slash pine plantations. Apply from late winter through spring after soil has settled after planting. Do not use a surfactant.

FOREST HERBICIDES

HERBICIDE	APPLICATION RATE	REI/PHI (Hours or Days)	REMARKS & PRECAUTIONS		
HERBICIDES FOR HERBACEOUS WEED CONTROL IN PINE PLANTATIONS (continued)					
<i>sulfometuron methyl</i> + <i>hexazinone</i> Oustar (limited availability)	Broadcast/A Rates vary by soil texture and seedling age	48 H/ —	Check soil pH and soil organic matter before application. If pH is 6.2 or above, or soil organic matter is less than 2% consider using <i>hexazinone</i> or <i>imazapyr</i> .		
			SOIL TEXTURE	1ST YEAR WEED CONTROL	2ND YEAR WEED CONTROL
			Coarse Texture: Loamy sand Sandy loam Sand	10–12 oz/A	12–16 oz/A
			Medium Texture: Laom Sandy clay loam Silt loam	12–16 oz/A	16–19 oz/A
			Fine Texture: Clay loam Sandy loam Silty clay loam Silty clay	16–19 oz/A	18–24 oz/A
Fine Texture: Clay	Not recommended	Not recommended			
<i>sulfometuron methyl</i> + <i>metsulfuron methyl</i> Oust Extra	3–4 oz/A for loblolly pine 2–3 oz/A for slash pine	4 H/ —	For control of blackberry and herbaceous weeds, and suppression of bermudagrass and johnsongrass. Do not use a surfactant.		
<i>clopyralid</i> Transline, Clean Slate 3 lb ai/gal 40.9%	0.25–1.33 pt/A	12 H/ —	Post-emergence control of herbaceous weeds, including cocklebur, coffeeweed, horseweed, kudzu, nightshade, ragweed, sicklepod, thistle, hairy indigo, and vetch in pine plantations applied as an over-the-top spray. Addition of surfactants can enhance activity—follow label directions for specifics.		

* Restricted use pesticide

FOREST VEGETATION MANAGEMENT TERMINOLOGY

The elimination of the undesirable vegetation in pine plantations requires that the applicator be familiar with certain herbicide systems and terminology as related to forestry.

1. Band treatment—Applied to a continuous restricted area such as on or along a crop row rather than over the entire field area.
2. Basal treatment—Applied to encircle the stem of a plant at and above the ground level. It is usually applied with a backpack sprayer.
3. Brush control—Control of woody plants such as sprout clumps, shrubs, small undesirable trees and vines.
4. Cambium—Tissue lying just under the bark that produces new wood and bark in the tree.
5. Concentration—The amount of active ingredient or herbicide equivalent in a quantity of carrier (such as water, oil, or dust) expressed as percent, lb/gal, ml/l, (volume/volume) V/V, etc.
6. DBH (diameter at breast-height)—Diameter of trees at a point 4.5 ft above ground level.
7. Directed application—Precise application to a specific area of plant organ; such as to a row or bed, or to the lower leaves and stems of plants.
8. Dormant spray—A chemical applied during the dormant season.
9. Foliar application—Application of an herbicide to the leaves or foliage of plants.
10. Frill—Series of overlapping cuts into the sapwood completely around the circumference of tree. Chips are not removed, but left to hold the herbicide in cuts. Herbicide can be applied with a brush, squirt/bottle, or sprayer.
11. Girdling—Complete removal of a band of bark plus the cambium layer from around a woody stem.
12. Hardened off—Term denoting stage of plant development when terminal buds have formed and stem and root tissues have ceased growth. Dormant stage of pine seedlings is often denoted by purplish or bronze/colored needles.
13. Herbaceous—Plants with non-woody stems that normally die back to the ground in the winter.

INVASIVE PLANT CONTROL IN FORESTS

David Clabo—Silviculture Assistant Professor & Extension Forester
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There are a number of non-native plants, referred to as exotic, noxious, alien, or invasive weeds that thrive in our southern forests in the absence of natural regulatory predators. Many of these plant species may be found under cultivation in yards, gardens, and landscapes, but may become problems when they “escape” cultivation and invade forests, roadsides, and natural areas. These weeds displace native vegetation, increase management costs, reduce productivity, diminish diversity, and impact wildlife habitat.

This section provides control options for plants that are of concern to the health and productivity of forest ecosystems. Be aware that in many cases these plants “escape” and spread into native habitats along roadsides, rights of way, streams, field edges, and fence rows. Controlling small infestations can minimize habitat impact and reduce future control costs.

These herbicide recommendations are specifically tailored for treatment of small areas using 3-gallon backpack sprayers.

Recommendations are adapted from:

Miller, J.H., S.T. Manning and S.F. Enloe. 2015. A management Guide for Invasive Plants of Southern Forests. Gen. Tech. Rep. SRS-131. Asheville, NC: U.S. Department of Agriculture Forest Service, Southern Research Station. 120p.

To view this publication online, and for images and information on invasive plants, insects, diseases, and animals go to www.invasive.org.

PLANT SPECIES Common & Scientific Name(s)	PRESCRIPTIONS
TREES	
<p>Tree of Heaven (<i>Ailanthus altissima</i>)</p>	<p>Large trees. Make stem injections and then apply Garlon 3A, Pathway*, Pathfinder II, or Arsenal AC*, Polaris AC*, <i>Imazapyr</i> 4SL* 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 (especially the cambium tissue just inside the bark) immediately after cutting.</p> <p>Saplings. Apply Garlon 4 Ultra as a 20% solution (2.5 qts/3 gal mix) in a commercially available basal oil, vegetable oil, or mineral oil carrier and add an oil surfactant penetrant (check with herbicide distributor) to young bark as a basal spray. Stalker* may be applied as a 6–9-percent solution (1.5 to 2 pints/3-gallon mix) in a commercially available basal oil, vegetable oil, or mineral oil carrier and add an oil surfactant penetrant as a basal spray.</p> <p>Seedlings and saplings. Thoroughly wet all leaves with one of the following herbicides in water with a surfactant (July–October prior to leaf color change). Arsenal AC*, Polaris AC Complete*, or <i>Imazapyr</i> 4SL* as a 0.75% solution (3 oz/3 gal mix), Krenite S as a 15% solution (58 oz/3-gal mix); Garlon 4 Ultra as a 2% solution (8 oz/3 gal mix); or Escort XP* at 1 oz/A (4 to 8 ounces per 3-gallon mix). TerraVue may also be applied at a rate of 2.85 oz/ac.</p> <p>*Non-target plants may be killed or injured by root uptake.</p>
<p>Mimosa, Silk Tree (<i>Albizia julibrissin</i>)</p>	<p>Large trees. Make stem injections using Arsenal AC*, Polaris AC Complete*, <i>Imazapyr</i> 4SL*, Milestone, or Garlon 3A in dilutions as specified on the herbicide label any time except February, March, April, and May. For felled trees, apply these herbicides to stem and stump tops (especially the cambium area just inside the bark) immediately after cutting.</p> <p>Saplings. Apply Garlon 4 Ultra as a 20% solution (2.5 qts/3 gallon mix) in a commercially available basal oil (20–25% solution) or a vegetable oil, crop oil concentrate, or mineral oil carrier; or apply undiluted Pathfinder II. Also add an oil surfactant penetrant (check with herbicide distributor). Apply as a basal spray.</p> <p>Resprouts and seedlings. Thoroughly wet all leaves with one of the following herbicides in water with a surfactant (July–October): Garlon 3A, Garlon 4 Ultra, or a <i>glyphosate</i> herbicide as a 2% solution (8 oz/3 gal mix) (July–September); Transline or Milestone as a 0.2–0.4% solution (1–2 oz/3 gal mix) plus a 4% solution of Garlon 3A. TerraVue may also be used at a rate of 2.85 oz/ac.</p> <p>*Non-target plants may be killed or injured by root uptake.</p>

PLANT SPECIES Common & Scientific Name(s)	PRESCRIPTIONS
TREES (continued)	
<p>Paper mulberry (<i>Broussonetia papyrifera</i>)</p>	<p>Large trees. Make stem injections using Garlon 3A as a 10% solution (1 qt/3 gal mix) in water or a 15% solution (58 oz/3 gal mix) for larger trees; Or cut large stems and immediately treat the stumps (especially the cambium area just inside the bark) with Garlon 3A as a 30% solution (38 ozs/1 gal mix) in water with a surfactant.</p> <p>Saplings. Apply Garlon 4 Ultra as a 20% solution (2.5 qts/3 gallon mix) in basal oil, vegetable oil, or crop oil concentrate and add an oil surfactant penetrant; or apply Stalker* as a 3% solution (12 oz/3 gal mix) plus Garlon 4 Ultra as a 15% solution (3 pts/3 gal mix) mixed in basal oil applied as a basal spray.</p> <p>Seedlings and saplings. Thoroughly wet all leaves with one of the following herbicides in water with a surfactant on young trees less than 10 ft tall. Garlon 3A at 2% (8 oz/3 gal mix) or Garlon 4 Ultra at 0.5–2% (2–8 oz/ 3 gal mix); a <i>glyphosate</i> herbicide as a 3% solution (12 oz/3 gal mix); Arsenal AC* as a 0.25% solution (1 oz/ 3 gal mix); or Arsenal Powerline* as a 0.5% solution (2 oz/3 gal mix), from July–October (prior to leaf color change).</p> <p>*Non-target plants may be killed or injured by root uptake.</p>
<p>Camphortree (<i>Cinnamomum camphora</i>)</p>	<p>Large trees. Make stem injections using undiluted Garlon 3A during June–September or Vanquish* as a 75% solution (96 oz/1 gal mix) with water (June–November) in cut spacings as specified on the herbicide label. For stems too tall for foliar sprays, cut large stems and immediately treat the stumps with Garlon 3A as a 30% solution (38 oz/1 gal mix) or Garlon 4 Ultra as a 25% solution (32 oz/1 gal mix) and add a penetrant oil for more effective control.</p> <p>Saplings. Apply Garlon 4 Ultra as a 30% solution in basal oil, vegetable oil or crop oil concentrate and add an oil surfactant penetrant (38 oz/ 1 gal mix) as a basal spray for trees up to 4" in diameter.</p> <p>Seedlings and saplings. Thoroughly wet all leaves with one of the following herbicides in water with a nonionic surfactant (0.25% solution): A <i>glyphosate</i> product or Garlon 3A as a 2–3% solution (8–12 oz/ 3 gal mix); or Garlon 4 Ultra as a 0.5–2% solution (2–8 oz/3 gal mix) from July–October. Clearcast may be used for trees in wetland or aquatic sites.</p> <p>* Non-target plants may be killed or injured by root uptake.</p>
<p>Russian Olive (<i>Elaeagnus angustifolia</i>)</p>	<p>Trees. Make stem injections using Arsenal AC*, Polaris AC*, <i>Imazapyr</i> 4SL*, or Garlon 3A in dilutions and cut spacings as specified on the herbicide label anytime except February, March, April, and May. For felled trees, apply Garlon 4 Ultra as a 25% solution to stem and stump tops immediately after cutting.</p> <p>Saplings. Apply Garlon 4 Ultra as a 20% solution (2.5 qts/3 gal mix) in commercially available basal oil or vegetable oil with an oil surfactant penetrant to young bark as a basal spray; or undiluted Pathfinder II. Stalker* as a 6–9% solution (24–32 oz/3 gal mix) in a labeled basal oil product vegetable oil, or oil surfactant penetrant (check with herbicide distributor).</p> <p>Seedlings and saplings. Thoroughly wet all leaves with one of the following herbicides in water with a surfactant (July–October). Arsenal AC*, Polaris AC*, or <i>Imazapyr</i> 4SL*, as a 0.75% solution in water (3 oz/3 gal mix); a <i>glyphosate</i> herbicide, Garlon 3A, or Garlon 4 Ultra as a 2% solution in water (8 oz/3 gal mix) for directed spray treatments that have limited or no soil activity. Apply from July into October prior to leaf color change.</p> <p>*Non-target plants may be killed or injured by root uptake.</p>
<p>Glossy Buckthorn (<i>Frangula alnus</i>)</p>	<p>Thoroughly wet all leaves with a <i>glyphosate</i> product or Garlon 3A as a 2–3% solution (8–12 oz/3 gal mix) in water with a surfactant. Or, apply Arsenal AC* as a 0.25% solution (1 oz/3 gal mix) or Arsenal Powerline* as a 0.5% solution (2 oz/3 gal mix).</p> <p>For stems too tall for foliar sprays, cut large stems and immediately treat the stumps with one of the following herbicides—a <i>glyphosate</i> herbicide or Garlon 3A as a 25% solution (32 oz/1 gal mix); in the winter, when the ground is not frozen, apply Garlon 3A as a 50% solution (64 oz/1 gal mix) in water with a surfactant. A subsequent foliar application may be required to control new seedlings and resprouts.</p> <p>Apply Garlon 4 Ultra as a 20% solution (2.5 qt/3 gal mix) in basal oil, vegetable oil, or crop oil concentrate and add an oil surfactant penetrant (check with herbicide distributor) as a basal spray to stems up to 4" diameter. Apply 360° around each stem from 0–18" above the ground.</p> <p>* Non-target plants may be killed or injured by root uptake.</p>

INVASIVE PLANT CONTROL IN FORESTS

PLANT SPECIES Common & Scientific Name(s)	PRESCRIPTIONS
TREES (continued)	
Chinaberrytree (<i>Melia azedarach</i>)	<p>Trees. Make stem injections using Arsenal AC*, Polaris AC*, <i>Imazapyr</i> 4SL*, Pathway, Pathfinder II, or Garlon 3A in dilutions and cut spacings as specified on the herbicide label anytime except February, March, and April. For felled trees, apply these herbicides to stem and stump tops immediately after cutting.</p> <p>Saplings. Apply Garlon 4 Ultra as a 20% solution (2.5 qt/3 gal mix) in commercially available basal oil product or vegetable oil and add an oil surfactant penetrant (check with herbicide distributor) to young bark as a basal spray 360° around each stem from 0-18" above the ground.</p> <p>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 Ultra as a 2% solution (8 oz/3 gal mix); Arsenal AC*, Polaris AC*, or <i>Imazapyr</i> 4SL*, as a 0.5% solution (2 oz/3 gal mix).</p> <p>* Non-target plants may be killed or injured by root uptake.</p>
Paulownia, Princess tree (<i>Paulownia tomentosa</i>)	<p>Large trees. Make stem injections using Arsenal AC*, Polaris AC*, <i>Imazapyr</i> 4SL*, or a <i>glyphosate</i> herbicide in dilutions and cut spacings as specified on the herbicide label anytime except February, March and April. For felled trees, apply these herbicides to stem and stump tops immediately after cutting.</p> <p>Saplings. Apply Garlon 4 Ultra as a 20% solution (2.5 qts/3 gal) in commercially available basal oil or vegetable oil and add an oil surfactant penetrant (check with herbicide distributor) to young bark as a basal spray. Pathfinder II can be applied undiluted as a basal spray. Stalker* is an option when damage to desirable vegetation is not an issue. Apply as a 6–9% solution (24–32 oz/3 gal) mix in basal oil or vegetable oil.</p> <p>Resprouts and seedlings. Thoroughly wet all leaves with one of the following herbicides in water with a surfactant (July–October). Arsenal AC*, Polaris AC*, or <i>Imazapyr</i> 4SL*, as a 0.75% solution (4 oz/3 gal mix); a <i>glyphosate</i> herbicide, Garlon 3A, or Garlon 4 Ultra as a 2% solution (8 oz/3 gal mix).</p> <p>*Non-target plants may be killed or injured by root uptake.</p>
Hardy orange, Trifoliolate orange (<i>Poncirus trifoliata</i>)	<p>Large trees. For stems too tall for foliar sprays, cut large stems and immediately treat the stumps with one of the following herbicides: a <i>glyphosate</i> herbicide or Garlon 3A as a 25% solution (32 oz/1 gal mix). A subsequent foliar application of may be required to control new seedlings and resprouts.</p> <p>Seedlings and saplings. Thoroughly wet all leaves with a <i>glyphosate</i> herbicide or Garlon 3A as a 4% solution (1 pt/3 gal mix) in water with a surfactant. Or apply Arsenal AC* as a 0.5% solution (2 oz/3 gal mix).</p> <p>* Non-target plants may be killed or injured by root uptake.</p>
Callery pear or Bradford Pear (<i>Pyrus calleryana</i>)	<p>Large trees. For stems too tall for foliar sprays, cut large stems and immediately treat the stumps with Garlon 3A or a <i>glyphosate</i> herbicide at a 25- 50% solution (3-6 qt/3 gal mix). A subsequent foliar application of may be required to control new seedlings and resprouts. Make stem injections using a 1:1 mixture or undiluted Garlon 3A or Vastlan (June-September) in cut spacings as specified on the herbicide label.</p> <p>Saplings. Apply Garlon 4 Ultra as a 20% solution (2.5 qts/3 gal) in a labeled basal oil, vegetable oil, or mineral oil product and add an oil penetrant surfactant (check with herbicide distributor). Pathfinder II can also be applied undiluted as a basal spray.</p> <p>Seedlings. Thoroughly wet all leaves with one of the following herbicides in water with a surfactant. A <i>glyphosate</i> product or Garlon 3A as a 2% solution (8 oz/3 gal mix); Arsenal AC* as a 0.25% solution (1 oz/3 gal mix); or Arsenal Powerline* as a 0.5% solution (2 oz/3 gal mix).</p> <p>*Non-target plants may be killed or injured by root uptake.</p>
Brazilian peppertree (<i>Schinus terebinthifolius</i>)	<p>Trees. For stems too tall for foliar sprays, cut large stems and immediately treat the stumps with Garlon 3A or a <i>glyphosate</i> herbicide as a 25–50% solution (3–6 qt/3 gal mix); Garlon 4 Ultra as a 12% solution (15 oz/1 gal mix); or Stalker as a 12% solution (16 oz/1 gal mix) when trees are not fruiting. A subsequent foliar application of may be required to control new seedlings and resprouts. For treatment of extensive infestations in forest situations, apply Velpar L* or Hyvar X-L* to the soil surface within 3 ft of the stem (one squirt of spot gun or utility spray bottle per 1" of stem diameter) or apply in a grid pattern at spacings and dilutions as specified on the herbicide labels.</p> <p>Saplings. Apply Garlon 4 Ultra as a 20% solution (2.5 qt/3 gal mix) in basal oil, vegetable oil, or crop oil concentrate and add an oil surfactant penetrant as a basal spray. Apply 360° around each stem from 0-18" above the ground. Pathfinder II may be applied undiluted as a basal spray in the fall when flowering.</p> <p>Seedlings and saplings. Thoroughly wet all leaves with one of the following herbicides in water with a surfactant. A <i>glyphosate</i> product or Garlon 3A as a 2–3% solution (8–12 oz/3 gal mix); Habitat* as a 0.5%–1.0% solution (2 oz/3 gal mix); or Clearcast as a 2% solution (8 oz/3 gal mix).</p> <p>*Non-target plants may be killed or injured by root uptake.</p>

PLANT SPECIES Common & Scientific Name(s)	PRESCRIPTIONS
TREES (continued)	
<p>Tallowtree, Popcorn tree (<i>Triadica sebifera</i>)</p>	<p>Large trees. Make stem injections using Arsenal AC*, Polaris AC*, <i>Imazapyr</i> 4SL*, Habitat*, Milestone, or Garlon 3A in dilutions and cut spacings as specified on the herbicide label anytime except February, March, April, and May. For felled trees, apply the herbicides to stem and stump tops immediately after cutting (at least a 10% solution for stumps ≤6" and 20% solution on larger stumps for Garlon 3A). For treatment of extensive infestations in forest situations, apply Velpar L* to the soil surface within 3 ft of the stem (one squirt of spot gun/1" stem diameter) or in a grid pattern at spacings specified on the herbicide label (mid-March-early June), apply Clearcast aerially at 64 oz/ac according to label directions. Clearcast is safe to many native hardwood species.</p> <p>Saplings. Apply Garlon 4 Ultra as a 15% solution (58 oz/3 gal mix) in commercially available basal oil or vegetable oil with an oil surfactant penetrant (check with herbicide distributor) to young bark as a basal spray; undiluted Pathfinder II; or apply Stalker* as a 6–9% solution (24-32 oz/3 gal) in basal oil, vegetable oil, or mineral oil with a penetrant as a basal spray.</p> <p>Seedlings. Thoroughly wet all leaves with one of the following herbicides in water with a surfactant July to October. Arsenal AC*, Polaris AC*, <i>Imazapyr</i> 4SL*, as a 0.75% solution (3 oz/3 gal mix); Krenite S as a 20% solution (77 oz/3 gal mix); or Garlon 4 Ultra as a 2% solution (8 oz/3 gal mix); or Clearcast* as a 2% solution (8 oz/3 gal mix).</p> <p>* Non-target plants may be killed or injured by root uptake.</p>
<p>Tung oil tree (<i>Vernicia fordii</i>)</p>	<p>Large trees. Make stem injections using undiluted Garlon 3A during June-September or Vanquish* as a 75% solution (96 oz/1 gal mix) with water during June-October in cut spacings as specified on the herbicide label. For stems too tall for foliar sprays, cut large stems and immediately treat the stumps with one of the following herbicides, Garlon 4 Ultra as a 25-50% solution (3-6 qt/3 gal mix) or Garlon 3A as a 30% solution (38 oz/1 gal mix).</p> <p>Saplings. Apply Garlon 4 Ultra as a 20% solution (2.5 qt/3 gal mix) in basal oil, vegetable oil, or crop oil concentrate and add an oil surfactant penetrant, as a basal spray in the fall when flowering; or apply Pathfinder II undiluted.</p> <p>Seedlings. Thoroughly wet all leaves with one of the following herbicides in water with a surfactant on young trees less than 10 ft tall. Garlon 3A as a 2% solution (8 oz/3 gal mix); a <i>glyphosate</i> herbicide as a 2–3% solution (8–12 oz/3 gal mix); or Chopper Gen2* as a 1% solution (4 oz/3 gal mix) or Arsenal AC* as a 0.5% solution (2 oz/3 gal mix).</p> <p>* Non-target plants may be killed or injured by root uptake.</p>
SHRUBS	
<p>Hen's eye or coral ardisia (<i>Ardisia crenata</i>)</p>	<p>Apply Garlon 4 Ultra as a 20% solution (2.5 qt/3 gal mix) in basal oil, vegetable oil, or crop oil concentrate and add an oil surfactant penetrant as a basal spray in the fall when flowering. For stems too tall for foliar sprays, cut large stems and immediately treat the stumps (especially the cambium area just inside the bark) with Garlon 4 Ultra as a 20-25% solution (5-6 pt/3 gal mix).</p> <p>Thoroughly wet all leaves with one of the following herbicides in water with a surfactant, a <i>glyphosate</i> product or Garlon 4 Ultra as a 5% solution (20 oz/3 gal mix) in July-October.</p>
<p>Japanese barberry (<i>Berberis thunbergii</i>)</p>	<p>Thoroughly wet all leaves with a <i>glyphosate</i> product or Garlon 3A as a 2% solution (8 oz/3 gal mix) in water with a surfactant from July-October. For stems too tall for foliar sprays, cut large stems and immediately treat the stumps (especially the cambium area just inside the bark) with one of the following herbicides, a <i>glyphosate</i> herbicide or Garlon 3A as a 25% solution (32 oz/1 gal mix). A subsequent foliar application may be required to control new seedlings and resprouts.</p>
<p>Silverthorn, Thorny Olive (<i>Elaeagnus pungens</i>)</p>	<p>Thoroughly wet all leaves with Arsenal AC*, Polaris AC*, <i>Imazapyr</i> 4SL*, or Vanquish* as a 1% solution in water (4 oz/3 gal mix) with a surfactant April-October. Garlon 3A or Garlon 4 Ultra as 2% solutions (8 oz/3 gal mix) are also options. Apply from July into mid October prior to leaf color change.</p> <p>For stems too tall for foliar sprays, apply Garlon 4 Ultra as a 20% solution in commercially available basal oil or vegetable oil and add an oil surfactant penetrant (2.5 qt/3 gal mix; check with herbicide distributor) to young bark as a basal spray January-February or May-October. Or, cut large stems and immediately treat stumps (especially the cambium area just inside the bark) with one of the following herbicides in water with a surfactant: Arsenal AC*, Polaris AC*, <i>Imazapyr</i> 4SL*, as a 5% solution (1 pt/3 gal mix); or a <i>glyphosate</i> herbicide as a 20% solution (2.5 qt/3 gal mix).</p> <p>* Non-target plants may be killed or injured by root uptake.</p>

INVASIVE PLANT CONTROL IN FORESTS

PLANT SPECIES Common & Scientific Name(s)	PRESCRIPTIONS
<i>SHRUBS (continued)</i>	
Autumn Olive (<i>Elaeagnus umbellata</i>)	<p>Thoroughly wet all leaves with Arsenal AC*, Polaris AC*, <i>Imazapyr</i> 4SL*, or Vanquish* as a 1% solution in water (4 oz/3 gal mix) with a surfactant April- October, or use Garlon 3A as a 2% solution (8 oz/3 gal mix)</p> <p>For stems too tall for foliar sprays, apply Garlon 4 Ultra as a 20% solution (2.5 qt/3 gal mix) in commercially available basal oil or vegetable oil and add an oil surfactant penetrant (check with herbicide distributor) to young bark as a basal spray January-February or May-October; or undiluted Pathfinder II may be used. Or, cut large stems and immediately treat the stumps with one of the following herbicides as a 5% solution (20 oz/3 gal mix) in water with a surfactant: Arsenal AC*, Polaris AC*, <i>Imazapyr</i> 4SL*, as a 5% solution (20 oz/3 gal mix) or a <i>glyphosate</i> herbicide as a 20% solution (2.5 qt/3 gal mix).</p> <p>* Non-target plants may be killed or injured by root uptake.</p>
Winged Burning Bush (<i>Euonymus alata</i>)	<p>Thoroughly wet all leaves with Arsenal AC*, Polaris AC*, <i>Imazapyr</i> 4SL*, or Vanquish* as a 1% solution in water (4 oz/3 gal mix) with a surfactant April- October, or use Garlon 3A or Garlon 4 Ultra as a 3% solution (12 oz/3 gal mix)</p> <p>For stems too tall for foliar sprays, apply Garlon 4 Ultra as a 20% solution (2.5 qt/3 gal mix) in commercially available basal oil or vegetable oil with an oil surfactant penetrant (check with herbicide distributor) to young bark as a basal spray January-February or May-October; undiluted Pathfinder II may also be used. Or, cut large stems and immediately treat the stumps with one of the following herbicides in water as a 5% solution (1 qt/3 gal mix) with a surfactant: Arsenal AC*, Polaris AC*, <i>Imazapyr</i> 4SL*. Or a <i>glyphosate</i> herbicide as a 20% solution (2.5 qt/3 gal mix) can be used for safety to surrounding vegetation.</p> <p>* Non-target plants may be killed or injured by root uptake.</p>
Chinese Privet (<i>Ligustrum sinense</i>) European Privet (<i>Ligustrum vulgare</i>)	<p>Thoroughly wet all leaves with one of the following herbicides in water with a surfactant August to December, a <i>glyphosate</i> herbicide as a 3% solution (12 oz/3 gal mix) or Arsenal AC*, Polaris AC*, <i>Imazapyr</i> 4SL*, as a 1% solution (4 oz/3 gal mix), or Escort XP at 1 oz/A + 0.25% non-ionic surfactant. Summer applications of <i>glyphosate</i> require greater percent solutions than winter applications. Arsenal AC* and Escort XP* should be applied during summer into early fall.</p> <p>During the dormant season November-February use a 3-5% <i>glyphosate</i> solution with water applied as a directed spray to completely wet the foliage of the privet. Use a <i>glyphosate</i> product that contains 41% or more active ingredient plus added surfactant. With no soil activity and low impact on dormant (leafless) plants, this treatment has low impact on desirable dormant non-target plants growing in close proximity to privet.</p> <p>For stems too tall for foliar sprays, apply Garlon 4 Ultra as a 20% solution (2.5 qt/3 gal mix) in commercially available basal oil or vegetable oil, and add an oil surfactant penetrant (check with herbicide distributor) to young bark as a basal spray applied 360° around each stem from 0–18" above the ground. Undiluted Pathfinder II may also be used. Or, cut large stems and immediately treat the stumps with a 5% solution of Arsenal AC*, Polaris AC*, <i>Imazapyr</i> 4SL*, or Velpar L* as a 10% solution in water (1 qt/3 gal mix) with a surfactant.</p> <p>When safety to surrounding vegetation is desired, immediately treat stumps and cut stems with Garlon 3A or a <i>glyphosate</i> herbicide as a 20% solution in water (2.5 qt/3 gal mix) with a surfactant.</p> <p>Stem injections may be used for larger stems. Apply Arsenal AC*, Garlon 3A, or a <i>glyphosate</i> herbicide using dilutions and cut-spacings specified on the herbicide label. Every branching trunk must be hack-n-squirt injected if the lower part (below forks) is not injected.</p> <p>* Non-target plants may be killed or injured by root uptake.</p>
Japanese and Glossy Privet (<i>Ligustrum japonicum</i>)	<p>Thoroughly wet all leaves with one of the following herbicides in water with a surfactant: Arsenal AC*, Polaris AC*, or <i>Imazapyr</i> 4SL* as a 1% solution (4 oz/3 gal mix) or Garlon 4 Ultra as a 3% solution (12 oz/3 gal mix); or a <i>glyphosate</i> herbicide as a 3% solution (12 oz/3 gal mix). Apply when new growth appears on the plant. Optimal timing of foliar sprays has not been determined yet.</p> <p>For stems too tall for foliar sprays, apply Garlon 4 Ultra as a 20% solution (2.5 qt/3 gal mix) in commercially available basal oil, mineral oil, or vegetable oil and add an oil surfactant penetrant (check with herbicide distributor) to young bark as a basal spray. Apply 360° around each stem from 0-18" above the ground (January-February or May-October). Undiluted Pathfinder II may also be used. Or, cut large stems and immediately treat the stumps (especially the cambium area just inside the bark) with a 5% solution of Arsenal AC*, Polaris AC*, <i>Imazapyr</i> 4SL*, or Velpar L* as a 10% solution in water (1 qt/3 gal mix) with a surfactant.</p> <p>When safety to surrounding vegetation is desired, immediately treat stumps and cut stems with a <i>glyphosate</i> herbicide or Garlon 3A as a 20% solution in water (2.5 qt/3 gal mix) with a surfactant.</p> <p>* Non-target plants may be killed or injured by root uptake.</p>

PLANT SPECIES Common & Scientific Name(s)	PRESCRIPTIONS
SHRUBS (continued)	
<p>Bush Honeysuckles Amur Honeysuckle (<i>Lonicera maackii</i>) Morrow's Honeysuckle (<i>Lonicera morrowii</i>) Tatarian Honeysuckle (<i>Lonicera tatarica</i>) Sweet/breath/of/spring (<i>Lonicera fragrantissima</i>)</p>	<p>Thoroughly wet all leaves with <i>glyphosate</i> herbicide, Garlon 3A, or Garlon 4 Ultra as a 4% solution in water (8 oz/3 gal mix) with a surfactant August- October. When the leaves turn yellow, increase the strength of the Garlon 4 Ultra application to a 6% solution (20 oz/3 gal mix).</p> <p>For saplings, apply Garlon 4 Ultra as a 20% solution (2.5 qt/3 gal mix) in commercially available basal oil or vegetable oil and add an oil surfactant penetrant (check with herbicide distributor) to young bark as a basal spray. Pathfinder II can be applied undiluted as a basal spray 360° around each stem from 0–18" above the ground.</p> <p>For stems too tall for foliar sprays, cut large stems and immediately treat the stumps (especially the cambium area just inside the bark) with one of the following herbicides in water with a surfactant. Arsenal AC*, Polaris AC*, <i>Imazapyr</i> 4SL*, as a 10% solution (1 qt/3 gal mix); Garlon 4 Ultra as a 20% solution; a <i>glyphosate</i> herbicide as a 20% solution (2.5 qt/3 gal mix); or Pathfinder II undiluted.</p> <p>For large stems, make stem injections using Arsenal AC* Polaris AC*, or <i>Imazapyr</i> 4SL* or when safety to surrounding vegetation is desired Garlon 3A, Vastlan, or <i>glyphosate</i> using dilutions and cut spacings specified on the herbicide label anytime except March through May.</p> <p>* Non-target plants may be killed or injured by root uptake.</p>
<p>Beale's barberry or mahonia (<i>Mahonia bealei</i>)</p>	<p>For stems too tall for foliar sprays, cut large stems and immediately treat the stumps (especially the cambium area just inside the bark) with one of the following herbicides Garlon 4 Ultra, Garlon 3A, or a <i>glyphosate</i> herbicide as a 25% solution (32 oz/1 gal mix).</p> <p>Thoroughly wet all leaves with one of the following herbicides in water with a surfactant: a <i>glyphosate</i> herbicide or Garlon 3A as a 5% solution (20 oz/3 gal mix) applied during the growing season when temperatures are above 70° F (July-October tends to be the best time frame prior to leaf color change); apply Arsenal AC* as a 0.12% solution (0.5 oz/3 gal mix) or Arsenal Powerline* as a 0.25% solution (1 oz/3 gal mix) plus a <i>glyphosate</i> herbicide as a 2% solution (8 oz/3 gal mix) plus Escort XP* at 0.4 dry oz/ 3 gal mix in water. Spray as a low volume application to lightly wet leaves.</p> <p>* Non-target plants may be killed or injured by root uptake.</p>
<p>Nandina, Scared Bamboo (<i>Nandina domestica</i>)</p>	<p>Thoroughly wet all leaves with <i>glyphosate</i> herbicide as a 1% solution in water (4 oz/3 gal mix) with a surfactant July-October. Or, apply Garlon 4 Ultra as a 20% solution (2.5 qt/3 gal mix) in commercially available basal oil, vegetable oil, or mineral oil and add an oil penetrant surfactant (check with herbicide distributor) to young bark as a basal spray 360° around each stem from 0-18" above the ground. Undiluted Pathfinder II may also be used.</p> <p>For stems too tall for foliar sprays, cut large stems and immediately treat the stumps (especially the cambium area just inside the bark) with one of the following herbicides in water with a surfactant. Arsenal AC*, Polaris AC*, or <i>Imazapyr</i> 4SL*, as a 10% solution (1 qt/3 gal mix). Or a <i>glyphosate</i> herbicide as a 20% solution (2.5 qt/3 gal mix) can be applied for safety to surrounding vegetation.</p> <p>* Non-target plants may be killed or injured by root uptake. Collect and destroy fruit.</p>
<p>Japanese knotweed (<i>Polygonum cuspidatum</i>)</p>	<p>Thoroughly wet all leaves with Garlon 3A (or aquatic Renovate) as a 2% solution (8 oz/3 gal mix), or a mix of Garlon 3A (or aquatic Renovate) and a <i>glyphosate</i> herbicide (Rodeo for aquatic sites) as a 2% solution (8 oz/3 gal mix) . Fall applications are most effective if seed production does not occur. Earlier treatments are better when seed production does occur.</p> <p>On terrestrial sites, foliar sprays of Arsenal AC* as a 0.25% solution (1 oz/3 gal mix), or Arsenal PowerLine* as a 0.5% solution (2 oz/3 gal mix) may be used if damage to desirable vegetation is not a concern. On aquatic sites, Habitat* as a 1% solution (4 oz/3 gal mix) may be used.</p> <p>For stems too tall for foliar sprays, cut large stems and immediately treat the stumps (especially the cambium layer just inside the bark) with one of the following herbicides in water with a surfactant: a <i>glyphosate</i> herbicide or Garlon 3A as 25% solutions (1 qt/1 gal mix). A subsequent foliar application of <i>glyphosate</i> will be necessary to control resprouts.</p> <p>* Non-target plants may be killed or injured by root uptake.</p>

INVASIVE PLANT CONTROL IN FORESTS

PLANT SPECIES Common & Scientific Name(s)	PRESCRIPTIONS
SHRUBS (continued)	
Nonnative Roses Multiflora Rose (<i>Rosa multiflora</i>) Macartney Rose (<i>Rosa bracteata</i>)	<p>Thoroughly wet all leaves (directed spray) with one of the following herbicides in water with a surfactant April-June (at or near the time of flowering): Escort XP* at 1 oz/A in water (0.2 dry oz/3 gal mix); during August-October: Arsenal AC*, Polaris AC*, or <i>Imazapyr</i> 4SL*, as a 1% solution (4 oz/3 gal mix). Repeated directed spray applications of a <i>glyphosate</i> herbicide as a 4% solution in water may be used as a less effective application (1 pt/3 gal mix) May-October. This is a less effective treatment that has no soil activity to damage surrounding plants.</p> <p>For stems too tall for foliar sprays, apply Garlon 4 Ultra as a 20% solution (2.5 qt/3 gal mix) in commercially available basal oil vegetable oil, or mineral oil and add an oil surfactant penetrant (check with herbicide distributor) to young bark as a basal spray (January-February or May-October). Or, cut large stems and immediately treat the stumps with one of the following herbicides in water with a surfactant: Arsenal AC*, Polaris AC*, or <i>Imazapyr</i> 4SL*, as a 10% solution, or a <i>glyphosate</i> herbicide as a 20% solution (2.5 qt/3 gal mix).*</p> <p>* Non-target plants may be killed or injured by root uptake</p>
Japanese spiraea (<i>Spiraea japonica</i>)	<p>Thoroughly wet all leaves with Garlon 3A or a <i>glyphosate</i> herbicide as a 3% solution (12 oz/3 gal mix) in water with a surfactant. While September is best applications may be made almost any time of year, as long as the air temperature is above 65°F to ensure absorption by the plant.</p> <p>For stems too tall for foliar sprays, cut large stems and immediately treat the stumps with one of the following herbicides: a <i>glyphosate</i> herbicide or Garlon 3A as a 25% solution (32 oz/1 gal mix).</p>
Introduced Lespedezas Shrubby (bicolor) Lespedeza (<i>Lespedeza bicolor</i>) Chinese (sericea) Lespedeza (<i>Lespedeza cuneata</i>)	<p>Thoroughly wet all leaves with one of the following herbicides in water with a surfactant July-September Garlon 4 Ultra as a 2% solution (8 oz/3 gal mix); Escort XP* at 0.3 of an ounce per acre; Transline as a 0.2% solution (1 oz/3 gal mix); a <i>glyphosate</i> herbicide as a 2% solution (8 oz/3 gal mix); or Milestone at 7 oz/A (2 oz/3 gal mix), or Velpar L as a 2% solution (8 oz/3 gal mix).</p> <p>* Non-target plants may be killed or injured by root uptake.</p> <p>Mowing 1–3 months before herbicide applications can assist control.</p>
Tropical Soda Apple (<i>Solanum viarum</i>)	<p>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 Ultra (or Remedy in pastures); Arsenal AC*, Polaris AC*, <i>Imazapyr</i> 4SL*, as a 2% solution (8 oz/3 gal mix); a <i>glyphosate</i> herbicide as a 3% solution in water (12 oz/3 gal mix).</p> <p>Milestone at 5-7 oz/A (2 oz/3 gal mix) at any growth stage, but application before flowering can reduce seed production Collect and destroy fruit to prevent reestablishment. If mowing is used to stop fruit production, delay herbicide applications 50-60 days to ensure adequate regrowth. This is a federally listed invasive species.</p> <p>* Non-target plants may be killed or injured by root uptake.</p>
VINES	
Five/leaf akebia or chocolate vine (<i>Akebia quinata</i>)	<p>Thoroughly wet all leaves with Garlon 3A as a 2–3% solution (8–12 oz/3 gal mix) in water with a surfactant applied during early to mid fall.</p> <p>To control climbing vines in trees, cut large stems within 1.5 in of the ground and immediately treat the cut stems with Garlon 3A or a <i>glyphosate</i> herbicide as a 25% solution (32 oz/1 gal mix). A subsequent foliar application may be required to control new seedlings and resprouts.</p>
Amur peppervine or porcelainberry (<i>Ampelopsis brevipedunculata</i>)	<p>Thoroughly wet all leaves with one of the following herbicides in water with a surfactant: a <i>glyphosate</i> herbicide or Garlon 3A as a 2–3% solution (8–12 oz/3 gal mix); or apply Arsenal AC* as a 0.25% solution (0.5 oz/3 gal mix) or Chopper Gen2* applied as a 0.5% solution (2 oz/3 gal mix) in water.</p> <p>To control climbing in trees, cut large stems within 1.5 in of the ground and immediately treat the cut stems with Garlon 3A or a <i>glyphosate</i> herbicide as a 25% solution (32 oz/1 gal mix).</p> <p>* Non-target plants may be killed or injured by root uptake.</p>

PLANT SPECIES Common & Scientific Name(s)	PRESCRIPTIONS
<i>VINES (continued)</i>	
<p>Oriental Bittersweet (<i>Cleastrus orbiculatus</i>)</p>	<p>Thoroughly wet all leaves with one of the following herbicides in water with a surfactant (July-October): Garlon 4 Ultra, Garlon 3A, or a <i>glyphosate</i> herbicide as a 3% solution (12 oz/3 gal mix).</p> <p>For stems too tall for foliar sprays, apply Garlon 4 Ultra as a 20% solution (2.5 qt/3 gal mix) in commercially available basal oil or vegetable oil and add an oil surfactant penetrant (check with herbicide distributor) to the lower 16" of stems. Pathfinder II may be applied undiluted as a basal spray to the lower two feet 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 Ultra or a <i>glyphosate</i> herbicide as a 25% solution (32 oz/1 gal mix).</p> <p>For large vines, make stem injections using Arsenal AC*, Polaris AC*, or Imazapyr 4SL* or when safety to surrounding vegetation is desired Garlon 3A or a <i>glyphosate</i> herbicide using dilutions and cut spacings as the herbicide label. Apply anytime except March-May.</p>
<p>Climbing Yams Air Yam (<i>Dioscorea bulbifera</i>) Chinese Yam (<i>Dioscorea oppositifolia</i>) Water Yam (<i>Dioscorea alata</i>)</p>	<p>Thoroughly wet all leaves with one of the following herbicides in water with a surfactant July-October. Garlon 3A or Garlon 4 Ultra as a 2% solution (8 oz/3 gal mix). Sometimes the air yams take up the herbicide; otherwise, they must be collected and destroyed (not composted).</p> <p>Cut climbing plants just above the soil surface and immediately treat the freshly cut stem with a 50% Garlon 3A solution (safe to surrounding plants).</p>
<p>Winter Creeper (<i>Euonymus fortunei</i>)</p>	<p>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* as a 3% solution (12 oz/3 gal mix) or Tordon K* as a 2% solution (8 oz/3 gal mix).</p> <p>Or, repeatedly apply Garlon 4 Ultra or a <i>glyphosate</i> herbicide as a 4% solution (1 pt/3 gal mix) in water with a surfactant, a less effective treatment that has no soil activity to damage surrounding plants.</p> <p>Cut all vertical climbing stems to prevent fruiting and spread by birds.</p> <p>For large vines, make stem injections using Arsenal AC*, Polaris AC* Imazapyr 4SL*, Garlon 3A, or a <i>glyphosate</i> herbicide using dilutions and cut spacings as specified on the label. Apply anytime except March through May.</p> <p>* Tordon products contain <i>picloram</i>, which is a restricted use herbicide. Non-target plants may be killed or injured by root uptake with this herbicide.</p>
<p>Kudzu (<i>Pueraria montana</i>)</p>	<p>Thoroughly wet all leaves, including those on climbing vines, as high as possible with one of the following herbicides in water with a surfactant: (June- October for successive years when regrowth appears): Tordon 101** as a 3% solution (12 oz/3 gal mix) or Tordon K** as a 2% solution (8 oz/3 gal mix), either by broadcast or spot spray; (July-early September for successive years); Escort XP* at 3–4 oz/A (0.8-1.2 dry oz/3 gal mix); or Milestone at 7 oz/A (2 oz/3 gal mix) in water.</p> <p>When safety to surrounding vegetation is desired, use Transline* as a 0.5% solution in water (2 oz/3 gal mix) or Milestone can safely treat kudzu under many desirable trees and shrubs if herbicide is not applied directly to them. For partial control and no soil activity, repeatedly apply Garlon 4 Ultra or a <i>glyphosate</i> herbicide as a 4% solution in water (1 pt/3 gal mix) with a surfactant during the growing season. Or cut large vines and immediately apply the herbicides to the cut surfaces or apply the ready-to-use Pathway*. Ortho Brush-B-Gon, Enforcer Brush Killer, and Vine-X readily available in retail garden stores (safe to surrounding plants). Ortho Brush-B-Gon, Enforcer Brush and other “poison ivy” herbicides can be used as foliar sprays.</p> <p>To control vines less than 2" in diameter, apply basal sprays of Garlon 4 as a 20% solution (5 pt/3 gal mix) in a labeled basal oil product or vegetable oil, and add an oil surfactant penetrant (January-April) (check with herbicide distributor); or use undiluted Pathfinder II.</p> <p>For larger vines, make stem injections using Tordon 101* **, Stalker*, Arsenal AC*, or a <i>glyphosate</i> herbicide using dilutions and cut-spacings as specified on the herbicide label (anytime except March and April).</p> <p>* Non-target plants may be killed or injured by root uptake.</p> <p>** Tordon products contain <i>picloram</i>, which is a restricted use herbicide. Non-target plants may be killed or injured by root uptake with this herbicide.</p>

INVASIVE PLANT CONTROL IN FORESTS

PLANT SPECIES Common & Scientific Name(s)	PRESCRIPTIONS
VINES (continued)	
English Ivy (<i>Hedera helix</i>)	Thoroughly wet all leaves (until runoff) with one of the following herbicides in water with a surfactant (July-October) for successive years. Garlon 3A or Garlon 4 Ultra as a 3-5% solution (12-20 oz/3 gal mix), or a <i>glyphosate</i> herbicide as a 4% solution (8 oz/3 gal 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% solution (2.5 qt/3 gal mix) in commercially available basal oil or vegetable oil and add an oil surfactant penetrant surfactant (check with herbicide distributor) to large vines being careful to avoid the bark of the host tree. Undiluted Pathfinder II may also be applied.
Japanese honeysuckle (<i>Lonicera japonica</i>)	Apply Escort XP* with a surfactant to foliage June-August-either by broadcast spraying 2 oz/A in water (0.6 dry oz/3 gal mix) or by spot spraying 2–4 oz/A water (0.6-1.2 dry oz/3 gal mix). * Non-target plants may be killed or injured by root uptake. When damage to surrounding vegetation is not an issue, Escort XP may be applied at a rate of 1 oz/A (0.2 dry ounces per 3 gallons of water). Apply at least 10 gallons of solution per acre. Or, treat foliage with one of the following herbicides in water with a surfactant (July-October) or during warm days in early winter, keeping spray away from desirable plants: a <i>glyphosate</i> herbicide as a 2% solution (8 oz/3 gal mix) or Garlon 3A or Garlon 4 Ultra as a 3-5% solution (12-20 oz/3 gal mix). Or, cut large vines just above the soil surface and immediately treat the freshly cut stem with a <i>glyphosate</i> herbicide or Garlon 3A as a 20% solution (2.5 qt/3 gal sprayer) in water with a surfactant July-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. Burning can be difficult due to absence of fine fuels beneath dense honeysuckle mats.
Vincas, Periwinkles Common Periwinkle (<i>Vinca minor</i>) Bigleaf Periwinkle (<i>Vinca major</i>)	Thoroughly wet all leaves (until runoff) with one of the following herbicides in water with a surfactant July-October for successive years. Tordon 101* as a 3% solution (12 oz/3 gal mix), Tordon K* as a 2% solution (8 oz/3 gal mix), or Garlon 4 Ultra as a 4% solution (15 oz/3 gal mix). Or, during the growing season, repeatedly apply Garlon 4 Ultra or a <i>glyphosate</i> herbicide as a 2% solution in water (8 oz/3 gal mix) with a surfactant. In winter, herbicide treatments should be limited to warm days. * Tordon products contain <i>picloram</i> , which is a restricted use herbicide. Non-target plants may be killed or injured by root uptake.
Nonnative Wisterias Chinese Wisteria (<i>Wisteria sinensis</i>) Japanese Wisteria (<i>Wisteria floribunda</i>)	From July-October for successive years when regrowth appears, apply Tordon 101* as a 3% solution (12 oz/3 gal mix), Tordon K* as a 2% solution (8 oz/3 gal mix), or Garlon 4 Ultra as a 4% solution (15 oz/3 gal mix) From July-September for successive years when regrowth appears, apply Transline* as a 0.5% solution in water (2 oz/3 gal mix) when safety to surrounding vegetation is desired, or from September to October with repeated applications of a <i>glyphosate</i> herbicide as a 4% solution (1 pt/3 gal mix). For large vines, make stem injections with Arsenal AC*, Polaris AC*, <i>Imazapyr</i> 4SL*, Garlon 3A, of a <i>glyphosate</i> herbicide using dilutions and cut- spacings specified on the herbicide label (anytime except March through May). * Tordon products contain <i>picloram</i> , which is a restricted use herbicide. Non-target plants may be killed or injured by root uptake. ** Non-target plants may be killed or injured by root uptake.
GRASSES	
Giant Reed (<i>Arundo donax</i>)	Foliar applications in September–October with a <i>glyphosate</i> herbicide as a 4% solution (1 pt/3 gal mix); or Arsenal AC*, Polaris AC*, <i>Imazapyr</i> 4SL*, as a 1% solution (4 oz/3 gal mix). A combination of these two herbicides can be used: Arsenal AC*, Polaris AC*, or <i>Imazapyr</i> 4SL* as a 0.5% solution (2 oz/3 gal mix) and a <i>glyphosate</i> herbicide as a 4% solution (1 pt/3 gal mix) can be used as a tank mix. * Non-target plants may be killed or injured by root uptake.
Weeping lovegrass (<i>Eragrostis curvula</i>)	Thoroughly wet all leaves with one of the following herbicides in water with a surfactant: a <i>glyphosate</i> herbicide as a 2% solution (8 oz/3 gal mix); Arsenal AC*, Polaris AC*, or <i>Imazapyr</i> 4SL* as a 0.5% solution (2 oz/3 gal mix); or apply Arsenal Powerline* as a 0.75% solution (3 oz/3 gal mix). All applications should be made in early summer when foliage is developed but before seeds have been produced. * Non-target plants may be killed or injured by root uptake.

PLANT SPECIES Common & Scientific Name(s)	PRESCRIPTIONS
<i>GRASSES (continued)</i>	
<p>Cogongrass (<i>Imperata cylindrica</i>)</p>	<p>Thoroughly wet all leaves with one of the following herbicides in water with a surfactant (June to September): Arsenal AC*, Polaris AC*, or <i>Imazapyr</i> 4SL* as a 1% or Chopper Gen2* as a 2% solution (4 or 8oz/3 gal mix); a <i>glyphosate</i> herbicide as a 2-5% solution (8-19 oz/3 gal mix) may be tank mixed with an <i>imazapyr</i> product to accelerate burn-down but may not improve rhizome kill. Grass should be 1 to 2 feet tall when treated.</p> <p>A 2-5 % solution (8-19 oz/gal) of a <i>glyphosate</i> product may be used alone to avoid soil activity in hardwood stands. Repeat applications before flowering in spring to suppress seed production and again in successive years for eradication are typically necessary.</p> <p>This is a Federally listed invasive species. Report suspected infestations to your Georgia Forestry Commission county office.</p> <p>* Non-target plants may be killed or injured by root uptake.</p>
<p>Tall Fescue (<i>Lolium arundinaceum</i>)</p>	<p>On forest lands, apply a <i>glyphosate</i> herbicide as a 5% solution in water (2 qt/10 gal mix/A), or Arsenal AC*, Polaris AC*, or <i>Imazapyr</i> 4 SL*, as a 1% solution (25 oz/20 gal mix/A) in spring.</p> <p>On noncroplands, apply 10-12 dry ounces of Plateau or 20-24 ounces of Journey/20 gal mix/A (consult the label for additives) in spring. Mixing Plateau* with a <i>glyphosate</i> herbicide or Arsenal AC*, Polaris AC*, or <i>Imazapyr</i> 4SL*, will improve control but may damage associated native plants. Vantage (<i>sethoxydim</i>), Poast (<i>sethoxydim</i>), Assure (<i>quizalofop</i>), and Select (<i>clethodim</i>) may be useful on pastures, but they are usually more costly than a <i>glyphosate</i> mix with Plateau or <i>imazapyr</i> herbicides such as Arsenal AC*, Polaris AC*, or <i>Imazapyr</i> 4SL*.</p> <p>Early spring burning, if repeated, inhibits fescue and encourages native warm/season grasses.</p> <p>* Non-target plants may be killed or injured by root uptake.</p>
<p>Nepalese Browntop (<i>Microstegium vimineum</i>)</p>	<p>Apply a <i>glyphosate</i> herbicide as a 0.5–2% solution in water (2-8 oz/3 gal mix) with a nonionic surfactant in late summer. Or, apply Fusilade DX or Plateau (see label) during summer for situations that require more selective control and less impact on associated plants.</p> <p>Repeat treatments for several years to control abundant germinating seeds are necessary. Mowing or pulling just before seed set in September will prevent seed buildup.</p>
<p>Chinese Silvergrass (<i>Miscanthus sinensis</i>)</p>	<p>Make foliar applications of Arsenal AC*, Polaris AC*, or <i>Imazapyr</i> 4SL*, as a 1% solution (4 oz/3 gal mix); a <i>glyphosate</i> herbicide as a 4% solution (16 oz/3 gal mix), or a combination of the two herbicides with Arsenal AC*, Polaris AC*, or <i>Imazapyr</i> 4SL* as a 0.5% solution (2 oz/3 gal mix) plus a <i>glyphosate</i> herbicide as a 4% solution (1 pt/3 gal mix) with a surfactant. Repeat applications when resprouts reach two feet tall.</p> <p>* Non-target plants may be killed or injured by root uptake.</p>
<p>Bamboos (<i>Phyllostachys spp.</i>) (<i>Bambusa spp.</i>)</p>	<p>Cut large stems and spray resprouts when stems reach 3–4 feet tall. Thoroughly wet all leaves with one of the following herbicides in water with a surfactant in September or October with multiple applications to regrowth: Arsenal AC*, Polaris AC* or <i>Imazapyr</i> 4SL* as a 1% solution (4 oz/3 gal mix) plus a <i>glyphosate</i> herbicide as a 10% solution (8 oz/3 gal mix); or a combination of the two herbicides.</p> <p>Apply Velpar L* as a soil treatment at 2 gallons per acre in a grid pattern (spacings and application rates per spot are specified on the label) following cutting or burning of stand. Application window is mid-March to early June.</p> <p>* Non-target plants may be killed or injured by root uptake.</p>
<p>Johnsongrass (<i>Sorghum halepense</i>)</p>	<p>Recommendation for mature grass control: Apply Outrider* as a broadcast spray at 0.75-2 oz/A plus a non-ionic surfactant to actively growing Johnsongrass. For handheld and high volume equipment, apply 1 ounce of Outrider*/100 gal of water plus a non-ionic surfactant at 0.25%. Or apply Plateau* as a 0.25% solution (1 oz/3 gal mix) post emergence when plants are 18-24" (45-60 cm) tall or larger.</p> <p>Recommendation for seedling control: Apply Journey* as a 0.3% solution (1.2 oz/3 gal mix) pre-emergence when desirable species are dormant.</p> <p>Apply a <i>glyphosate</i> herbicide as a 2% solution (8 oz/3 gal mix).</p> <p>* Non-target plants may be killed or injured by root uptake.</p>

INVASIVE PLANT CONTROL IN FORESTS

PLANT SPECIES Common & Scientific Name(s)	PRESCRIPTIONS
FERNS	
Japanese Climbing Fern (<i>Lygodium japonicum</i>)	Thoroughly wet all leaves from July-September with one of the following herbicides in water plus surfactant: Escort XP* at 1–2 oz/A in water (0.3-0.6 dry oz/3 gal mix); or a <i>glyphosate</i> herbicide as a 2–4% solution (12 oz/3 gal mix).
FORBS	
Garlic Mustard (<i>Alliaria petiolata</i>)	To control two generations, thoroughly wet all leaves with a <i>glyphosate</i> herbicide as a 2% solution in water (8 oz/3 gal mix) during flowering April- June. <i>Glyphosate</i> may also be applied during the winter when safety to surrounding vegetation is desired. Include a surfactant unless plants are near surface waters. Or apply Garlon 4 Ultra as a 1–2% solution (4 to 8 ounces per 3 gallon mix) in water (March through May). 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.
Alligatorweed (<i>Alternanthera philoxeroides</i>)	Thoroughly wet all leaves with one of the following herbicides in water: Habitat* applied as a 0.5% (2 oz/3 gal mix) solution in a 100 gal/A mix. Clearcast as a 1% solution (4 oz/3 gal mix) if foliage is emerged; A <i>glyphosate</i> product (Rodeo for aquatic sites) or Garlon 4 Ultra (Renovate 3 for aquatic sites) as a 2% solution (8 oz/3 gal mix) or a <i>glyphosate</i> herbicide (Rodeo for aquatic sites) as a 2% solution (8 oz/3 gal mix) for good control above the water line. * Non-target plants may be killed or injured by root uptake.
Nodding plumeless thistle (<i>Carduus nutans</i>)	Thoroughly wet all leaves with one of the following herbicides in water with a surfactant: Transline* as a 0.5% solution (2 oz/3 gal mix) applied during the rosette stage or prior to flowering; Garlon 3A, Milestone or a <i>glyphosate</i> herbicide as a 2% solution (8 oz/3 gal mix); or Overdrive as a 0.8% solution (0.3 oz/3 gal mix) applied at the rosette growth stage. *Non-target plants may be killed or injured by root uptake.
Spotted knapweed (<i>Centaurea stoebe ssp.</i>)	Thoroughly wet all leaves with one of the following herbicides in water with a surfactant: Milestone at 5-7 oz/A applied at the spring bolting or fall rosette stages; Tordon K* at 0.25-0.5 lb/A will control spotted knapweed plants and seedlings for 2–3 years. Tordon K* should be applied either in fall when the plant is in the rosette growth stage, or in spring during the bud to bloom stage; Vanquish* at 1–2 lb (acid equivalent/see label)/A. May require annual follow-up treatment for a minimum of 2 years; Overdrive as a 0.2% solution (0.6 oz/3 gal mix) plus Tordon 101* as a 4% solution (2 pt/3 gal mix); or Garlon 3A as a 2–3% solution (8–12 oz/3 gal mix) 3–4 times/year for 2 years. * Tordon products contain <i>picloram</i> , which is a restricted use herbicide. Non-target plants may be killed or injured by root uptake.
Big blue lilyturf (<i>Liriope muscari</i>), (<i>L. spicata</i>) creeping liriop (<i>Liriope spicata</i>)	A <i>glyphosate</i> herbicide as a 2% solution (8 oz/3 gal mix) applied June-October. Escort XP* as a 2% solution (8 oz/3 gal mix); Arsenal AC* as a 0.5% solution (2 oz/3 gal mix); Arsenal Powerline* as a 1% solution (4 oz/3 gal mix); or Journey as a 3% solution (12 oz/3 gal mix) applied to actively growing shoots. * Non-target plants may be killed or injured by root uptake
Crownvetch (<i>Securigera varia</i>) or (<i>Coronilla varia</i>)	Thoroughly wet all leaves with a <i>glyphosate</i> product or Garlon 3A as a 1–2% solution (4-8 oz/3 gal mix) in water with a surfactant during the vegetative stage prior to branching or during flowering. Apply Transline* as a 0.5% solution (2 oz/3 gal mix); Arsenal AC* as a 0.5% solution (2 oz/3 gal mix); or apply Arsenal Powerline* as a 1% solution (4 oz/3 gal mix) in fall, before frost or leaf drop. Milestone at 7 oz/A (2 oz/3 gal mix) may also be used. * Non-target plants may be killed or injured by root uptake.

* **Tordon101 and Tordon K are Restricted Use Pesticides.** Rainfall must occur within 6 days after Tordon application for soil activation.

RESTRICTED ENTRY INTERVAL (REI) FOR HERBICIDES LISTED IN INVASIVE PLANT CONTROL IN FORESTS

HERBICIDE	RESTRICTED ENTRY INTERVAL (REI)
Arsenal AC	12 H
Arsenal Powerline	48 H
Assure II	12 H
Chopper Gen2	48 H
Clearcast	4 H
Enforcer Brush Killer	Do not enter treated area until after spray has dried.
Escort XP	4 H
Garlon 3A	48 H
Garlon 4	12 H
Habitat	No restriction
Hyvar	12 H
<i>Imazapyr</i> 4SL	12 H
Journey	12 H
Kernite S	12 H
Milestone	48 H
Ortho Brush-B-Gone	Do not enter treated area until after spray has dried.
Outrider	12 H

HERBICIDE	RESTRICTED ENTRY INTERVAL (REI)
Overdrive	24 H
Pathfinder II	12 H
Pathway	48 H
Plateau	12 H
Poast	12 H
Polaris AC	12 H
Remedy	Do not enter treated area until after spray has dried.
Renovate 3	48 H
Select	24 H
Stalker	48 H
TerraVue	48 H
Tordon 101	48 H
Tordon K	48 H
Transline	12 H
Vanquish	24 H
Vantage	12 H
Velpar L	48 H

CHRISTMAS TREE INSECT CONTROL

Will Hudson, Extension Entomologist

PEST	INSECTICIDE	MOA	AMOUNT/100 GAL	REI/PHI (Hours or Days)	REMARKS AND PRECAUTIONS
Bagworm, Pine webworm, other foliage feeders	<i>dimethoate</i> 4EC	1B	52.5 fl oz	10 D/ —	Apply when small bagworms are first observed.
	<i>carbaryl</i> Sevin 80S	1A	1 1/4 lb	24 H/ —	
	Sevin XLR	1A	1 qt	24 H/ —	Materials listed for tip moths are also effective for most foliage feeding caterpillars.
	<i>acephate</i> Orthene 75S and others Tree & Ornamental Spray Formulations	1B	1/3 lb	24 H/ —	
	<i>spinosad</i> Spintor 25E	5	2–8 fl oz/A	4 H/ —	
	<i>cyantraniliprole</i> Mainspring GNL	28		4 H/ —	No more than 32 fl oz per acre per year.
Aphids	<i>dimethoate</i> 4EC	1B	52.5 fl oz	10 D/ —	Apply as needed to prevent aphid and honeydew buildup. A clean-up spray should be applied 2 weeks prior to harvest. Thorough coverage is critical in aphid clean-up sprays.
	<i>acephate</i> Orthene 75S and others Tree & Ornamental Spray Formulations	1B	1/3 lb 2–4 oz	24 H/ —	
	<i>thiamethoxam</i> Flagship 25WG	4A	See label	12 H/ —	Formulations vary.
	<i>imadacloprid</i> many brands available	4A	4–8 fl oz	12 H/ —	
	<i>cyantraniliprole</i> Mainspring GNL	28	2–8 fl oz	4 H/ —	No more than 32 fl oz per acre per year.
Hemlock woolly adelgid	<i>dimethoate</i> 4 EC	1B	52.5 fl oz	10 D/ —	
	<i>thiamethoxam</i> Flagship 25WG	4A	4 oz	12 H/ —	
Nantucket Pine Tip and other tip moths	<i>permethrin</i> Ambush 2EC	3A	9.6 fl oz/A	12 H/ —	Use pheromone traps to improve timing of tip moth sprays. Repeat application as needed to prevent young larvae from penetrating tips. Two applications, two weeks apart, are required for each of the third and fourth generations.
	<i>esfenvalerate</i> Asana XL .66EC	3A	8–9.6 fl oz	24 H/ —	
	<i>tebufenozide</i> Confirm 2F	1B	8 fl oz/A	4 H/ —	
	<i>dimethoate</i> 2.67 EC	1B	3 pt	24 H/ —	
	<i>acephate</i> Orthene 75SP and others, Tree & Ornamental Spray Formulations	1B	1 lb	24 H/ —	

PEST	INSECTICIDE	MOA	AMOUNT/100 GAL	REI/PHI (Hours or Days)	REMARKS AND PRECAUTIONS
Nantucket Pine Tip and other tip moths <i>(continued)</i>	<i>diflubenzuron</i> Dimilin 25WP	15	4 oz/A	12 H/ —	Dimilin should be applied only once, at the beginning of the second generation egg hatch.
	<i>lambda-cyhalothrin</i> Warrior T	3A	3.2 fl oz/A	12 H/ —	Do not apply more than 16 fl oz/year. Thorough coverage is very important.
	<i>tebufenozide</i> Mimic 2LV	18	8 fl oz/A	4 H/ —	
	<i>spinosad</i> Spintor 25E	5	2–8 fl oz/A	4 H/ —	
Mites	<i>bifentozate</i> Floramite SC	un	4–8 oz	12 H/ —	
	<i>cyflumetofen</i> Sultan	25	13.7 fl oz/100 gal	12 H/ —	
	<i>fenazaquin</i> Magus 12-24 oz.	21A	12–24 oz	12 H/ —	
Pine needle scale Pine tortoise scale	Superior oil, 70 sec		2 gal		Apply oil as dormant spray. Apply other chemicals when crawlers are active.
	<i>acephate</i> Orthene 75SP and others Tree and Ornamental Spray Formulations	1B	2/3 lb	24 H/ —	
	<i>spirodiclofen</i> Envidor 2SC	23	18–24.7 oz	12 H/ —	
Pine weevils (Pales & Pitch eating weevils) (White pine weevils)	<i>chlorpyrifos</i> Dursban 4E, others	1B	1 pt	24 H/ —	Apply in early spring when new growth starts and adult weevils are active.
	<i>permethrin</i> Astro, etc.	3A	See label	12 H/ —	
	<i>bifenthrin</i> Onyx	3A	16–32 oz	12 H/ —	
Sawflies	<i>imidacloprid</i> Provado	4A	4–8 oz/A	12 H/ —	Sawflies may be controlled by sprays applied for tip moths.
	<i>spinosad</i> Spintor 25C	5	2–8 fl oz/A	4 H/ —	
	<i>carbaryl</i> Sevin XLR	1A	1 qt	24 H/ —	
	<i>acephate</i> Orthene 75S and others	1B	1/3 lb	24 H/ —	

If different pesticide formulations are used, they should be used at an equivalent amount of actual toxicant per unit (100 gal, acre, or tree).
PLEASE READ ALL INSTRUCTIONS, RESTRICTIONS, AND SAFETY REQUIREMENTS ON THE PESTICIDE LABELS.

FOREST (PINE) AND CHRISTMAS TREE DISEASE CONTROL

Jean L. Williams-Woodward, Extension Plant Pathologist

CROP	DISEASE	FUNGICIDE (FRAC #)	REI	RATE	SCHEDULE AND REMARKS
Eastern Red Cedar, Junipers Arizona Cypress Arborvitae Leyland Cypress (Nurseries, Christmas trees)	Needle blight (<i>Passalora sequoiae</i> ; syn. <i>Cercosporidium sequoia</i> ; <i>Cercospora sp</i>)	<i>azoxystrobin</i> (11) Heritage	4 H	4 oz/100 gal	Symptoms and sporulation peaks in August-September. Sporulation begins in early summer. Begin scouting for sporulation (tufts of olive green spores) on previous year's infection sites in mid-May to mid-June. Apply fungicides at 1–2 week intervals depending on product (systemics can be applied at 14-day intervals; non-systemics at 7-day intervals). Curative applications can reduce disease when applied Aug-Oct when symptoms are first seen. Note: Removal and disposal of infected plant parts can reduce spread. Air-blast applications are not as effective as pistol or direct application to interior of tree.
		<i>chlorothalonil</i> (M5) Daconil Bravo	12 H	Labeled rate depending upon formulation.	
		<i>copper hydroxide</i> (M1) Kocide 2000, 3000 Nu-Cop; CuPRO 2005 T/N/O	24 H	Labeled rate depending upon formulation.	
		<i>mancozeb</i> (M3) Fore Dithane, etc.	24 H	1.5 lb/100 gal	
		<i>myclobutanil</i> (3) Eagle 20EW	24 H	6 oz/100 gal	
Eastern Red Cedar, Junipers	Phomopsis tip blight (<i>Phomopsis juniperovora</i>)	<i>azoxystrobin</i> (11) Heritage	4 H	1 to 4 oz/100 gal	Spray at 7–28 day intervals as needed. Do not make more than 3 sequential applications before rotating with non-strobilurin product
		<i>mancozeb</i> (M3) Fore Dithane, etc.	24 H	1.5 lb/100 gal	Begin spraying at first sign of disease in a full coverage spray at 7–10 day intervals throughout season.
		<i>propiconazole</i> (3) Banner Maxx II	12 H	5–8 fl oz/100 gal	Begin at bud break in spring. Spray to drip every 14–21 days during periods of active growth.
		<i>thiophanate methyl</i> (1) 3336WP + other formulations	12 H	24 oz/100 gal	Begin applications when disease first appears or during suggested periods of disease incidence. Apply additional applications every 7–14 days.
	Cedar Rust (<i>Gymnosporangium sp.</i>)	Bordeaux (M2) Mixture	?	8 lb copper sulfate + 8 lb hydrated lime + 100 gal water	Spray cedars and junipers from July to August.
	<i>propiconazole</i> (3) Banner Maxx II	12 H	2–4 fl oz/100 gal	Spray to drip. Spray from July through August every 14–21 days.	

CROP	DISEASE	FUNGICIDE (FRAC #)	REI	RATE	SCHEDULE AND REMARKS
Pines (Nursery beds, Christmas trees)	Needle diseases (Lophodermium needle cast, Brown spot, Diplodia tip blight)	<i>azoxystrobin</i> (11) Heritage Quadris	4 H	1–4 oz/100 gal 6–15.5 fl oz/A	Begin applications prior to disease development and continue at 7–21 day intervals following resistance management guidelines. Do not apply more than 2 sequential applications before alternating with a fungicide not in FRAC Group 11.
		<i>chlorothalonil</i> (M5) Bravo Ultrex Daconil Weatherstik	12 H	5 lb/100 gal or acre 2.75–5.5 pt/A	Make first application in spring prior to bud break. Make applications at 6–8 week intervals.
		<i>fluopyram + trifloxystrobin</i> (7 + 11) Broadform	12 H	13.4 fl oz/100 gal	Apply dosage per acre or per 100 gallons of water as a full coverage, dilute spray as needed at 7–21 day intervals. Under high disease pressure, use higher rate and shorter interval. Use a nonionic spary adjuvant.
		<i>mancozeb</i> (M3) Pentathlon DF	24 H	1–2 lb/100 gal	For Lophodermium, spray every 7–10 days from mid-August to October.
		<i>propiconazole</i> (3) Banner Maxx II	12 H	5–8 fl oz/100 gal	Spray to drip. Spray from July through August every 14–21 days.
		<i>triadimefon</i> (3) Bayleton 50	12 H	8 oz/A	Use a nonionic surfactant to improve performance. Begin application to coincide with spore release (usually in mid-July and ending in mid-October). Make applications at 21 day intervals.
		<i>triadimefon + trifloxystrobin</i> (3 + 11) Armada 50 WDG	12 H	9 oz/A	A non-ionic spray adjuvant is recommended. Do not use with organosilicate-based products or plant injury may occur. For Lophodermium, begin applications to coincide with spore release, normally beginning in mid-July and ending in mid-October. Make applications at 21-day intervals. Use a minimum of 50 gals of water/A (100 gal/A preferred to thoroughly wet trees).
Pine Nursery	Fusiform rust <i>Cronartium fusiforme</i>	<i>prothioconazole</i> (3) Proline 480 SC	12 H	Seedlings: 5.0 fl oz/A Seeds: 10 fl oz/50 lbs seed	Seedling application: Repeat application using 14–21 day intervals. Maximum of 25 fl oz of product can be applied per acre per crop year. Seed treatment: apply in tumbler apparatus, and mix for at least 10 minutes. Thoroughly air dry before sowing.
		<i>triadimefon</i> (3) Bayleton 50 Bayleton Flo	12 H	4–16 oz/A	Begin applications prior to infection intervals, depending on disease pressure. Use lower rates in areas of low disease incidence and higher rates in areas of severe disease incidence. Repeat as necessary at 2–3 week intervals. A maximum of 4 applications of 16 oz/A may be made per season. A nonionic surfactant is needed to help adhere spray solution to the pine trees.
		<i>triadimefon + trifloxystrobin</i> (3 + 11) Armada 50 WDG	12 H	9 oz/A	A spreader-sticker is needed to help adhere spray solution to pine trees. Do not use with organosilicate-based products or plant injury may occur. Begin application prior to infection when the needles break thorough the fascicle sheath. Repeat at 14–21-day intervals. Use a minimum of 50 gals of water/A.
		Ziram Granuflo (M3) Ziram 76WP	48 H	2 lb/100 gal water	Apply at 3–5 day intervals from plant emergence to mid-June.
Pines (Nursery beds, Christmas trees)	Phytophthora root disease	<i>Mefenoxam</i> (4) Subdue GR	48 H	Seedbeds and plug plantings: 6–30 lbs/A or 2.2–11 oz/1000 sq. ft. 2–0 Transplants: 12–60 lbs/A or 4.4–22 oz/1000 sq. ft.	Uniformly apply to the soil surface in the spring and again in the fall. Apply ½ inch of irrigation if rainfall is not expected within 24 hrs after application.
		<i>Mefenoxam</i> (4) Subdue Maxx	48 H	Seedbeds and plug plantings: 1.25 pt/A 2–0 Transplants: 2.5 pt/A Plantations: 0.625–1.25 gal/A	Apply as a soil surface spray in at least 50 gallons of water per acre. Apply to seedbeds, transplants or 2-0 transplants in the spring and again in the fall. For best results, ½ inch irrigation or rainfall is required within 24 hrs after application.
		<i>Phosphorous acid</i> (P07) Phostrol	4 H	Foliar spray: 26–54 fl. oz/100 gal	Spray foliage until thoroughly wet. Repeat at 14–21-day intervals, if needed.

CHRISTMAS TREE WEED CONTROL

Mark A. Czarnota, Extension Horticulturist—Weed Science

APPLICATION	HERBICIDE	MOA	APPLICATION RATE/ACRE	REI (Hours)	REMARKS & PRECAUTIONS
Site Preparation	<i>glyphosate-ammonium</i> Finale 1L	10	2–6 qt	12 H	Broadleaf weed and grass control: For annual grasses & weeds, apply 2–3 qt/A if weeds are less than 6" tall, apply 4 qt/A when weeds are taller than 6". For control of perennial grasses & weeds, apply 4 qt/A when weeds are less than 8" tall, and 6 qt/A when weeds are taller than 8". Do not apply over-the-top of desirable seedlings.
	<i>glyphosate</i> Various trade names and formulations.	9	Refer to label	4-12 H	Broadleaf weed and grass control: <i>Glyphosate</i> should be applied prior to transplanting, but after weed emergence. Refer to the label for rates, surfactant recommendations, and tillage delays after application. In areas with severe perennial weed problems such as johnsongrass or bermudagrass, it is advisable to treat areas in late summer or early fall (about 6 weeks before first frost). This must be done prior to planting trees. Do not apply over-the-top of desirable seedlings.
Seed Bed Preparations	<i>dazomet</i> 99% Basamid 99 G	27	350 lb	48-120 H	Control of germinating weed seed: Refer to label for detailed instructions. Product must be applied to cultivated soil, incorporated, watered in, and sealed with water or a tarp for several days. This product can also control soil borne diseases and nematodes (see label for control directions).
Pre-emergence ^{1,2}	<i>benfen</i> 1% + <i>oryzalin</i> 1% XL 2 G	15 + 3	200–300 lb	24 H	Broadleaf weed and grass control: May be applied over the top of established Christmas trees. Do not apply to Douglas-fir or Eastern Hemlock.
	<i>flumioxazin</i> BroadStar 0.25GR SureGuard 51WDG	14	150 lb 8–12 oz	12 H	Provides excellent control of many annual weeds. BroadStar may be used over-the-top of many containerized Christmas trees / ornamentals (see label). SureGuard can be used as a post directed spray to containerized and field grown Christmas trees / ornamentals that have been established for at least 1 year. SureGuard can also be applied over-the-top of select conifers (see label for precautions and tolerant species).
	<i>indaziflam</i> Marengo 0.0224 GR Marengo 0.622 FL	29	100–200 lb 9–18.5 fl oz	12 H	Controls a wide range of annual weeds in both containerized and field grown Christmas trees. Provides one of the longest pre-emergence weed control windows of any pre-emergence herbicide. Do not apply any more than 400 lb pr/A or 18.5 fl oz/A in a 12-month period. Can be tank mixed with Finale or <i>glyphosate</i> . Wait at least 2 months after transplanting liners before using this herbicide. It is recommended that you apply Marengo to trees that are healthy and at least 12–18" tall. Do not apply herbicide spray over-the-top of Christmas trees.
	<i>isoxaben</i> Gallery 75 DF Gallery SC	21	0.66–1.33 lb 23–31 oz	12 H	Provides good preemergence control of broadleaf weeds (from seed), but requires a tank mix partner for control of grasses (i.e. Surflan). Safe for use on a wide range of containerized and field grown Christmas trees / ornamentals (see label).
	<i>oryzalin</i> Surflan 4 AS Surflan 85 DF	3	2–4 qt 2.4–7.1 lb 2.4–4.7 lb	24 H	Broadleaf weed and grass control: Apply as directed spray to soil surface or as in over-the-top in established ³ <i>Abies</i> spp., <i>Cedrus</i> spp., <i>Chamaecyparis</i> spp., <i>Cryptomeria</i> spp., <i>Cupressus</i> spp., Leyland cypress, Deodar cedar, <i>Picea</i> spp., <i>Pinus</i> spp., <i>Tsuga</i> spp., and <i>Taxus</i> spp. The 2 qt rate will provide 2–4 months of weed control while 4 qt rate will extend control to 4–8 months.
	<i>oxyfluorfen</i> + <i>prodiamine</i> Biathlon 2.75 GR	14 + 3	100 lb		See label for a list of tolerant plants. Apply before weed emergence. DO NOT apply when trees are breaking dormancy or growing rapidly. Do not apply to wet foliage.
	<i>pendimethalin</i> Pendulum 3.3 EC Pendulum AquaCap 3.8 ACS	3	2.4–4.8 qt 2.1–4.2 qt	24 H	Broadleaf weed & grass control: Apply at 2.4–4.8 qt/A. Use low rates for short-term weed control (2–4 months) and higher rates for long term weed control (6–8 months). May be applied over the top of established ³ Christmas trees. Species listed on label are: <i>Abies</i> spp., <i>Taxus</i> spp., <i>Thuja</i> spp., <i>Tsuga</i> spp., <i>Chamaecyparis</i> spp., <i>Cryptomeria</i> spp., <i>Juniperus</i> spp., <i>Picea</i> spp., <i>Pinus</i> spp., Leyland cypress, red cedar, and Douglas fir. Do not apply over the top of trees on very hot days or some burn may occur.

APPLICATION	HERBICIDE	MOA	APPLICATION RATE/ ACRE	REI (Hours)	REMARKS & PRECAUTIONS
Pre-emergence ^{1,2} (continued)	<i>pendimethalin</i> Pendulum 2G Corral 2.68GR	3	100–200 lb 76–114 lb	24 H	Broadleaf weed & grass control: Use low rates for short term weed control (2–4 months) and higher rates for long term weed control (6–8 months). May be applied over the top of established ² Christmas trees. Species listed on label are: <i>Abies</i> spp., <i>Taxus</i> spp., <i>Thuja</i> spp., <i>Tsuga</i> spp., <i>Chamaecyparis</i> spp., <i>Cryptomeria</i> spp., <i>Juniperus</i> spp., <i>Picea</i> spp., <i>Pinus</i> spp., Leyland cypress, Redcedar, and Douglas fir.
	Princep Caliber 90 Simazine 90 DF Simazine 90 WDG Various trade names available	5	Broadcast 2.2–4.4 lb	12 H	Broadleaf weed and grass control: Can be applied over-the-top (see label) of established conifers including arborvitae, <i>Abies</i> spp., <i>Picea</i> spp., <i>Taxus</i> spp., white pine, red cedar, and scotch pine. Remove weed growth before application.
	<i>prodiamine</i> Barricade 65WG Barricade 4L	3	1–2.3 lb 21–48 oz	12 H	Broadleaf weed and grass control: May be applied over-the-top of <i>Abies</i> spp., <i>Chamaecyparis</i> spp., <i>Cupressus</i> spp., <i>Juniperus</i> spp., <i>Picea</i> spp., <i>Pinus</i> spp., <i>Taxus</i> spp., <i>Thuja</i> spp., <i>Tsuga</i> spp. seedlings
	<i>prodiamine</i> + <i>Isoxben</i> Gemini 0.65 GR Gemini 3.7SC	3 + 21	100–200 lb 21.75–56.5	12 H	See label for a list of tolerant trees. Excellent preemergence herbicide for the control of annual grass and broadleaf weeds from seeds.
	<i>simazine</i> Simazine 4L Princep 4L	5	Broadcast 2–4 qt	12 H	Broadleaf weed and grass control: Can be applied over-the-top (see label) of established conifers including arborvitae, <i>Abies</i> spp., <i>Picea</i> spp., <i>Taxus</i> spp., white pine, red cedar, and scotch pine. Remove weed growth before application.
	<i>simazine</i> Simazine 4 L and Princep 4 L + <i>oryzalin</i> Surflan AS	5 + 3	Broadcast 2–4 qt + 2–4 qt	12 H	Broadleaf weed and grass control: Apply as directed spray to soil or over-the-top of established ² conifers including arborvitae, <i>Abies</i> spp., <i>Picea</i> spp., <i>Taxus</i> spp., white pine, redcedar, and scotch pine. Do not apply more than once a year. Remove weed growth before application.
	<i>sulfometuron</i> Oust XP 75%	2	Broadcast 2–6 oz	4 H	Broadleaf weed and grass control: Provides excellent long-term pre-emergence weed control when starting with bare ground. Apply to established <i>Pinus</i> spp. Limited information is available on the safe use on other conifers. Initial studies at University of Georgia have indicated safety on plants established 2 years or more. Rates included in the study were 2-6 oz/A, and tolerant species included <i>Abies</i> spp., <i>Cedrus</i> spp., <i>Chamaecyparis</i> spp., and <i>Cupressus</i> spp. Would suggest using Oust on small acreage for 1–2 years before large-scale usage. Stunting has been reported in several species when applied to plants established less than 1 year.
	<i>trifluralin</i> Treflan 5G	3	Broadcast 80 lb	12 H	Broadleaf weed & grass control: Apply to established ² <i>Abies</i> spp., <i>Chamaecyparis</i> spp., <i>Cupressus</i> spp., <i>Juniperus</i> spp., <i>Picea</i> spp., <i>Pinus</i> spp., <i>Taxus</i> spp., & <i>Tsuga</i> spp. seedlings preferably to bare ground. Activate with rain or shallow incorporation within 3 days of applications.
	<i>trifluralin</i> + <i>isoxaben</i> Snapshot 2.5 TG	3 + 21	Broadcast 100–200 lb	12 H	Broadleaf weed & grass control: Apply to established ² <i>Abies</i> spp., <i>Chamaecyparis</i> spp., <i>Cryptomeria</i> spp., <i>Cupressus</i> spp., <i>Juniperus</i> spp., <i>Picea</i> spp., <i>Pinus</i> spp., & <i>Thuja</i> spp., seedlings with a drop or rotary type spreader in late summer to early fall or in early spring before target weeds germinate, or immediately after cultivation. Weed residues must be removed or mixed into the soil before application. One-half inch of rainfall or irrigation, or soil incorporation within 3 days after treatment is required for activation. Provides pre-emergent control of most annual grasses and broadleaf weeds.

1. All pre-emergent herbicides require a rain or irrigation event in order for herbicide activation to occur (approximately 0.5–1" of water). If no rain event occurs and no supplemental watering is provided after a pre-emergent herbicide application, weed control can be extremely poor.
2. Most pre-emergent herbicides will only control germinating weed seed. Generally, pre-emergent herbicides will not control weeds after they have become established (1st or 2nd true leaf), and most pre-emergent herbicides will not control weeds coming from vegetative structures (i.e. yellow and purple nutsedge).

CHRISTMAS TREE WEED CONTROL

APPLICATION	HERBICIDE	MOA	APPLICATION RATE/ ACRE	REI (Hours)	REMARKS & PRECAUTIONS
Pre-emergence ^{1,2} & Post-emergence	<i>oxyfluorfen</i> Goal 2 XL GoalTender 4L	14	Broadcast 4–8 pt 2–4 pt	24 H	Broadleaf weed and grass control: Applications may be made prior to weed emergence or to weeds already emerged that are less than 4" tall. Add 0.25% (2 pts/100 gal of spray solution) of an 80% or greater nonionic surfactant. Apply over-the-top prior to bud break or after foliage has hardened off to the following: <i>Abies</i> spp., <i>Tsuga</i> spp., <i>Pinus</i> spp., <i>Picea</i> spp., <i>Thuja</i> spp., <i>Juniperus</i> spp., and <i>Taxus</i> spp.
	<i>pronamide</i> (Kerb 50 WP)	3	Broadcast 2–4 lb	24 H	Broadleaf weed and grass control: Apply in fall to 6 month and older Arborvitae, pine, cedar, Hemlock, Juniper, fir, spruce, and Yew seedlings for pre and early post-emergence control of winter annual and perennial grasses and pre-emergence control only of selected broadleaf weeds and some grasses.
Post-emergence	<i>clethodim</i> Envoy Plus 0.97 L	1	Broadcast 9–32 oz	24 H	Grass control: Controls most grasses in over-the-top application to cedars, firs, pines and spruces. For control of annual grasses use a 9–16 oz rate. For control of perennial grasses use a 12–32 oz rate. Add a crop oil concentrate at 1% by volume to all treatments.
	<i>clopyralid</i> Stinger 3 L	4	1/5–1/4 fl oz/gal	12 H	Broadleaf weed control: Spray over-the-top to actively growing balsam fir, blue spruce, Fraser fir, scotch pine, and white pine. Apply 0.25–0.5 pt/A Stinger to control annual weeds. For perennial weeds apply 0.5–0.66 pt/A. Use broadcast or band application with a minimum of 10 gal water/A. Applications may be repeated but do not exceed 3/4 pt/A. Do not use a crop oil or surfactant.
	<i>fluzifop-P-butyl</i> Fusilade DX 2L	1	8–16 oz	12 H	Grass control: Apply to actively growing, non-stressed grasses 2–8" tall. Perennial grasses, such as bermuda grass, may require second application to regrowth. Add 1% crop oil concentrate (2 pt/25 gal) or 0.25% (1/2 pt/25 gal) nonionic surfactant to all applications. Avoid contact with conifer foliage by directing spray.
	<i>sethoxydim</i> Segment 1L	1	2.25–3.75 pt		Grass control: Controls annual and perennial grasses in over-the-top spray in pine, fir, spruce, juniper, and cypress Christmas tree plantations. A crop oil or surfactant is not needed. Use a 1.5–2.25% solution for spot application.
	<i>sethoxydim</i> Segment 1L + <i>oxyfluorfen</i> Goal 2XL	1 + 14	2.25–3.75 pt + 1–2 pt	12 H	Broadleaf weed and grass control: Apply as an over-the-top spray in conifer Christmas tree plantation. Do not apply to seedlings less than 10 months old. Apply when weeds are actively growing, but before conifers break bud in spring or after conifer foliage hardens off in the fall.
	<i>sethoxydim</i> Segment 1L + <i>clopyralid</i> Stinger 3L	4 + 14	0.5–1.5 pt + 1/4–2/3 pt	12 H	Broadleaf weed and grass control: Spray over-the-top to actively growing balsam fir, blue spruce, Fraser fir, scotch pine, and white pine. Apply Stinger at 1/4–1/2 pt/A to control annual weeds. For perennial weeds apply Stinger at 0.5–0.66 pt/A. Use broadcast or band application with a minimum of 10 gal water/A. Applications may be repeated but do not exceed 0.66 pt/A. Do not use a crop oil or surfactant.
	<i>triclopyr</i> Garlon 3A	4	2–5 pt	48 H	Broadleaf weed control: Recommend applying to actively growing perennial broad leaf weeds in late summer after all Christmas tree growth has hardened off. Spray solution can cause injury to foliage. To avoid injury, minimize contact to tree foliage (research at the University of Georgia has determined that Virginia pine and firs are more tolerant than cedars, leyland and Arizona Cypress. Apply Garlon 3A only to established Christmas trees that have been planted at least one year prior to treatment. Do not use if trying to establish clover ground covers or allies, and wait until new plantings of turf allies have been mowed at least 3 times before making any broadcast applications. Use broadcast or band application with a minimum of 20 gal water/A. Use a nonionic surfactant at 0.15% v/v (or as label recommends).

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Directed & Spot Sprays	2,4-D Barrage and many others	4	Check label	12–48 H	Broadleaf weed control: For herbaceous broadleaf weed control, mix 51 oz of Barrage in 100 gallons of water. For brush control mix 96 oz of Barrage in 100 gallons of water. Do not allow spray of drift to contact conifer foliage.
	<i>glufosinate-ammonium</i> Finale 1 L	10	1.5–4 oz/gal water	12 H	Broadleaf weed and grass control: Use the lower rate for control of annual weeds and the higher rate for perennial weeds. DO NOT apply over-the-top of desirable seedlings.
	<i>glyphosate</i> Various trade names and formulations	9	Refer to label	4–12 H	Vegetation control: Maybe applied as a shielded or directed spray to the base of the trees. DO NOT apply over-the-top of desirable seedlings. Injury to trees can occur if the spray contacts the foliage. Use a 0.5% solution for control of annual weeds less than 6" tall (add a nonionic surfactant). A 1–2% solution will control most perennial weeds. Use a 5% solution for annual and perennial weed control if spray coverage is not complete. Use a 5–10% solution for woody brush and trees. Refer to the label for rates and surfactant recommendations for specific perennial weeds. <i>Glyphosate</i> is highly water soluble and can be tanked mixed with many pre-emergent herbicides. Refer to <i>glyphosate</i> label to determine compatibility with pre-emergent herbicides.
	<i>halosulfuron</i> SedgeHammer 75DF Manage 75DF Prosedge	2	0.9 grams (per gal) $\frac{2}{5}$ – $1\frac{1}{2}$ oz	12 H	Sedge control: Apply as a post-directed application to control yellow and purple nutsedge in established Christmas trees. Apply with 0.33 fl oz of nonionic surfactant/gal. DO NOT allow the spray to contact foliage of Christmas trees. Wait three months after transplanting before application. On areas scheduled to be planted in Christmas trees wait 4 weeks between application and transplanting.
	<i>sulfosulfuron</i> Certainty	2	0.8–1/6g/1 gal, plus surfactant (spray sedge until runoff)	12 H	Provides post-emergence control of many difficult weeds including ground ivy, Johnsongrass, pennywort, wild garlic, yellow and purple nutsedge. Can be used over the top of select ornamentals such as: Asiatic jasmine, azalea, boxwood, holly, juniper, English ivy, and others. See label for full list of tolerant ornamentals.
	<i>paraquat</i> Gramoxone Inteon 2SL Various trade names and formulations	22	1.3–4 pt (Varies by formulation, check label)	12 H	Apply as directed spray to control annual weeds in ornamental trees. DO NOT allow spray to contact green stems or foliage of ornamentals. Add a nonionic surfactant. ALL PARAQUAT PRODUCTS ARE RESTRICTED USE HERBICIDES.
	<i>triclopyr</i> Garlon 3A	4	2–5 pt	48 H	Broadleaf weed control: Garlon spot sprays can be useful at controlling isolated broadleaf plants. Research at the University of Georgia has indicated that spray solutions of 2–5% (3–6 oz/gal water, plus 2 tsp of a nonionic surfactant) provides good control of many difficult perennial broadleaf weeds (i.e. <i>Smilax</i>).

1. All pre-emergent herbicides require a rain or irrigation event in order for herbicide activation to occur (approximately 0.5–1" of water). If no rain event occurs and no supplemental watering is provided after a pre-emergent herbicide application, weed control can be extremely poor.
2. Most pre-emergent herbicides will only control germinating weed seed. Generally, pre-emergent herbicides will not control weeds after they have become established (1st or 2nd true leaf), and most pre-emergent herbicides will not control weeds coming from vegetative structures (i.e. yellow and purple nutsedge).