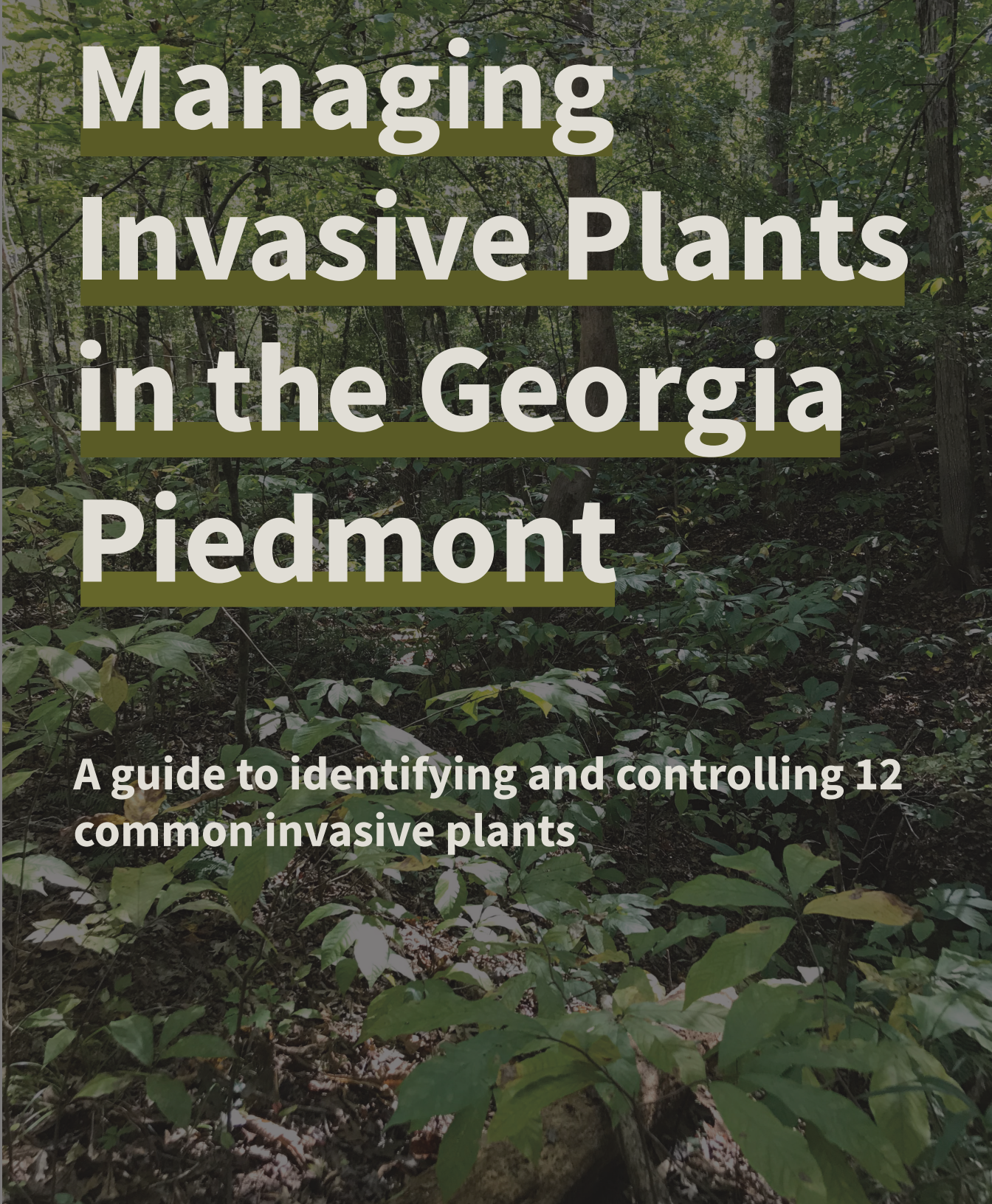

Managing Invasive Plants in the Georgia Piedmont

A guide to identifying and controlling 12 common invasive plants

Northeast Georgia-Invasive Plant Cooperative

Thank you to our partners!

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Athens Land Trust

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INTRODUCTION

This booklet discusses the identification and management of 12 common invasive plants found in Georgia Piedmont forests and woodlands. While this booklet is by no means a comprehensive list of invasive plants in Georgia, these twelve plants pose an increasing threat to the health of Georgia's woodlands, forests, and other natural areas. This booklet represents the collaborative effort of all of the project partners that make up the Northeast Georgia Invasive Plant Cooperative. We have evaluated different management techniques, herbicide products, and timing for control of these twelve invasive plants. By sharing this information, the Northeast Georgia Invasive Plant Cooperative aims to expand our capacity for invasive plant removal by increasing public awareness of these harmful plant species and by sharing our dependable control methods.

What is an Invasive Plant?

Invasive plants are defined by the U.S. government as non-native (or alien) to an ecosystem whose introduction causes, or is likely to cause, economic or environmental harm or harm to human health. This definition is important to keep in mind as we discuss and recognize certain species as harmful to an ecosystem. A plant's nativity may be defined in terms of ecosystem, geography, state, or country, however, it is generally agreed that a native plant is one that has been present in a region for many years without human intervention. A plant may be exotic but might not present a threat to the health of an ecosystem and would therefore not be considered invasive. Conversely, there are also "weedy" native plants that can opportunistically form dense monocultures in the presence of disturbance but wouldn't be referred to as invasive.

Invasive plant species in the Georgia Piedmont region were introduced as ornamental landscape and agricultural plants and may have desirable characteristics such as lush vegetative growth or attractive flowers. Over time, these plants have escaped cultivation and infiltrated our woodlands, riverbanks, and grasslands. Do not let these pretty flowers fool you for these plants are far more insidious than they may appear.

Why are Invasive Plants Harmful?

Invasive plants have devastating effects on economic, human and ecosystem health and have been cited as a principal driver behind global declines in biodiversity. This is especially important in the Georgia Piedmont, as this region has rich biodiversity due to a unique mosaic of habitats

such as hardwood forests, grasslands, floodplains and rock outcrops. As invasive plants spread and form dense monocultures, they swiftly replace native vegetation while also impacting the animals and insects that rely on these plants. Invasive plants also alter soil chemistry, water quality, forest succession, fire regimes, and light availability, negatively impacting habitat.

Invasive plants share several vegetative and reproductive characteristics that enable them to quickly out-compete and displace native plants. Prolific seed production, evergreen leaves, rhizomatous spreading, and toxic root exudates that inhibit growth of other plants are some characteristics of invasive plants. Additionally, habitat disturbance often promotes plant invasions. As development increases, natural areas become smaller or fragmented and human-caused disturbance provides an opportunity for invasive plants to establish themselves into the landscape.

What is the Northeast Georgia Invasive Plant Cooperative?

The Northeast Georgia Invasive Plant Cooperative (NGIPC) was formed in response to the increasing threat of invasive plants to Georgia Piedmont ecosystems. The primary focus areas of this collaborative effort are improved land management and community outreach and engagement. Our partnerships facilitate outreach opportunities and improve connections with federal, state, and local levels of land management. NGIPC works to increase removal of invasive plants, promote educational opportunities, and improve land management through volunteer coordination and development of The Young Conservation Stewards program. The Young Conservation Stewards are local youth that are trained by Athens Land Trust and other partners to improve and restore habitat while providing workforce development opportunities for local youth.

This guide is designed to educate people on the removal of major invasive plants found in the Georgia Piedmont. The guide will provide identification techniques, plant biology, and several management strategies to effectively treat invasive plant species that pose a major threat to the environment.

SUGGESTED HERBICIDES

Herbicides must be used in accordance to the label. Herbicide labels are the law! Read chemical labels prior to use. Herbicide labels clearly define the chemical's directions for use, percent active ingredient, human health hazards, environmental hazards, first aid, application methods, application rates, and storage and disposal protocol. Failure to comply with label guidelines may result in injury and is punishable by law. Listed below are three active ingredient herbicides that are commonly used to control invasive plants. We recommend the following herbicides because of their favorable environmental profile, low toxicity, and availability in most lawn and garden stores.

Glyphosate

41%, 50%, 53 % active ingredient

Glyphosate is a non-selective, post-emergent, systemic herbicide used to control of grasses, broadleaf herbs, trees and shrubs. This product has no residual action in the soil, is not available for uptake by plant roots, and is degraded by soil microbes.

Mode of action: Disrupts an enzymatic pathway responsible for amino acid synthesis found only in plants.

Application Methods: Cut and treat; foliar spraying.

Personal protective equipment: Long pants, long-sleeved shirt, shoes and socks.

Target species: Autumn Olive, Callery Pear, Chinese Privet, English Ivy, Golden Bamboo, Japanese Honeysuckle, Japanese Knotweed, Japanese Stiltgrass, Mahonia, Nandina, Perilla Mint, and Wisteria.

Environmental Considerations: The surfactants added to most glyphosate formulations may negatively impact aquatic species. Do not apply directly to water. Aquatic formulations are available for use in wetlands. Avoid spraying or allowing spray drift to come in contact with desirable non-target plants including adjacent sensitive areas. Glyphosate binds tightly with soil particles and is not mobile in the environment.

Triclopyr

ester form

Triclopyr is a selective, post-emergent, systemic herbicide used to control broadleaf herbs, trees, and shrubs. May be used for weed control when invasives are growing in proximity to desirable grasses. This product is slightly persistent in the soil. Degradation pathways include photolysis and microbial degradation. The ester form of triclopyr can be highly volatile and is best applied on days with lower temperatures and no wind.

Mode of action: Mimics the action of the plant hormone, auxin, resulting in uncontrolled abnormal growth and ultimately plant death.

Application Methods: Cut and treat, basal bark, & foliar spraying.

Personal protective equipment: Must wear long pants, long-sleeved shirt, shoes, socks, eye protection, and chemical-resistant gloves.

Target Species: Autumn Olive, Callery Pear, Chinese Privet, English Ivy, Japanese Knotweed, Mahonia, Nandina, and Wisteria.

Environmental considerations: Triclopyr is moderately persistent in the soil and has a half-life of 30 days but generally isn't very mobile in the soil. Triclopyr is slightly toxic to aquatic species. Do not apply directly to water or in aquatic habitats.

Triclopyr

amine form

Triclopyr is a selective, post-emergent, systemic herbicide used to control broadleaf herbs, trees, and shrubs. May be used for weed control when invasives are growing in proximity to desirable grasses. This product is slightly persistent in the soil. Degradation pathways include photolysis and microbial degradation.

Mode of action: Mimics the action of the plant hormone, auxin, resulting in uncontrolled abnormal growth and ultimately plant death.

Application Methods: Cut and treat & foliar spraying.

Personal protective equipment: Must wear long pants, long-sleeved shirt, shoes, socks, eye protection, and chemical-resistant gloves.

Target Species: Autumn Olive, Callery Pear, Chinese Privet, English Ivy, Japanese Honeysuckle, Japanese Knotweed, Mahonia, Nandina, and Wisteria.

Environmental considerations: Triclopyr is moderately persistent in the soil and has a half-life of 30 days but generally isn't very mobile in the soil. Triclopyr is slightly toxic to aquatic species. Do not apply directly to water or in aquatic habitats.

Sethoxydim

13%-18% active ingredient

Sethoxydim is a selective, post-emergent, systemic herbicide used for control of grasses. This product has no residual action and degrades rapidly in the environment. Degradation pathways include photolysis and microbial degradation.

Mode of action: Inhibits the pathway in grasses responsible for synthesis of fatty acids necessary for the formation of cell membranes.

Application Methods: Foliar spray.

Personal protective equipment: Long pants, long-sleeved shirt, shoes, socks, eye protection, chemical resistant gloves.

Target Species: Japanese Stiltgrass and other invasive grasses.

Environmental considerations: Sethoxydim is moderately toxic to aquatic species. Do not apply to water or in aquatic habitats. Sethoxydim is water soluble and is mobile in the soil.

TOOLS OF THE TRADE

Folding Saw

This tool is excellent for control of invasive shrubs and small trees using the cut and treat method described in the following section.

Spray Bottle

Quart-sized spray bottles with adjustable nozzles are an effective way to apply herbicide solutions to cut stumps using the cut and treat method.

Loppers

Loppers are a great option for cutting and treating smaller stems of invasive shrubs and vines.

String Trimmer or Mowers

Mowers and string trimmers may be used to cut back tall invasives such as Golden Bamboo or Japanese Knotweed to make foliar herbicide applications more feasible. After cutting plants back, the new growth is both shorter and more susceptible to foliar treatment.

Cut and Treat Method

01

This method is effective for all woody vines, shrubs, and trees. Start with a standard glyphosate product (41%-53% active ingredient). Mix glyphosate product half and half with water. Do not use ready-to-use glyphosate as this solution is already pre-diluted and are not strong enough for this method. You may also use full strength triclopyr amine products.

02

Using loppers, pruners, or hand saw, cut stems or trunk 1-2” above the soil level, creating a clean and level cut.

03

Immediately after cutting (preferably within 15 seconds) thoroughly wet the cut surface with the herbicide mix. A quart-sized spray bottle works well for this. Try not to step on the cut stump after application as mud/clay on your shoes may diminish the herbicide’s effectiveness.

Why Cut and Treat?

The cut and treat method is preferred to methods that disturb the soil, such as digging up roots or using a “weed wrench”. When soil is disturbed, the seed bank is stimulated, possibly resulting in a secondary invasion of another problematic plant, such as Japanese Stiltgrass. Additionally, if plants are cut and not treated with herbicide, plants will often produce more stems from the root stock.

Materials Needed

- Pruners, loppers or handsaw
- Quart-sized spray bottle
- Herbicide solution

Foliar Spraying

Tools to use: 3- or 4-gallon backpack sprayer or 1- or 2-gallon handheld sprayer. Handheld sprayers are only practical for treating small pockets of invasive plants. Backpack sprayer nozzles are interchangeable and the versatile and adjustable cone nozzle works best for this herbicide application method.

Timing and conditions: Apply to actively growing plants when leaves are dry and there is little wind. Evergreen plants are active and may be sprayed in the winter on warm days, preferably when air temperature is over 60°F. Glyphosate can be applied an hour before light rain but do not apply before periods of heavy rain.

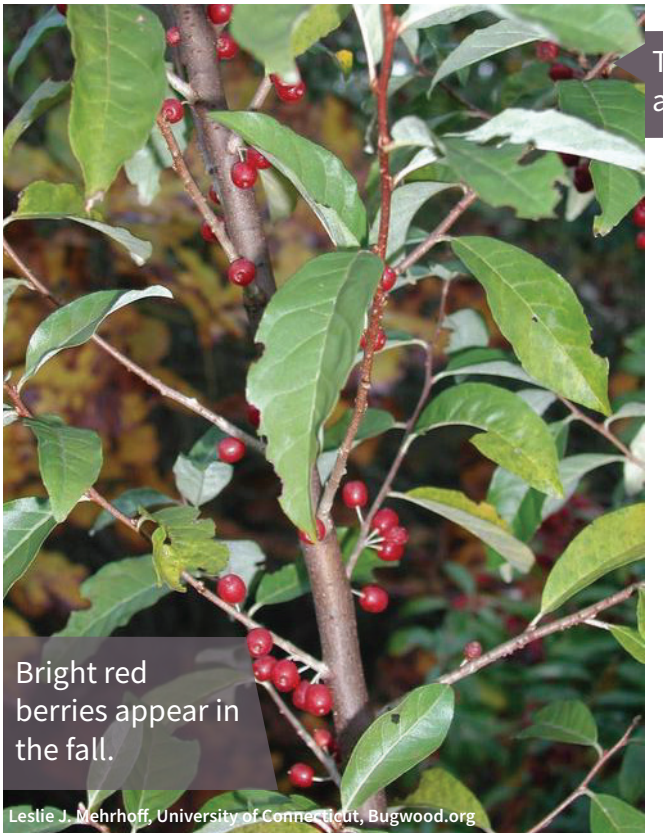
Methods: Wet 90% of leaves avoiding surrounding vegetation. Follow species-specific guidelines found in this booklet for herbicide concentrations to use, but it is generally recommended that for thin-leaved plants, apply a 1%-3% volume solution (1.5 - 4 oz per gallon) and 4-7% volume solution (5 - 9 oz per gallon) for thick or waxy-leaved plants. Be patient! Certain plants such as English Ivy take longer to show the effects of herbicide application.

IDENTIFICATION
TREATMENT

Autumn Olive

~ *Elaeagnus umbellata*

IDENTIFICATION



Bright red berries appear in the fall.

Leslie J. Mehrhoff, University of Connecticut, Bugwood.org

The bark is smooth and gray.

Chris Evans, University of Illinois, Bugwood.org

The undersides of Autumn Olive leaves are covered in prominent white scales.

Extremely fragrant white flowers bloom in the early spring.

Nancy Loewenstein, Auburn University, Bugwood.org

Autumn Olive

TREATMENT

~ Elaeagnus umbellata

01 Do Not Plant

Autumn Olive produces fruit that are attractive to a variety of birds which then spread the seed through their droppings. Related invasive, Thorny Olive, can be treated in the same ways described below.

02 Cut and Treat

Using pruners, loppers, or hand saws, cut stems 1-2" above the ground. Immediately apply full strength triclopyr amine to the portion of the cut stump using a quart-sized spray bottle. Spray the cut stump until thoroughly wet and monitor regularly for potential re-sprouting from the root stock.

03 Foliar Herbicide Application

Dense thickets of seedlings or re-sprouting after the cut and treat method are effectively treated using an application of 3-4% Triclopyr amine solution to the leaves during the summer months. Mix 3.8-5 ounces of triclopyr amine per gallon of water and apply to the leaves using a handheld or backpack sprayer.

04 Mowing or Grazing

Brush mowers can efficiently level shrubs with stems up to 2” in diameter. These walk-behind mowers are widely available as rentals and usually cost less than $100 per day. Treat with herbicide the following season. Goats and sheep will readily feed upon Autumn Olive and can quick defoliate dense thickets under four feet in height. Only use grazing or mowing as a part of an integrated approach in conjunction with herbicide application the following season.

Callery Pear

~ *Pyrus calleryana*

IDENTIFICATION

Small, round pears form in June and are eaten and spread by birds.

Chuck Bargeron, University of Georgia, Bugwood.org

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

Clusters of white flowers bloom in March-May and have an unpleasant, fish-like odor.

Trees can reach 30-40 feet tall or form dense thickets.

Dan Tenaglia, Missouriplants.com, Bugwood.org

Florida Division of Plant Industry , Florida Department of Agriculture and Consumer Services, Bugwood.org

Dark, glossy leaves have wavy edges and a tapered tip. In the fall, foliage turns a bright red to maroon.

Callery Pear

TREATMENT

~ Pyrus calleryana

01 Do Not Plant

This species is widely commercially available and planted in the landscape. Unfortunately, sterile varieties are able to cross with other pear species and produce fruit in just 3 years. Fruit are spread by birds, creating dense, thorny thickets in fields, roadsides, and woodlands.

02 Hack and Squirt

Mature trees serve as a seed source and produce many fruit that are then dispersed by birds. Using an axe or hand saw, make cuts into the bark deep enough to expose cambium layer and immediately apply herbicide (Half water and half 41% Glyphosate) to the exposed trunk using a quart-sized spray bottle.

03 Cut and Treat

For small-medium trees, using pruners, loppers, or hand saws, cut stems 1-2” above the ground. Immediately apply herbicide solution (1/2 volume of water and 1/2 volume of 41% active ingredient glyphosate concentrate) to the stump using a quart-sized spray bottle. Spray the cut stump until thoroughly wet. Apply foliar spray to re-sprouts.

04 Foliar Herbicide Application

Spray re-sprouts and seedlings with a 2% glyphosate solution to the leaves. Mix 2.6 ounces of glyphosate (41% active ingredient) per gallon of water and apply to the leaves using a handheld or backpack sprayer.

Chinese Privet

~ *Ligustrum sinense*

IDENTIFICATION

Karan A. Rawlins, University of Georgia, Bugwood.org

Leaves are arranged oppositely of one another on smooth gray stems.

Small purple berries form in fall to winter.

Chris Evans, University of Illinois, Bugwood.org

Clusters of tiny, fragrant white flowers bloom in the spring.

Chinese Privet forms dense thickets in floodplains, forested bottomlands, and disturbed areas. Shrubs can reach 30 feet in height.

Chuck Bargeron, University of Georgia, Bugwood.org

Chinese Privet

TREATMENT

~ Ligustrum sinense

01 Control Plants When Young

Remove small seedlings and sprouts before they mature and begin forming fruit. Each plant produces many berry-like fruit that are readily dispersed by birds. Sprouts can be sprayed using a foliar herbicide application.

02 Cut and Treat

Using pruners, loppers, or hand saws, cut stems 1-2" above the ground. Immediately apply herbicide solution (half water and half 41% active ingredient glyphosate concentrate) to the cut stump using a quart-sized spray bottle. Spray the cut stump until thoroughly wet and monitor regularly for potential re-sprouting from the root stock. Apply foliar spray to re-sprouts.

03 Foliar Herbicide Application

Dense thickets of seedlings or re-sprouting after the cut and treat method are most effectively treated using an application of 3% glyphosate solution to the leaves. This method is effective year round but is perhaps less effective in the spring. Mix 2.6 ounces of glyphosate (41% active ingredient) per gallon of water and apply to the leaves using a handheld or backpack sprayer.

04 Mowing or Grazing

Goats and sheep will readily feed upon Chinese Privet and can quickly defoliate short shrubs and sprouts. Multi-year treatments will be required to completely eradicate this shrub by depleting the root system of its reserves. Preferred method would be using grazing in conjunction with herbicide application.

English Ivy

~ *Hedera helix*

IDENTIFICATION

Vines can form thick mats on the forest floor or on the trunks of trees.

Vines are woody and often appear hairy.

Dark green, shiny, evergreen leaves.

Leaves can be heart-shaped or lobed depending on maturity of the vine.

Vines flower in June-October. Flowers are white to green and form small purple clusters of fruit in late winter.

English Ivy

TREATMENT

~ Hedera helix

01 Do Not Plant

English ivy is readily available in home and garden stores. Unfortunately, landscape plantings can easily spread to adjacent natural areas by spreading vines that root at the nodes. Vines only flower when mature and growing vertically on trees, structures, and virtually never when growing on the ground. Birds feed on the fruit and spread seeds through their droppings.

02 Remove Vines from Trees

Using pruners, loppers, or hand saws, sever each vine as close to the base of the tree as possible. Immediately apply herbicide solution to the portion of the cut vine that attaches to the root. It is important to cut and treat every vine around the trunk. A single missed vine can "feed" the whole tree-full of vines. English ivy sap may also cause a mild skin rash.

03 Clear Vines on Ground Level

Wearing thick gardening gloves, pull up vines and attached roots from the ground. Any roots remaining will sprout new vines that can be pulled or sprayed. Mowers, string trimmers, or grazing animals can also clear ivy with a follow-up treatment of foliar herbicide application on re-sprouts.

04 Foliar Herbicide Application

English ivy leaves have thick waxy cuticle, inhibiting penetration by herbicides and making the use of surfactant crucial. In the fall-winter wet leaves with a 7% glyphosate solution (Mix 10 ounces of 41% glyphosate concentrate and one ounce of non-ionic surfactant per gallon of water) using a handheld or backpack sprayer.

Golden Bamboo

~ *Phyllostachys aurea*

IDENTIFICATION

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

Evergreen leaves are blade-like with parallel veins. Leaf bases have papery sheaths which fall off as the plant matures.

Stems can reach 6 inches in diameter and are hollow between joints. Color of stems can range from yellow, green, or black.

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

Stems' joints are solid. Wiry branches emerge from joints.

Plants spread and create dense monocultures due to their extensive network of underground roots. Stems can reach up to 30 feet in height.

Chuck Bargeron, University of Georgia, Bugwood.org

Golden Bamboo

TREATMENT

~ Phyllostachys aurea

01 Do Not Plant

Bamboo is sold and marketed as a screen or green-fence, but these plantings easily spread beyond their original planting location. Once established, bamboo can be very challenging to control due to their extensive network of fast-growing underground stems.

02 Control the Edges of Infestation

Georgia is home to three native species of bamboo. Please check with a botanist before beginning treatment to ensure you are controlling the invasive species of bamboo. Begin by controlling the outer-most stems using the cut and treat method (see step 3). It is important to prevent the infestation from spreading further. Additionally, underground barriers may be used to keep a neighbor's bamboo at bay.

03 Cut and Treat

Using pruners, loppers, or hand saws, cut stems 1-2" above the ground. Immediately apply herbicide solution (1/4 volume of water and 3/4 volume of 41% active ingredient glyphosate concentrate) to the portion of the cut stem that attaches to the root using a quart-sized spray bottle. Spray the cut stump until thoroughly wet, filling the "cup" that forms from the hollow stem. Apply foliar spray to re-sprouts.

04 Foliar Herbicide Application

Spray re-sprouts following cut and treat when shoots are 1-2 ft tall with a 10% glyphosate solution to the leaves. Mix 10.6 ounces of glyphosate (41% active ingredient) per gallon of water and apply to the leaves using a handheld or backpack sprayer.

Japanese Honeysuckle

~ *Lonicera sempervirens*

IDENTIFICATION

Mature leaves have smooth unlobed edges while young leaves are lobed.

Wendy VanDyk Evans, Bugwood.org

Japanese Honeysuckle blooms from April-July. Tubular-shaped flowers are white-cream and are very fragrant.

Chuck Bargeron, University of Georgia, Bugwood.org

Leslie J. Mehrhoff, University of Connecticut, Bugwood.org

Perennial woody vines can form a mat on the forest floor or climb trees, fence posts, or shrubs.

Japanese Honeysuckle

TREATMENT

~ Lonicera sempervirens

01 Regular Monitoring

Japanese Honeysuckle is a vigorous grower and can quickly out compete native understory species, smother shrubs and small trees, and reduce native seedling recruitment. Monitor for vines on the forest floor, forest edges, and open sunny areas.

02 Cut and Treat

Using pruners, loppers, or hand saws, cut vines 1-2" above the ground. Immediately apply herbicide solution (half water and half 41% active ingredient glyphosate concentrate) to the portion of the cut stump that attaches to the root using a quart-sized spray bottle. Spray the cut stump until thoroughly wet and monitor regularly for potential re-sprouting from the root stock. Apply foliar spray to re-sprouts.

03 Fall Foliar Herbicide Application

Honeysuckle leaves are semi-evergreen, allowing plants to photosynthesize when most other plants are dormant. Take advantage of persistent leaves and apply herbicide to the leaves in the fall and winter when the risk of killing non-target plants is reduced. Apply 2% glyphosate solution to the leaves by mixing 2.6 ounces of glyphosate per gallon of water and applying with a hand-held or backpack sprayer on a warm day (best when over 60°F).

04 Grazing & Prescribed Burning

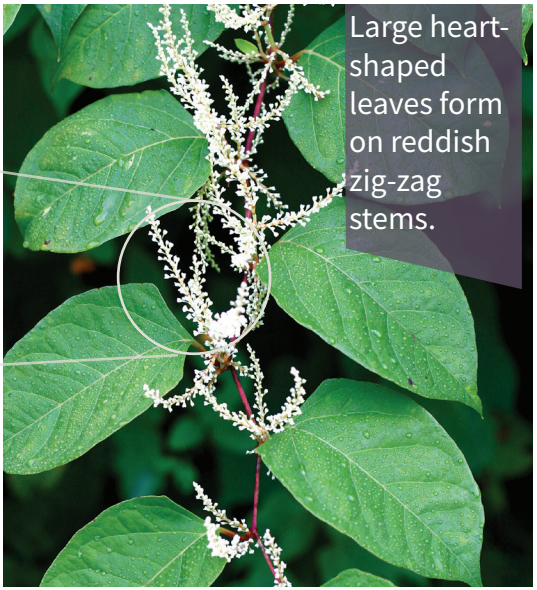
Grazing and burning can effectively remove above ground vegetation but Honeysuckle has been shown to recover with even more vigorous growth than before a single treatment. The use of both fire or grazing followed by foliar application of herbicide on re-sprouts can be effective.

Japanese Knotweed

~ Fallopia japonica

IDENTIFICATION

White flower clusters bloom May-September.



Large heart-shaped leaves form on reddish zig-zag stems.

Robert Vidéki, Doronicum Kft., Bugwood.org

Knotweed grows in clumps of hollow, bamboo-like canes.

Tom Heutte, USDA Forest Service, Bugwood.org

Dense patches of canes can reach 12' in height.

Japanese Knotweed

TREATMENT

~ Fallopia japonica

01 Early Detection

Japanese Knotweed grows vigorously and spreads rhizomatously. Once established, this plant becomes very challenging to control. Regularly monitor stream or river banks and other riparian areas where Knotweed is commonly found.

02 Cut and Treat

Using pruners, loppers, or hand saws, cut stems 1-2" above the ground. Immediately apply herbicide solution (half water and half 41% active ingredient glyphosate concentrate) to the portion of the cut stump that attaches to the root using a quart-sized spray bottle. Spray the cut stump until thoroughly wet and monitor regularly for potential re-sprouting from the root stock. Apply foliar spray to re-sprouts.

03 Mowing

For taller or larger infestations, cut back plants twice during the summer months using a brush-cutter. These are readily available for rent and usually cost less than $100 per day. The shorter flush of growth in the early fall is susceptible to foliar herbicide application.

04 Foliar Herbicide Application

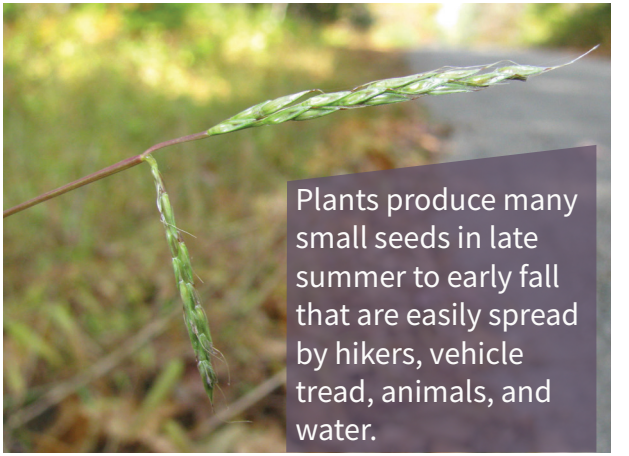
Spray leaves using an application of 5% glyphosate solution to the leaves during the summer months. Mix 7 ounces of glyphosate (41% active ingredient) per gallon of water and apply to the leaves using a handheld or backpack sprayer.

Japanese Stiltgrass

~ *Microstegium vimineum*

IDENTIFICATION

Patches of Japanese Stiltgrass can reach 2-3' in height and spreads aggressively. Stems are slender and bamboo-like with jointed nodes. Plants often root from these nodes.



Plants produce many small seeds in late summer to early fall that are easily spread by hikers, vehicle tread, animals, and water.

Leaves are linear and narrow.

Central vein is silvery and reflective.

Japanese Stiltgrass

TREATMENT

~ Microstegium vimineum

01 Minimize Disturbance

This annual grass quickly invades open and disturbed spaces in forests, roadsides, and utility easements. Avoid soil disturbance to prevent invasion. Keep in mind that invasions can still invade and spread aggressively even without disturbance.

02 Foliar Herbicide Application

Application of grass-specific herbicides are extremely effective at low concentrations and preserve adjacent broad-leafed plants that can provide competition for the next season of Stiltgrass seed germination. Mix 2 teaspoons of Sethoxydim (13%-18% active ingredient) + 2 teaspoons (1/3 ounce) of non-ionic surfactant per gallon of water and apply to leaves thoroughly using a backpack sprayer in late July- August before seeds form. Treatment timing is crucial. Early treatments may stimulate a second round of seed germination, which will require second treatment.

03 Mowing or Hand-pulling

Japanese Stiltgrass can also be mowed or hand-pulled late in the season (Aug-Sept) before seeds form. Hand pulling is only a viable method for small areas.

04 Annual Treatments are Required

Depending on conditions, Japanese Stiltgrass seeds can remain dormant and viable in the soil for 3-5 years, possibly as many as 7 years. To deplete the seed bank, repeat treatments annually before seeds form in late June-early September.

Mahonia

~ *Mahonia bealei*

IDENTIFICATION

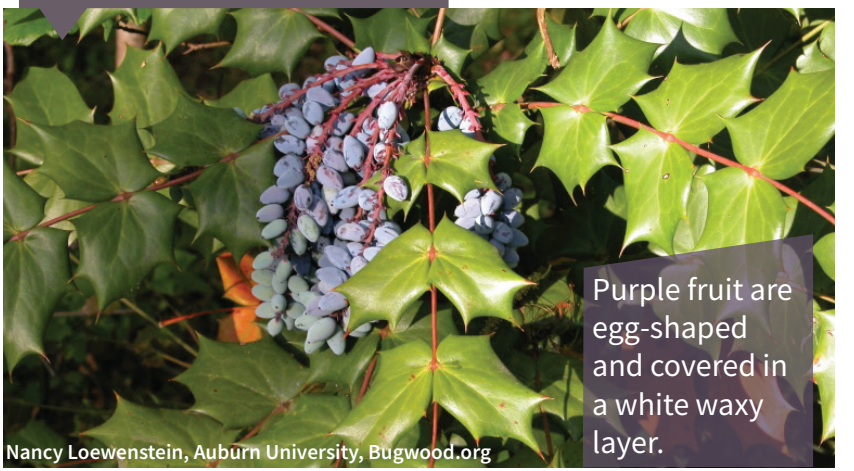
Nancy Loewenstein, Auburn University, Bugwood.org

Bird-dispersed seedlings on the forest floor.

Multi-stemmed shrubs can reach 10 feet in height. Stems are often spindly-looking and have dark brown, corky bark. This plant's inner wood is bright yellow.

John Ruter, University of Georgia, Bugwood.org

Dark green leaves appear holly-like with prickly spines. Leaves are pinnately compound on reddish stalks.



Nancy Loewenstein, Auburn University, Bugwood.org

Purple fruit are egg-shaped and covered in a white waxy layer.

Mahonia

TREATMENT

~ Mahonia bealei

01 Do Not Plant

Unfortunately, mahonia is readily available in the nursery trade. Remove plantings from the landscape using listed control methods or remove berries to prevent bird dispersal.

02 Control Plants When Young

Remove small seedlings and sprouts before they mature and begin forming fruit. Each plant produces many berry-like fruit that are readily dispersed by birds. Sprouts can be pulled when the soil is moist or sprayed using herbicide application.

03 Cut and Treat

Using pruners, loppers, or hand saws, cut stems 1-2" above the ground. Immediately apply herbicide solution (half water and half 41% active ingredient glyphosate concentrate) to the portion of the cut stump that attaches to the root using a quart-sized spray bottle. Spray the cut stump until thoroughly wet and monitor regularly for potential re-sprouting from the root stock. Apply foliar spray to re-sprouts.

04 Foliar Herbicide Application

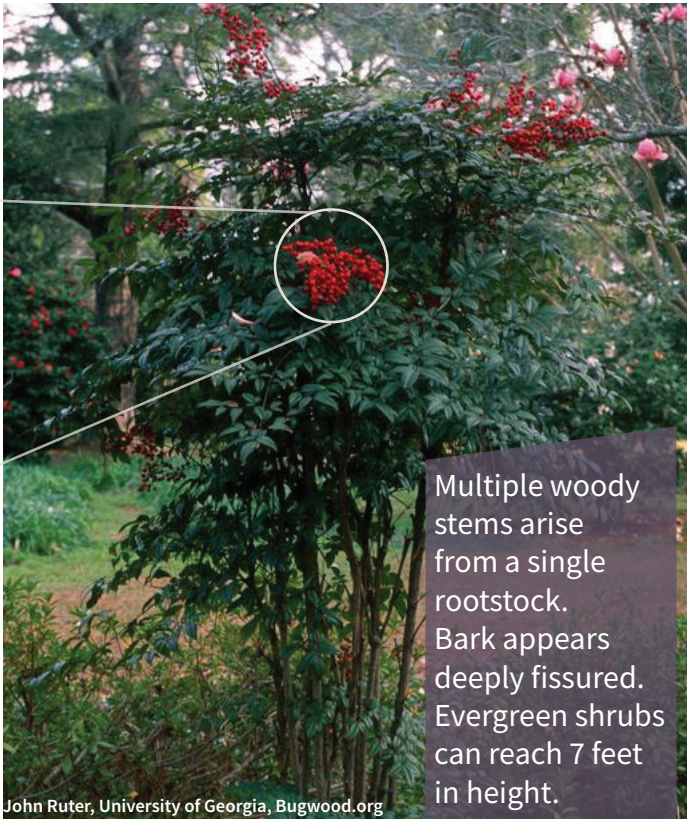
Seedlings or re-sprouts following a cut and treat application are most effectively treated using an application of 5% glyphosate solution to the leaves during the summer months. Mix 7 ounces of glyphosate (41% active ingredient) per gallon of water and apply to the leaves using a handheld or backpack sprayer.

Heavenly Bamboo

~ *Nandina domestica*

IDENTIFICATION

Bright red berries form in April in dense clusters and persist through the winter. Can be toxic to birds such as Cedar Waxwings.



John Ruter, University of Georgia, Bugwood.org

Multiple woody stems arise from a single rootstock. Bark appears deeply fissured. Evergreen shrubs can reach 7 feet in height.

Many Nandina cultivars are used in the landscape due to their red-orange fall color and evergreen foliage.

Heavenly Bamboo

TREATMENT

~ Nandina domestica

01 Do Not Plant

Many cultivars of Nandina are available in the nursery trade. However, birds readily feed on and disperse berries; berries contain cyanide which is known to kill Cedar Waxwings.

02 Remove Fruit

In a landscape setting where removing plants isn't an option, cut off berries and dispose to avoid animal dispersal and bird poisoning.

03 Cut and Treat

Using pruners, loppers, or hand saws, cut stems 1-2" above the ground. Immediately apply herbicide solution (half water and half 41% active ingredient glyphosate concentrate) to the portion of the cut stump that attaches to the root using a quart-sized spray bottle. Spray the cut stump until thoroughly wet and monitor regularly for potential re-sprouting from the root stock. Apply foliar spray to re-sprouts.

04 Foliar Herbicide Application

Seedlings or re-sprouts after a failed cut and treat method are most effectively treated using an application of 2% glyphosate solution to the leaves during the summer months. Mix 2.6 ounces of glyphosate (41% active ingredient) per gallon of water and apply to the leaves using a handheld or backpack sprayer.

Perilla Mint

~ *Perilla frutescens*

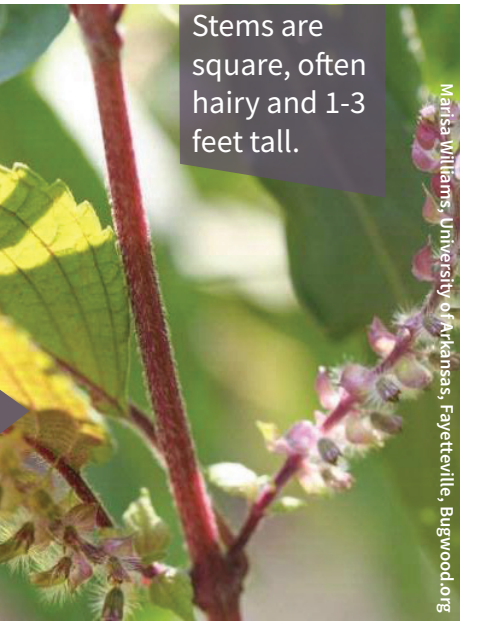
IDENTIFICATION

Foliage smells minty or like basil when crushed. All portions of the plant are toxic and cause respiratory distress or death to cattle, horses, and goats.

Leaves are often wavy and can range in color from green to purple.

Chris Evans, University of Illinois, Bugwood.org

Leaf edges are serrated and tooth-like.



Stems are square, often hairy and 1-3 feet tall.

Marisa Williams, University of Arkansas, Fayetteville, Bugwood.org

Clusters of small white or purple flowers bloom August to October.

Perilla Mint

TREATMENT

~ Perilla frutescens

01 Scout Early

Begin looking for this annual weed in the late spring-early summer. Treating plants before producing seed in late summer is important as individual plants may produce up to 1,500 seeds if allowed to go to seed.

02 Apply Post-emergent Herbicide or Manual Removal

Applying a 0.25% glyphosate solution (2 teaspoons of 41% glyphosate per gallon of water) to leaves in the late summer. Use hand-held sprayer or backpack sprayer to wet uppermost leaves. Hand-pulling plants is also an option for small invasions. This low-dose of herbicide is very effective on perilla mint and as a side benefit, will preserve adjacent perennial vegetation.

03 Avoid Dispersal

Treat Perilla Mint before seed are produced to avoid dispersal to adjacent lands. The most effective months for management are July-August, right before flowering.

04 Monitor and Treat Annually

Vigilant monitoring and early detection is an important component of invasive plant management. Preventing seed set is the first line of defense against this annual broadleaf weed.

Wisteria

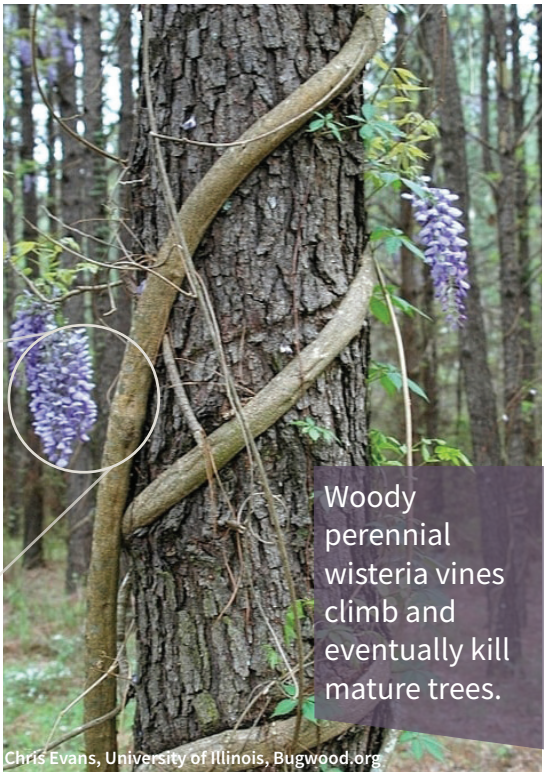
~ *Wisteria sinensis*

IDENTIFICATION

Nancy Dagley, USDA National Park Service, Bugwood.org

New shoots and vines emerge from underground rhizomes and can form a dense mat on the forest floor. Leaves are compound. Leaflets have smooth margins and tapered tips. Underground vines and roots arising from single plant can travel 50 yards.

Purple pendulous flowers bloom simultaneously as the vine's leaves emerge in early spring. Flowers are extremely fragrant.



Chris Evans, University of Illinois, Bugwood.org

Woody perennial wisteria vines climb and eventually kill mature trees.

Wisteria

TREATMENT

~ Wisteria sinensis

01 Do Not Plant

Chinese Wisteria is available in the nursery trade and is often planted as a trellising vine. Vines can easily escape cultivated areas and spread to adjacent natural areas by underground rhizome or vines rooting at the nodes.

02 Basal Bark Treatment

Vines or stems can often be seen running just along the surface of the soil. Apply a solution of 25% triclopyr ester and 75% vegetable cooking oil to the exposed vines.

03 Cut and Treat

Using pruners, loppers, or hand saws, cut vines 1-2” above the ground. Immediately apply herbicide solution (half water and half 41% active ingredient glyphosate concentrate) to the portion of the cut stump using a quart-sized spray bottle. Spray the cut stump until thoroughly wet and monitor regularly for potential re-sprouting from the root stock. Apply foliar spray to re-sprouts.

04 Foliar Herbicide Application

This may be the most effective treatment. Using a backpack sprayer, apply a solution of 5% glyphosate to the leaves during the summer months. Mix 7 ounces of glyphosate (41% active ingredient) per gallon of water and apply to the leaves using a handheld or backpack sprayer.

Vocabulary Words

Cambium: The thin, actively growing region between the plant's bark and inner wood. This is the region of a plant's stem where herbicide is uptaken after application of cut and treat.

Invasive plant: An exotic plant that has expanded its range or has been introduced into a new habitat, has the ability to proliferate quickly, and whose introduction has negative impacts ecologically and economically.

Monoculture: The cultivation or growth of a single species in an area; often referring to a plant in an agricultural or natural habitat.

Non-selective herbicide: Indiscriminately effects all types of plants including grasses, trees, shrubs, and broadleaved herbaceous plants. Glyphosate-based products are an example of a non-selective herbicide.

Photolysis: The process by which a compound is degraded by exposure to light.

Post-emergent herbicide: An herbicide product that is applied to a weed's leaves or stems after the seeds have germinated. Glyphosate, Triclopyr, and Sethoxydim are all examples of post-emergent herbicide products.

Pre-emergent herbicide: An herbicide product that is used to prevent the germination of weed seeds and has no effect on actively growing plants and seeds that have already germinated.

Selective herbicide: An herbicide that specifically effects a certain group of plants but not others. For example, Sethoxydim is used for the control of grasses but has no effect on broadleaf herbaceous plants.

Succession: A natural process by which the species composition of a particular habitat changes over time.

Urbanization: A shift towards an area becoming more urban and less rural.

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