

## Controlling Invasive Exotic Plants in North Florida Forests<sup>1</sup>

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Of the more than 4,000 known plant species growing in Florida, approximately 30% are not native to Florida or the Southeast. Organisms are considered non-native when they occur artificially in locations beyond their known historical native ranges.

The term non-native can refer to species brought in from other continents, regions, ecosystems and even other habitats. The most important aspect of a non-native (exotic) plant is how it responds to a new environment. An invasive species is one that displays rapid growth and spread, allowing it to establish over large areas. Invasive species are free from the complex array of natural controls, including herbivores, parasites, and diseases, that are present on their native lands. The term noxious is a legal designation used specifically for plant species that have been determined to be major pests of agricultural ecosystems and are subject, by law, to certain restrictions.

Invasive non-native organisms are one of the greatest threats to the natural ecosystems of the

United States. According to the U.S. Fish & Wildlife Service, an estimated 42% of the nation's endangered species have declined as a result of encroaching invasive species. Invasive species cause billions of dollars in economic losses and expenditures each year for agriculture, forestry, range lands and roadways management (Westbrooks 1998). Known ecological impacts of invasive plants include: reduction of biodiversity, loss of and encroachment upon endangered and threatened species, loss of habitat for native insects, birds and other wildlife, alterations to the frequency and intensity of fires and disruption of native plant-animal associations such as pollination, seed dispersal and host-plant relationships. In addition, invasive plants can hybridize with native plants and alter their genetics; they grow rapidly, sometimes girdling native shrubs and trees; they increase the incidence of plant disease and stress in forested areas; and they reduce the amount of space, water, sunlight and nutrients that would otherwise be available for native species.

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**Use pesticides safely. Read and follow directions on the manufacturer's label.**

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This publication describes many of the current methods being used to manage some of the more common and troublesome invasive exotic plants in north Florida forests. Consult the sources referenced at the end of the paper for additional details about these and several other methods. This publication is intended to assist private forest landowners in managing their existing forests or establishing new plantations. All of the control methods involve some combination of mechanical and chemical treatments. Biological control agents for some of these plants are currently under investigation. Pictures of each species can be found at the following Web sites: <http://plants.ifas.ufl.edu/ie6/index.html> or in Langeland and Burks' book, "Identification and Biology of Non-Native Plants in Florida's Natural Areas."

### Disclaimer

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Treatment recommendations involve general herbicide prescriptions that have yielded acceptable levels of control in experimental trials. However, these recommendations are not guaranteed to work on every site. Most herbicides are applied in some combination with water and a surfactant (wetting agent). *Always* follow current herbicide label instructions for determining rates of application, necessary surfactants, approved application sites, safety gear, and use precautions. Additional information about the various herbicides used in

forestry applications are in Osiecka, Nowak, Long and Mossler, *Herbicides registered for pine management in Florida – 2005 update*. (<http://edis.ifas.ufl.edu/FR158>) and Osiecka, Nowak and Long, *Primer on chemical vegetation management in Florida pine plantations* (<http://edis.ifas.ufl.edu/FR160>).

## Trees/Shrubs

### Chinese tallow (*Sapium sebiferum*)

The Chinese tallow, a.k.a. popcorn tree, was introduced from China in the early 1900s and has since invaded most of the southeastern states. It is a small tree whose seeds are widely dispersed by birds and water runoff. The tree's attractive, light green, heart-shaped leaves that yield bright yellow and orange fall colors have made it a popular ornamental. It is also used by beekeepers for honey production. However, this tree is threatening to become the prominent component of marshes, river margins, and dry uplands within its expanding range. Further planting of this tree is prohibited by the Florida Department of Agriculture and Consumer Services (FDACS), and it is listed as a noxious weed by the U.S. Department of Agriculture (USDA) and the Exotic Pest Plant Council (EPPC).

### Control

Herbicide application is required to achieve adequate control of Chinese tallow. It can be cut down but will re-sprout from stumps if not also treated with herbicides. The treatments below will be most effective when applied from late summer to early fall. Follow-up treatments may be necessary in all cases. See Table 1

**Table 1.** Control of Chinese Tallow

Herbicide	Treatment
Garlon 4™	<u>Basal Bark</u> : Treat with 15-20% concentration. <sup>1</sup> Basal bark treatments are only effective on saplings and seedlings less than 3 inches in stem diameter. ( <i>Caution: Garlon4 can volatilize in hot weather, so spray early in the day or on cooler days</i> )
Garlon 3A™	<u>Cut down tree</u> and spray the cut stump with a 50% concentration <sup>2</sup> <u>Stem Injection</u> : Hack-'n'-squirt or girdle by cutting around the tree with a hatchet or similar tool and spraying the herbicide solution into the cut areas. ( <i>Effective on large trees</i> ) <u>Foliar</u> : treat foliage with 3% concentration with surfactant from July to October.
Arsenal AC™	<u>Foliar</u> : Treat foliage of seedlings with 1% concentration. <sup>3</sup> ( <i>Caution: Arsenal is very soil active and has a high potential for non-target tree damage</i> )
<sup>1</sup> Kline and Duquesnel, 1996 <sup>2</sup> Langeland and Stocker, 1997 <sup>3</sup> Miller, 1999	

**Mimosa or silk tree (*Albizia julibrissin*)**

Mimosa is a small to medium-sized tree with attractive, fern-like leaves and showy pink flowers. It vigorously establishes on disturbed areas, often spreading by seed from nearby ornamentals. It was introduced to the United States as an ornamental in 1745 and continues to be used as such because of its attractive form, foliage and flowers. It reproduces both vegetatively and by seed. If cut or top-killed, it will re-sprout quickly, growing 3 feet in a single season. Due to its ability to produce large seed crops and re-sprout when damaged, mimosa is a strong competitor to native trees and shrubs in open areas or

forest edges. Dense stands of this tree can significantly reduce sunlight and nutrients available for other plants.

**Control**

Mimosa can be controlled with the use of mechanical (cutting, chopping, mowing) and chemical treatments. Due to suckers and re-sprouts, chemical treatments are necessary for full control. Basal bark treatments are most effective if applied when seeds are present on the tree, which reduces seed spread. Seedlings up to 10 inches tall can be hand-pulled. See Table 2.

**Table 2.** Control of Mimosa

Herbicide	Treatment
Garlon 4™	<u>Basal-bark:</u> treat with 15% concentration 12-15 inches from ground. <sup>1</sup> ( <i>Effective on sapling size trees, less than 3 inches in diameter</i> ) <u>Cut stem:</u> apply 10% solution covering the outer 20% of stump. <sup>1</sup> <u>Foliar:</u> treat all leaves until wet with 2% solution and a wetting agent. <sup>2</sup>
Garlon 3A™	<u>Cut stem:</u> apply 25-50% solution covering the outer 20% of stump. <sup>1,3</sup> <u>Foliar:</u> treat all leaves until wet with 2% solution and a wetting agent. <sup>2</sup> Treat trees by hack-n-squirt or stem injections circling the entire tree according to label directions. <u>Stem injection:</u> Treat trees by hack-n-squirt or stem injections circling the entire tree according to label directions.
Accord™	<u>Cut stem:</u> apply 25% solution covering the outer 20% of stump. <sup>3</sup> <u>Foliar:</u> treat all leaves until wet with 2% solution and a wetting agent. <sup>2</sup>
Transline™	<u>Foliar:</u> July to September as a 0.2 to 0.4-percent solution (1 to 2 ounces per 3-gallon mix) <sup>4</sup>
<sup>1</sup> Langeland and Stocker, 1997 <sup>2</sup> Miller, 1999 <sup>3</sup> Remaley, 1998 <sup>4</sup> Miller, 2003	

**Chinese privet (*Ligustrum sinense*)**  
**Japanese privet (*Ligustrum japonicum*)**  
**glossy privet (*Ligustrum lucidum*)**

These members of the olive family are shade-tolerant, tall, evergreen-leaved shrubs that can grow to about 30 feet in height. They spread by bird-dispersed seeds or underground runners, and form dense stands that prevent pine and hardwood

regeneration and/or land access. These plants were introduced from Asia.

**Control**

Adequate control of these shrubs can be achieved through herbicide application. Often dense thickets of privet need to be cut down or mowed and the sprouts treated with herbicides. See Table 3.

**Table 3.** Control of Privets

Herbicide	Treatment
Glyphosate	<u>Foliar:</u> In the fall, spray the foliage of Chinese privet with a mixture of 3 oz glyphosate, 0.7 oz ammonium sulfate, and 0.3 oz of surfactant per gallon of water.
Garlon 4™	<u>Basal-bark:</u> Treat with 15-20% concentration 16 inches from ground. <sup>1,2</sup> ( <i>Basal bark solutions are herbicides mixed with a crude vegetable oil or diesel as the carrier</i> )
Arsenal AC™	<u>Foliar:</u> Treat all leaves until wet with 1% solution and a wetting agent August to September. <sup>2</sup>
Accord™	<u>Foliar:</u> Treat all leaves until wet with 3% solution and a wetting agent August to September. <sup>2</sup>
<sup>1</sup> Langeland and Stocker, 1997 <sup>2</sup> Miller, 1999	

### Coral ardisia (*Ardisia crenata*)

Coral ardisia, or spice ardisia, is an evergreen shrub, 2-6 ft tall, with dark green scallop-margined leaves. Flowers and fruit are produced in axillary, not terminal, clusters, usually drooping below the foliage.

Fruit are small, bright red, one-seeded drupes. It was introduced into Florida for ornamental purposes in the early 1900s and has spread and become naturalized in hardwood hammocks across the north part of the

state. It does not grow well in full sunlight. Seedlings of native plant species are shaded out where it forms dense thickets of more than 100 plants per square meter.

#### Control

Adequate control of this plant can be achieved through herbicide application. Seedlings can be hand-pulled. See Table 4.

**Table 4.** Control of Coral Ardisia

Herbicide	Treatment
Garlon 4™	Basal-bark: Apply a treatment with 10% concentration to the bottom 12 inches of stem. Foliar: Treat all leaves thoroughly with a 5% solution.
Garlon 3A™	Cut stem treatment with 50% concentration.
Langeland and Stocker, 1997	

## Vines

### Kudzu (*Pueraria montana*) (= *Pueraria lobata*)

Although restricted to northern portions of Florida, kudzu is among the worst weed problems for forest managers in the southeastern United States. Kudzu was introduced into the United States at the Philadelphia Centennial Exposition in 1876. By 1900 kudzu was available through mail order as an inexpensive livestock forage, and was later sold by the USDA to be planted for erosion control purposes along rights-of-way and gullies. It now exists in impenetrable patches as large as 100 acres and will overtop and kill trees, even after they are mature. Kudzu is an aggressive leguminous vine capable of growing 1 foot per day. It can easily grow 60 feet in a single growing season. It also establishes roots sporadically as it covers an area, layering vines and foliage on top of each other. One key to this plant's efficiency is its ability to orient each leaf so that the maximum amount of sunlight possible is absorbed. This multidirectional orientation of leaves also poses special problems with sufficiently wetting the top sides of foliage with herbicide.

#### Control

Special effort is required to control kudzu. The older the patch, the harder it will be to control and the longer it will take to completely eradicate the plant. In severe cases, follow-up spot treatments may be required for 5 to 10 years.

It is best to first evaluate the kudzu problem by determining the age of the patch. Do this by looking at the root crowns (the top of the primary root). If the root crowns are 2 inches or larger in diameter, the patch is about 10 years of age or older. In some cases, patches of kudzu greater than 10 years old may require higher concentrations of herbicide for adequate control. For easiest access, it is best to evaluate kudzu problems in winter when vines and foliage are withered.

Due to their potency, Tordon™ products are the most effective herbicides for kudzu control. However, the active ingredient - picloram - has a long period of soil activity and the products are not labeled for use in the state of Florida. Acceptable control can be achieved with the use of other herbicides.

Where kudzu is draping trees, a foliar application of Garlon 4™, as shown in the table below, provides effective control. If kudzu is in a drain or around open water, Veteran 720™ or Vanquish™, both labeled for ditch banks, is the best choice. Where kudzu invades hardwoods or young pine stands, a broadcast application of Escort™ may control the kudzu without harming pines and most hardwoods (with the exception of cottonwoods, elms, and legumes such as redbud or locusts). Transline™ is specifically formulated to control legumes and other plants. All treatments will likely need to be followed by a second treatment 1 year after the initial treatment. Repeat follow-up treatments until acceptable control is achieved. See Table 5 on page 5.

Table 5. Control of Kudzu

Herbicide	Treatment
Garlon 4 <sup>TM</sup>	<u>Cut stem</u> : Cut the stem 5 cm (2 in.) above ground level. Immediately apply a 25% solution to the cross section of the stem. A subsequent foliar application (2% concentration) may be necessary to control new seedlings. <sup>2</sup> <u>Vines</u> : 4% solution in diesel sprayed to cover vines on pines >6 inches diameter at 4.5 ft above the ground in late winter or early spring. <sup>1</sup>
Accord <sup>TM</sup>	<u>Cut stem</u> : Cut the stem 5 cm (2 in) above ground level. Immediately apply a 25% solution to the cross section of the stem. This may require a subsequent foliar application (2% concentration) during the late growing season. <sup>2</sup>
Vanquish <sup>TM</sup>	For areas near water, broadcast 2 gal. per acre (growing season), or 3 gal. per acre if patch is >10 years old. Do not spray into water. <sup>1</sup>
Veteran 720 <sup>TM</sup>	For areas near water, broadcast 2 gal. per acre (growing season), or 3 gal. per acre if patch is >10 years old. Do not spray into water. <sup>1</sup>
Escort <sup>TM</sup>	<u>In hardwood stands</u> : Broadcast 4 oz. per acre in mid-summer as a foliar spray. <sup>1</sup> <u>In young pine stands</u> : Broadcast 2-4 oz. per acre in mid-summer as a foliar spray. <sup>3</sup>
Transline <sup>TM</sup>	<u>Broadcast</u> : 0.5% solution (2 oz. in 3-gal. sprayer) in July to September as a foliar spray. <sup>3</sup> <u>In young pine stands</u> : Broadcast 22 oz. per acre. <sup>1</sup>
<sup>1</sup> Ezell, 1998 <sup>2</sup> Johnson, 1998 <sup>3</sup> Miller, 1999	

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Table 6. Control of Air Potato

Herbicide	Treatment
Garlon 4 <sup>TM</sup>	<u>Frill/girdle</u> : Treat girdle cuts with 10% concentration. <sup>1</sup> <u>Stems</u> : Treat stems emerging from bulbils with 10% concentration. <sup>2</sup> Foliar: Thoroughly wet all leaves with a 2% solution of herbicide in water plus surfactant from July to October. <sup>3</sup>
Garlon 3A <sup>TM</sup>	Treat girdle cuts with 50% concentration. <sup>1</sup> Foliar: Thoroughly wet all leaves with a 2% solution of herbicide in water plus surfactant from July to October. <sup>3</sup>
<sup>1</sup> Kline and Duquesnel, 1996 <sup>2</sup> Langeland and Stocker, 1997 <sup>3</sup> Miller, 2003.	

**Japanese climbing fern (*Lygodium japonicum*)**

Japanese climbing fern is a perennial, delicate looking, climbing vine that forms dense clumps that can cover trees and shrubs. Introduced from Japan as an ornamental, it is scattered throughout the lower portions of Alabama, Georgia, Louisiana, South Carolina and south into central Florida. Further planting of this vine is prohibited by FDACS.

Japanese and Old World climbing ferns are presently the only non-native invasive ferns in the South. At this time, Old World climbing fern is restricted to central and south Florida. Both ferns

reproduce readily by wind-blown spores. Animals, equipment and even people that move through an area with climbing fern are also very likely to pick up spores and move them to other locations on the property or even to other properties.

**Control**

Adequate control of this plant has been achieved with multiple applications of Accord™. Other herbicides have also been used to control Japanese climbing fern. As with most invasive plants, repeated treatments may be necessary. See Table 7.

**Table 7.** Control of Japanese Climbing Fern

Herbicide	Treatment
Accord™	Foliar: Treat all leaves until wet with 2% solution and a wetting agent July to October. Repeat until controlled. <sup>1</sup>
Arsenal AC™	Foliar: Thoroughly wet all leaves with a 2% solution and a wetting agent. Repeat until controlled. <sup>2</sup>
Escort™	Foliar: Spray at 1 to 2 ounces per acre. Mix in water (0.3 to 0.6 dry ounces per 3 gallon mix).
Garlon 3A™	Foliar: Spray as a 2 percent solution (8 ounces per 3 gallon mix).
<sup>1</sup> Miller, 1999	
<sup>2</sup> Miller, 2003	

**Grasses**

**Cogongrass (*Imperata cylindrica*)**

Cogongrass is a fast-growing, rhizomatous, perennial grass that has become one of the most troublesome weeds in non-agricultural areas in Florida. It was accidentally introduced as packing material from Japan in Mobile, Alabama in 1911. It was later intentionally introduced from the Philippines into Mississippi as forage. The Mississippi population was shared with the University of Florida, USDA Plant Introduction Station, and Soil Conservation Service in 1937 for forage and soil stabilization. It has proved to be an excellent soil stabilizer but it is extremely difficult to prevent its escape into unintended areas. It spreads predominantly by wind-blown seeds. Cogongrass is listed as a noxious weed by FDACS and USDA, and it is ranked among the 10 most invasive weeds in the world.

**Control**

Recommendations to control cogongrass are to treat these infestations in the fall with glyphosate and/or imazapyr herbicides. These recommendations are consistent over a wide range of studies conducted across the South such as Miller (2003) and Faircloth et al. (2005). Fluazifop (Fusilade™) is also an effective option. Because of the extensive rhizomes of cogongrass, repeated applications of herbicide are often necessary to maintain some control. Guidelines for herbicide control are shown below. Remember to thoroughly wet the plants with the herbicide mixture when they are green and growing, not during droughts or time of plant stress. Our demonstration areas indicate that successful treatments have been achieved from late May through October. See Table 8

**Table 8.** Control of Cogongrass

Herbicide	Treatment
Arsenal AC™ Chopper™	Foliar: Treat with 1% concentration of herbicide and surfactant in September or October. Mowing, burning and/or disking earlier in the year often enhances the effectiveness of the herbicides. <sup>2,3,4</sup>
Accord™	Foliar: Treat with 2% concentration of herbicide and surfactant in September or October. <sup>2, 3</sup>
Fusilade™	Foliar: Treat with 0.5 qt. per acre herbicide plus surfactant. <sup>1</sup>
Glyphosate	Foliar: Treat with a 2% concentration when the plants are green and growing. Glyphosate products can be enhanced with surfactants and/or by adding Cogon-X. The glyphosate products should have at least 40% active ingredients.
<sup>1</sup> Langeland and Stocker, 1997 <sup>2</sup> Miller, 1999 <sup>3</sup> Jose et. al. 2002 <sup>4</sup> Miller 2003 *Chopper and Arsenal AC are both imazapyr herbicides formulated differently.	

**Bahiagrass (*Paspalum notatum*)  
 Bermudagrass (*Cynodon dactylon*) giant  
 fescue (*Festuca arundinacea*) Johnsongrass  
 (*Sorghum halepense*)**

These grasses have been widely planted and continue to provide forage for livestock, but they can present problems for forest landowners wanting to establish pine stands on sites dominated by them. Introduced as improved pasture grasses from the Mediterranean region of Europe and Africa, they are now distributed worldwide.

**Control**

Adequate control of these grasses can be achieved with a summer application of Accord™ followed by a spring application of an Arsenal AC™ and Oust™ tank mix. See Table 9.

**Conclusion**

The invasive exotic species described in this publication represent those most likely to be found in forestlands in north Florida. More complete information on these and other non-native plants can be found in Langeland and Burks' "Identification and Biology of Non-native Plants in Florida's Natural Areas" (1998) and Langeland and Stocker's "Control of Non-native plants in Natural Areas of Florida" (1997). Another good source of information on invasive plants can be found in Miller's "Non-native Invasive Plants of Southern Forests."

Learn to identify these invasive plants and if they show up on your property treat them quickly before they can expand and increase the difficulty of controlling them. Treated areas should be periodically examined to determine if retreatment is necessary. It is normal for areas infested with invasive plants to receive multiple treatments to effectively reduce the impact and presence of these plants.

**Table 9.** Control of Bahiagrass

Herbicide	Treatment
1. Accord™	Treat with 2% concentration in water with wetting agent in late summer before planting. Then follow up with tank mixture of Arsenal AC™ + Oust™ (see below).
2. Follow-up tank mix	Over-spray mixture of 1% Arsenal AC™ + 1-2 ounces Oust™ in water and wetting agent the following May for pine release.
Miller, 1999	

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