

Site Weed (Invasive Plant) Management Plan
Submitted to:

Florida Department of Environmental Protection
Florida Greenways and Trails

First of Three Management Plans

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Helpful Notes:

Surfactant – 0.25% is the standard rate for all foliar herbicide applications, 2 teaspoons per gallon.
Dry time – generally 4-6 hours is adequate, but the longer the better for glyphosate
Pay particular attention to herbicide labels near wetlands or bodies of water.

The use of trade names in these publications is solely for the purpose of providing specific information. UF/IFAS does not guarantee or warranty the products named, and references to them in this publication does not signify our approval to the exclusion of other products of suitable composition. All chemicals should be used in accordance with directions on the manufacturer's label.

Air Potato

Dioscorea bulbifera (L.) Dioscoreaceae

INTRODUCTION

A native to tropical Asia, air potato, *Dioscorea bulbifera*, was first introduced to the Americas from Africa. In 1905 it was introduced to Florida. Due to its ability to displace native species and disrupt natural processes such as fire and water flow, air potato has been listed as one of Florida's most invasive plant species since 1993, and was placed on the Florida Noxious Weed List by the Florida Department of Agriculture and Consumer Services in 1999.

DESCRIPTION

Air potato is in the family Dioscoreaceae, or simply the Yam Family. It is an herbaceous twining vine, growing 70 feet or more in length. Leaves are broadly cordate (heart shaped) and alternately arranged on stems. A distinguishing characteristic of air potato is that all leaf veins arise from the leaf base, unlike other herbaceous vines such as smilax and morningglories. Flowers are inconspicuous, arising from leaf axils in panicles 4 inches long, and are fairly uncommon in Florida. Vegetative reproduction is the primary mechanism of spread. This is through the formation of aerial tubers, or bulbils, which are formed in leaf axils. These vary in roundish shapes and sizes. In addition, large tubers are formed underground, some reaching over 6 inches in diameter.

Dioscorea alata or winged yam can easily be mistaken for air potato, *D. bulbifera*. Winged yam gets its name from its winged internodes, a characteristic feature of the species. Another difference between *D. alata* and *D. bulbifera* is the arrangement of the leaves. *D. alata* has opposite leaves as opposed to the alternate leaves of air potato. Winged yam grows to 30 feet, roughly half the length of the invasive species. This species of *Dioscorea* does not produce nearly as many bulbils as *D. bulbifera*. However, this species can also be considered invasive and problematic, but to a lesser extent than *D. bulbifera*. Although considered to be a species of yam, these plants are very toxic and **should not be consumed.**

IMPACTS

Air potato can grow extremely quickly, roughly 8 inches per day. It typically climbs to the tops of trees and has a tendency to take over native plants. New plants develop from bulbils that form on the plant, and these bulbils serve as a means of dispersal. The aerial stems of air potato die back in

winter, but resprouting occurs from bulbils and underground tubers. The primary means of spread and reproduction are via bulbils. The smallest bulbils make control of air potato difficult due to their ability to sprout at a very small stage.

MANAGEMENT

Preventative: Prevention is a key step in the management of air potato. Bulbils are the primary mechanism of spread, and research has shown even minutely small propagules can sprout and form new plants. How these bulbils are spread is speculative, but it appears movement of contaminated brush, debris or soil is the primary mechanism. Mowers and other brush-cutting equipment may also disperse long distances, either through contaminated equipment or throwing of the bulbils during the mowing operation. Spread via birds and other animals may occur, but this has not been confirmed. Water is also a major means of dispersal, so care must be taken to first eliminate populations along water bodies where bulbils may be easily spread. In addition, extra time must be utilized after flood events, as spread may be extensive.

Cultural: Weeds such as air potato generally invade open or disturbed areas – following a burn, clearing mowing, etc., so these areas are particularly vulnerable to invasion. Therefore, a healthy ecosystem with good species diversity will help to deter infestation.

Another very important combined cultural and mechanical method is the air potato roundup. Each year many counties in Florida, including Hernando, Alachua, and Duval counties, recruit volunteers to help protect and conserve Florida's natural areas through the removal of air potato. During the air potato round up, citizens, organizations, and local businesses get together to collect vines and bulbils. In 2003, the City of Gainesville collected 13 tons of air potato and other invasive plants (Gainesville Parks and Recreation). Removing bulbils and vines from natural areas helps prevent the spread of air potato to new areas, as well as reduces the possibility of reinfestation. In addition to collecting and removing aboveground bulbils, digging up and removing below ground tubers will help. This may be particularly useful to eliminate isolated plants/small populations – especially in areas that cannot be easily accessed or chemically treated. One of the most important control measures for air potato is the removal of bulbils and tubers.

Mechanical: Mechanical methods are limited for air potato, as control of the vines generally results in damage to the vegetation being climbed/smothered by the air potato. Burning also results in excessive damage to the native vegetation, as the fire follows the vines into the tree canopy.

Mowing will help to suppress air potato, but as mentioned previously, this may increase the overall problem due to spreading of the bulbils.

Biological: There is limited research and data on biological control of air potato.

Chemical: Chemical control is one of the most effective means of control for air potato, but single applications will generally not provide complete control. This is due to resprouting of bulbils or underground tubers. A dilution of triclopyr (Garlon 3A at 1 to 2% solution or Garlon 4 at 0.5 to 2% solution) in water can be an effective control for air potato when applied as a foliar application. Be sure to include a non-ionic surfactant at 0.25% (10 mls or 2 teaspoons per gallon of spray solution). A 2 to 3% solution of glyphosate (Roundup, etc.) can also be effective. These herbicides are systemic (move throughout plant tissue) so care must be exercised to minimize off-target damage. If air potato vines are growing up into trees or other desirable species, vines should be cut or pulled down to minimize damage to the desirable vegetation. Pulling the vines down without severing them from the underground tuber will allow the herbicide to move into the tuber and provide better control. The best time to apply an herbicide is in the spring and summer when air potato is actively growing. Be sure to allow adequate time for the plant to regrow from the winter to ensure movement of the herbicide back into the underground tuber. (As plants grow and mature, they begin to move sugars back into the roots and below-ground tubers). However, treat *before* the plants begin to form new bulbils. Persistence and integration of control methods will be the key to complete air potato management.

REFERENCES:

Langeland, K.A. 2003. Natural Area Weeds: Air Potato (*Dioscorea bulbifera*). IFAS Publication SS AGR 164. Florida Cooperative Extension Service, Agronomy Department, University of Florida.

Langeland, K.A. and K. Craddock Burks. 1998. Identification and Biology of Non-Native Plants in Florida's Natural Areas. IFAS Publication SP 257. University of Florida, Gainesville. 165 pp.

Langeland K.A. and R.K. Stocker. 2001. Control of Non-Native Plants in Natural Areas of Florida. IFAS Publication SP 242. University of Florida, Gainesville. 34pp.

HELPFUL LINKS:

Center for Aquatic and Invasive Plants Web Site: <http://www.plants.ifas.ufl.edu>

Nature Operations Division, Gainesville Parks and Recreation: <http://www.natureoperations.org/>

Florida Exotic Pest Plant Council: <http://www.fleppc.org/>

Camphor Tree

Cinnamomum camphora (L.) Lauraceae

INTRODUCTION

Camphor tree grows natively in China and Japan where it is used for oils and timber. In 1875 camphor tree was introduced into Florida and established in plantations for camphor production, although it was not profitable for growers.

In Florida, camphor tree is able to rapidly displace native trees and infest forests and other natural areas. This invasive species displaces native plants due to its fast growth habit and the ability to produce large amounts of seed. This seed is readily eaten and spread by birds. Nurseries and garden centers sell camphor tree as a popular ornamental plant which aids in its dispersal in landscaped areas. Camphor tree is not on the Federal or State Noxious Weed List; however it is listed as a Category I species on the Florida Exotic Pest Plant Council (FLEPPC) list of invasive species. FLEPPC considers Category I plants invasive exotic species that displace or disrupt native plant communities, alter the ecology of the environment, or hybridize with native species.

DESCRIPTION

A quick and easy method of identifying camphor is by crushing the leaves or peeling a twig or bark. This will release oils and the scent of camphor. Camphor is an evergreen tree with oval to elliptical leaves, arranged alternately on the stem. Slender twigs are initially green but change to reddish brown. Buds are sharply pointed, roughly 1/2 inch in length. Camphor tree bark is variable, from scaly to irregularly furrowed with flat topped ridges. The camphor tree habit ranges from small to medium (25 to 40 feet tall), but some specimens have attained over 100 feet. Leaf margins are entire, but can be wavy with a shiny, dark green color. Fragrant flowers are greenish white to pale yellow, borne on panicles about 3 inches long. The fruit is dark blue to black, fleshy and approximately 1 to 1.5 cm in diameter. These are produced in large quantities during the winter and spring months in central and north Florida.

IMPACT

Camphor tree can be found throughout Florida, Georgia, and western Texas. Habitats conducive for camphor tree establishment are dry, disturbed areas, such as roadsides. Camphor tree will also invade natural areas. The Florida jujube, *Ziziphus celatus*, is an endangered native species in Polk

County that is being pushed out by camphor tree. Because camphor tree is available in garden centers and nurseries, home-owners are able to purchase plants, ensuring its survival and spread. This species is also spread by wildlife such as birds and other animals that eat the fruit, spreading the seed to different areas.

MANAGEMENT

Preventative: Preventing the spread and establishment of camphor tree is the first step in a successful management plan. Since the fruit is the primary means of spread, controlling trees before maturation and fruit development is critical. Given this, large trees with heavy fruit potential should be eliminated first. However, since birds vector the seeds, constant monitoring will be necessary to keep this species in check.

Cultural: Weeds such as camphor tree generally invade open or disturbed areas – following a burn, clearing mowing, etc., so these areas are particularly vulnerable to invasion. Therefore, a healthy ecosystem with good species diversity will help to deter infestation. Given this, disturbed areas should be monitored more frequently and extensively.

Mechanical: Mechanical control is particularly effective on seedling trees when smaller equipment can be used to remove/destroy the plants. Mowing will kill seedling trees and continuous mowing will eventually kill resprouting shoots from a cut-stump treatment. Discing or other mechanical tillage will kill small plants but may encourage subsequent re-infestation due to disturbance. Burning may also provide good control of camphor tree, but resprouting will likely occur on larger trees. Physical removal of seedlings and young trees is also another tactic, although this may be labor intensive. Care should be taken when removing small trees.

Biological: There is limited research and data on biological control of camphor tree.

Chemical: Chemical control can be separated into two categories, cut-stump treatments and foliar treatments. Foliar treatments will work well on young trees, less than 10 feet tall. A dilution of triclopyr (Garlon 3A at 1 to 2% solution or Garlon 4 at 0.5 to 2% solution) in water can be an effective control when applied as a foliar application. Be sure to include a non-ionic surfactant at 0.25% (10 mls or 2 teaspoons per gallon of spray solution). A 2 to 3% solution of glyphosate (Roundup, etc.) can also be effective. These herbicides are systemic (move throughout plant tissue) so care must be exercised to minimize off-target damage.

For larger trees, triclopyr (Garlon 4, 30% in oil) is the product of choice. Basal bark treatments are effective for trees up to 4 inches in diameter. Be sure to spray around the entire tree, up 12

inches from the base. Retreatment may be necessary. For larger trees a frill treatment is recommended, where the basal bark is cut and peeled back and the herbicide solution is poured into the pocket created by the frill. Three to four frills per tree is adequate. Cut-stump treatments are effective on larger trees. Use a 50% solution of triclopyr (Garlon 4) and be sure to coat the entire cambium layer (outer ring of the trunk). This should be applied within 2 minutes of cutting and remove all sawdust and debris from the trunk before applying.

REFERENCES AND USEFUL LINKS:

Langeland, K.A. and K.C. Burks. 1998. Identification and Biology of Non-Native Plants in Florida's Natural Areas. University Press of Florida, Gainesville, FL.

University of Florida, IFAS, Center for Aquatic and Invasive Plants and St. Johns River Water Management District: <http://aquat1.ifas.ufl.edu/camphor.html>

Florida Exotic Pest Plant Council: <http://www.fleppc.org/>

Plants of Hawaii Reports:

http://www.hear.org/starr/hiplants/reports/html/cinnamomum_camphora.htm

Land Protection. 2001. NRM facts pest series. Department of Natural Resources and Mines, State of Queensland, Australia. Available: <http://www.nrm.qld.gov.au>

Chinaberry

***Melia azedarach* (L.) Meliaceae**

INTRODUCTION

A native of Asia, Chinaberry and was brought to the U.S. in the late 1700's by a French botanist. Chinaberry has been used over the years as an ornamental plant, shade tree, and fuel wood. There are also some medicinal applications for Chinaberry including a peptide isolated from leaf tissue that is effective against the herpes simplex virus. Unfortunately, Chinaberry has all the qualities of a successful weed. This plant is adaptable to many environmental conditions, is virtually disease and insect free, and thrives in disturbed or open areas.

Chinaberry is not currently listed on Florida's Noxious Weed list, nor is it listed on the Federal Noxious Weed List. Distribution of Chinaberry is not limited to the United States (from Virginia to Florida and westward to Texas) for it is common in Central America, the Virgin Islands, and Puerto Rico. Chinaberry is known to form dense thickets in forests and marshes, displacing native vegetation as it grows. It is also a very common hedgerow tree.

DESCRIPTION

Chinaberry is a deciduous tree in the Meliaceae, or Mahogany Family with purplish, reddish bark. It is able to grow to 50 feet in height, although trees less than 30 feet in height are more common. Leaves are alternate and 2 to 3 times compound (8 to 18 inches). Leaflets have serrated edges and are 1 to 3 inches long.

In spring, long, fragrant, lilac-like flowers are produced in leaf axils. Yellow to yellow-green round drupes are formed after flowering and can persist after leaf drop in the fall. The fruits are mucilaginous and sticky, with hard, round; marble-like seed. Birds spread seed effectively but the fruits are poisonous to humans and other mammals. Because the seeds are poisonous, birds may become paralyzed after ingesting seeds. Chinaberry also reproduces vegetatively when the tree is cut, producing suckers that form a dense stand of vegetation.

IMPACT

When Chinaberry was introduced into the U.S. as an ornamental its natural enemies (diseases or insects) were not brought along with it to maintain its populations at low levels. Along Florida's road sides, in natural areas and forests, and marshes Chinaberry has the ability to grow rapidly and

displace the native vegetation in those areas. Through prolific reproduction via seed as well as vegetative reproduction, it is able to shade out other species by forming a dense thicket. The leaf litter produced by Chinaberry causes the soil to become more alkaline, giving an advantage to those species that fair well in alkaline soils. Chinaberry is also believed to have allelopathic properties, prohibiting other species to colonize the area in close proximity to Chinaberry. Overall Chinaberry reduces the plant diversity in any area in which it grows.

CONTROL

Preventative: Controlling Chinaberry is best accomplished when trees are very young, prior to seed production. Because the seed is very hard, it may remain dormant in the soil for several months or years. Therefore, be persistent and visit a clean site several times before declaring it “Chinaberry-free”. Another preventative measure is to control trees along fencerows and neighboring hedges, limiting seed introduction.

Cultural: Weeds such as Chinaberry generally invade open or disturbed areas – following a burn, clearing mowing, etc., so these areas are particularly vulnerable to invasion. Therefore, a healthy ecosystem with good species diversity will help to deter infestation. Seeds may be hand picked from trees and discarded properly, however this may not be a realistic or cost effective tactic for larger infestations.

Mechanical: Mechanical control is limited to cutting, although mowing prevents seedling establishment in pasture and rangeland settings. It is thought that Chinaberry may be susceptible to fire, but more research must be done to validate this claim. Cutting back Chinaberry must be integrated with chemical control because of its proclivity to resprout.

Biological: There is limited research and data on biological control of Chinaberry.

Chemical: Herbicides prove to be the best method of control for Chinaberry. Foliar applications of glyphosate or triclopyr will be fairly effective on trees less than 10 feet tall. A dilution of triclopyr (Garlon 3A at 1 to 2% solution or Garlon 4 at 0.5 to 2% solution) in water can be used. Be sure to include a non-ionic surfactant at 0.25% (10 mls or 2 teaspoons per gallon of spray solution). A 2 to 3% solution of glyphosate (Roundup, etc.) can also be effective.

A basal bark application of triclopyr (Garlon 4) has also been shown to be an effective treatment. Triclopyr can be applied in a 4 to 8-inch band near the base of the trunk in a 15% solution. Studies have shown a cut stump treatment of 8% triclopyr is almost completely effective in eliminating

Chinaberry. Herbicides should be applied before the onset of fruit production to prevent seed production. Repeat applications may also be necessary for complete control.

REFERENCES AND USEFUL LINKS:

LSU AgCenter Research and Extension Louisiana Invasive Plants:

<http://www.lsuagcenter.com/Communications/newsletters/pdfs/June02foreststewrd.pdf>

<http://www.lsuagcenter.com/invasive/Chinaberrytree.asp>

Element Stewardship Abstract for *Melia azedarach*:

<http://tncweeds.ucdavis.edu/esadocs/documnts/meliaze.html>

USDA NRCS - PLANTS Database <http://plants.usda.gov/index.html>

Southeast Exotic Pest Plant Council Invasive Plant Manual

<http://www.invasive.org/library/FLFSNoxWeeds/chinaberry.html>

The Plant Conservation Alliance's Alien Plant Working Group: Weeds Gone Wild:

<http://www.nps.gov/plants/alien/index.htm>

Chinese Brake Fern

Pteris vittata (L.) Pteridaceae

INTRODUCTION

Pteris vittata, also known as Chinese Brake or Ladder Fern, is native to China. It is found in the Southeastern United States including Florida, Louisiana, and Georgia. Brake fern is also found in California. Although brake fern is not on the Federal or State Noxious Weed Lists, it is listed on the Florida Exotic Pest Plant Council's Invasive Plant List, as of 1999.

DESCRIPTION

Brake fern bears a close resemblance to swamp fern, *Blechnum serrulatum*. Swamp and brake ferns can be distinguished by the spore arrangement on the fronds. In brake fern, spores form lines along the edge of each pinna, whereas the spores of swamp fern form lines along the midrib of each pinna. Fronds of brake fern are dark green in color and only once divided, growing generally < 12 inches in a sunny site but > 20 inches in shade. Fertile fronds bear sporangia (spore producing structures) on the underside of fronds. A group of sporangia is referred to as a sorus. Individual sori are often mistaken for fungal pathogens or another type of disease.

IMPACT

Arsenic is a highly toxic heavy metal that is found in herbicides such as MSMA (monosodium-methane-arsenate) and in insecticides such as CCA (chromated copper arsenate), which is used to treat lumber against termites and rot. *Pteris vittata* is a hyperaccumulator of arsenic. It has been praised for its potential to remediate soils contaminated with arsenic. Even though it has the beneficial quality of being a natural bioaccumulator, it is still considered an invasive plant and should be managed as such.

Millions of spores are produced during the life cycle of a single fern, safeguarding the persistence of fern populations. Spore survival is low compared to the number of spores that are produced; however *Pteris* can out-compete native vegetation due to its invasive nature. The amount of spores produced can certainly provide a challenge for its control.

MANAGEMENT

Preventative: Steps to prevent spore movement or formation are the key in controlling brake fern. Since the microscopic spores are easily transported via clothing, wind and possibly water,

contamination is a constant threat. Control measures should be employed when the fern is not producing spores, which occurs year-round in Florida. If control measures must be employed during spore formation and dispersal, then these areas should be treated at a time when workers will not be traveling to other sites in the same day. Take care not to drive equipment through the fern foliage, as this will also help to minimize spore movement.

Cultural: Weeds such as Chinese brake fern generally invade open or disturbed areas following a burn, clearing mowing, etc., so these areas are particularly vulnerable to invasion. Therefore, a healthy ecosystem with good species diversity will help to deter infestation. Plants have been shown to thrive under high arsenic conditions, this being a competitive advantage for the species. Therefore small patches in seemingly isolated areas may be an indicator of a high arsenic contamination in the soil.

Mechanical: Mechanical controls, such as mowing or pulling the fronds, can reduce spore production and reduce fern populations. Rouging small, isolated patches may also be cost-effective.

Biological: There is limited research and data on biological control of brake fern.

Chemical: There has been very little work performed on chemical control of brake fern. Ferns can be very difficult to control, and regrowth often occurs from the underground rhizoids. A 2 to 3% solution of glyphosate (Roundup, etc.) will probably be the most effective treatment, although triclopyr may also provide control (Garlon 4 at 0.5 to 2% solution plus surfactant at 0.25%).

REFERENCES AND HELPFUL LINKS:

Invasive Plants of the Eastern United States: <http://www.invasive.org/eastern/species/3045.html>

Florida Exotic Pest Plant Council: <http://www.fleppc.org>

Center for Aquatic & Invasive Plants: Univ. of Florida: IFAS: <http://aquat1.ifas.ufl.edu/>

American Fern Society: <http://amerfernsoc.org/>

Cogongrass

Imperata cylindrica (L.) Beauv. *Poaceae*

Introduction

Cogongrass is an aggressive, rhizomatous, perennial grass that is distributed throughout the tropical and subtropical regions of the world. It has become established in the southeastern United States within the last fifty years, with Alabama, Mississippi, and Florida having extensive acreage of roadway and pasture infested with cogongrass. Cogongrass first appeared in the area around Grand Bay, Alabama as an escape from Satsuma orange crate packing in 1912. It was intentionally introduced from the Phillipines into Mississippi as a possible forage in 1921. Cogongrass was introduced into Florida in the 1930s and 1940s as a potential forage and for soil stabilization purposes. However, it was revealed that cogongrass was of little economic (forage) benefit and could become a serious pest. Consequently, it was placed on the noxious weed list, which prohibits new plantings. Unfortunately, cogongrass was spread by illegal plantings and inadvertent transport in forage and in soil during roadway construction. It does not survive in cultivated areas but becomes established along roadways, in forests, parks, and mining areas. It is now found throughout Florida from the panhandle region well into south Florida.

Description

Cogongrass is a perennial grass that varies greatly in appearance. The leaves appear light green, with older leaves becoming orange-brown in color. In areas with killing frosts, the leaves will turn light brown during winter months and present a substantial fire hazard. Cogongrass grows in loose to compact bunches, each 'bunch' containing several leaves arising from a central area along a rhizome. The leaves originate directly from ground level and range from one to four feet in length. Each leaf is 1/2 to 3/4 of an inch wide with a prominent, off-center, white mid-rib. The leaf margins are finely serrated; contributing to the undesirable forage qualities of this grass. Seed production predominately occurs in the spring, with long, fluffy-white seedheads. Mowing, burning or fertilization can also induce sporadic seedhead formation. Seeds are extremely small and attached to a plume of long hairs. Although the seeds can be carried long distances by wind and animals, the spread of cogongrass by seed is questionable and still under investigation.

Rhizomes are responsible for the survival and short-distance spread of cogongrass. Established stands may produce over 3 tons of rhizomes per acre. The specialized anatomy of the rhizome allows for water conservation. The rhizome can also penetrate to a depth of 4 feet in the soil, although the majority of rhizomes remain in the top 6 inches. The sheer mass and persistence of rhizomes is not the only factor contributing to the ability of cogongrass to dominate an area. It has also been reported that these rhizomes exude allelopathic substances, which inhibit growth of other plants. As the density of cogongrass increases, all other vegetation may be excluded and normal succession of species will not occur.

Impact

Cogongrass is native to southeast Asia and infests nearly 500 million acres of plantation and agricultural land worldwide. It is found on every continent, although it does not tolerate cool temperatures. In the United States, cogongrass extends as far north as South Carolina and west to Texas. In Florida, cogongrass infests ditch banks, pastures, road sides/right-of-ways, golf courses, and forests. In central Florida, monocultures of cogongrass have become established on hundreds of acres of reclaimed phosphate mining areas. Cogongrass thrives on fine sand to heavy clay and does well on soils of low fertility. Attempts at finding natural pests of cogongrass have met with limited success. Pathogens have been isolated but none have been developed for effective control. Cogongrass does not tolerate dense shade. In Asian rubber plantations, cogongrass dies back upon canopy formation. However, reports of invasion into old growth forests in Florida suggest that a more shade-tolerant ecotype has developed.

Management

Extensive research has been conducted in Africa, southeast Asia and the United States for the control of cogongrass. Burning, cultivation, cover crops, and herbicides have been used with varying degrees of effectiveness. To eliminate cogongrass, the rhizomes must be destroyed to avoid regrowth. Cultivation and herbicides have been the two control strategies used most often. One of the oldest and most successful methods is to deep plow or disk several times during the dry season to desiccate the rhizomes and exhaust the food reserves. It is essential to cut to a depth of at least 6 inches to ensure that most, if not all the rhizomes have been cut. Results from these practices are evident when observing cogongrass growing up to the edge of a cultivated field with no evidence of spread into the field itself.

The use of herbicides for control of cogongrass began in the 1940s. Today, only a few of the hundreds of herbicides tested are effective against cogongrass. In non-crop areas such as rights-of-way and fence rows, the so-called soil sterilants such as prometon (Pramitol), tebuthiuron (Spike), and imazapyr (Arsenal) will give excellent control; however, areas treated with these materials will be free of any vegetation for 6 months to a year. Often these conditions promote erosion and are unacceptable.

In other areas, current chemical control alternatives are very limited. Glyphosate (Roundup, etc.) applied at 3-4 qt/A will substantially reduce cogongrass stands but multiple applications are needed. However, Roundup is a non-selective herbicide and will control/injure all vegetation present at the time of treatment. Subsequent to application, crops can be planted immediately because glyphosate has little or no residual soil activity. If high rates (4-5 qt) of Roundup are used, slight soil residual may exist in Florida soils; therefore, a 10-14 day waiting period should be observed before revegetating with tender seeds or seedlings. Fluazifop (Fusilade DX) provides moderate suppression of cogongrass. Fusilade is a selective grass herbicide that provides more flexibility when desirable broadleaf species are present for revegetation. For exact rates and times of herbicide application, consult the herbicide label for most current legal information.

Although tillage and herbicides will provide some control and suppression of cogongrass, long-term eradication is seldom achieved. It has been shown that an integrated approach that combines burning, tillage (mechanical disturbance) and chemical applications provide the best solution for cogongrass management. Initially, cogongrass should be burned or mowed to remove excess thatch and older leaves. This initiates regrowth from the rhizomes, thereby reducing rhizome biomass. It also allows herbicides to be applied to only actively growing leaves, maximizing herbicide absorption into the plant. Ideally, burning should take place in the summer. A one-to-four month regrowth period has been shown to provide a sufficient level of leaf biomass for herbicide treatment. This targets herbicide applications to be made in the late summer/early fall - approximately 1 month prior to the average killing frost, depending on area. Once again, the herbicides glyphosate (Roundup, others) or imazapyr (Arsenal, Chopper) have been shown to provide the best control. If tillage can be incorporated, then a discing treatment directly following a burn is the best approach. This will further deplete the rhizome reserve through dessication and increase the number of shoots per given area. A one-to-four month regrowth period before herbicide treatment is also needed with this approach as well.

Once good control of cogongrass has been achieved, it is essential to introduce desirable vegetation as quickly as possible to prevent cogongrass from re-infesting the area. Several species have been shown to colonize rapidly and tolerate the residual affects of imazapyr. A wider range of plant species can be used with glyphosate due to the lack of soil activity. However, cogongrass will eventually begin to re-infest, regardless of control. Therefore, diligence and persistence are essential to remove/treat re-infested areas before this grass regains a foothold.

Japanese Climbing Fern

Lygodium japonicum (Thunb.) Lygodiaceae

INTRODUCTION

Lygodium japonicum, or Japanese Climbing Fern (JCF), is an adventive species that was introduced into Florida as an ornamental plant in the 1930's. In Florida it is currently found in the north and western areas of the state, but is quickly spreading and has been found as far south as Broward and Collier counties. It is also found in the southern areas of Alabama, Mississippi, and Louisiana. Japanese climbing fern is able to engulf shrubbery and ground covers by forming a dense canopy of vegetation.

DESCRIPTION

Lygodiaceae includes many plants such as Japanese climbing fern, *Lygodium japonicum*, and old world climbing fern, *Lygodium microphyllum*. It is often confused because of the close similarities between the species but is easily distinguished by differing leaf characteristics. Old world climbing fern has unlobed leaflets that are glabrous (smooth, not hairy) below. Japanese climbing fern is a perennial vine-type fern, reaching up to 90 feet in length. Its leaves are lacy and finely divided, arranged opposite on the vine. The vines are green to orange to black and wiry, often infesting trees and shrubs forming dense mats of vegetation. Fronds are tan-brown and persist in winter, but remain green in south Florida. Vines formed from branches arise from underground rhizomes, which are slender, black and wiry. Fertile fronds are usually smaller segments with fingerlike projections around the margins. These bear sporangia (spore producing structures) in double rows under the margins. These are very tiny and easily dispersed by wind.

IMPACT

Japanese climbing fern can grow in sun or shade, damp, disturbed or undisturbed areas. It can grow so dense that it forms a living 'wall', leading to the elimination of seedlings and other native vegetation. Japanese climbing fern was added to the Florida Noxious Weed List in 1999. It is also a major problem in pine plantations, causing contamination and harvesting problems for the pine straw industry.

MANAGEMENT

Preventative: Monitoring is very important in the strategy for the management of Japanese climbing fern. Constant monitoring can aid in the detection of new populations. Steps to prevent spore movement or formation are the key in controlling climbing fern. Since the microscopic spores are easily transported via clothing, wind and possibly water, contamination is a constant threat. Control measures should be employed when the fern is not producing spores, which occurs in the late summer/early fall. If control measures must be employed during spore formation and dispersal, then these areas should be treated at a time when workers will not be traveling to other sites in the same day. Take care not to drive equipment through the fern foliage, as this will also help to minimize spore movement.

Cultural: Very little strategies have been observed that limit the spread of Japanese climbing fern through cultural methods. Because of the small size of the spores, these can travel over great distances and infest seemingly undisturbed areas.

Mechanical: Hand pulling is one mechanical strategy for the removal of small patches of Japanese climbing fern, however it will regrow from below the cut as well as from hand pulling. Machinery can be used to remove the large mats of foliage that form over vegetation in areas where compaction is not a concern. Fire will kill it back, but regrowth occurs. Fire also causes major damage to the native vegetation as the fire climbs up the vines into the canopy of the trees and shrubs.

Biological: A rust (*Puccinia lygodii*) of *Lygodium* spp. in greenhouses is being looked at as a biological control agent to control Japanese climbing fern, although many of the biological control efforts are focused on old world climbing fern. More studies are being done to determine the efficacy of other biological control agents for Japanese climbing fern.

Chemical: Some research has been conducted on Japanese climbing fern, and it appears a 2 to 3 % solution of glyphosate (Roundup, etc.) is effective. Another herbicide, metsulfuron (Escort), has been shown to provide excellent control at rates of 0.5 to 1 oz. per acre. Be sure to include a non-ionic surfactant at 0.25% (10 mls or 2 teaspoons per gallon of spray solution). A combination of these herbicides has provided good control when applied in the fall of the year before a killing frost.

REFERENCES AND HELPFUL LINKS:

Invasive Plants of the Eastern United States: <http://www.invasive.org/eastern/species/3045.html>

Lygodium Management Plan for Florida. A report from the Florida Exotic Pest Plant Council's Lygodium Task Force: http://www.fleppc.org/Manage_Plans/lymo_mgt.pdf

Center for Aquatic and Invasive Plants: University of Florida: IFAS:
<http://aquat1.ifas.ufl.edu/welcome.html>

Skunkvine

Paederia foetida (L.) Rubiaceae

INTRODUCTION

Sometime before 1897 at a USDA Field Station, *Paederia foetida*, or skunkvine, was introduced from Asia to Hernando County, Florida as a potential fiber crop. Skunkvine was reported as a troublesome weed very early in its introduction, escaping into native areas throughout Florida. It was soon recognized as an economically important invasive weed. In 1993, skunkvine was labeled a Category 1 species on the Florida Exotic Pest Plant Council's List of Invasive Species. In 1999, it was placed on the Florida Noxious Weed List. Currently skunkvine is found in at least 17 counties in central and north central Florida.

This invasive plant did not receive its common name "skunkvine" for smelling like a rose. In fact the species name, *foetida*, is Latin for "stinky" or "foul smelling". When the leaves or stems of skunkvine are crushed or broken, a displeasing, foul odor is released. The foul odor of skunkvine is derived from the sulfur compounds in its leaves.

DESCRIPTION

Skunkvine is a woody vine that does not have thorns. Its vines are able to grow 30 feet in length, climbing up into tree canopies or crawling along the ground. For some unknown reason, the vines constantly twine to the right. The smelly, foul odor released when skunkvine is crushed may a useful characteristic that can aid in identification. Skunkvine leaves vary in size and shape. Generally skunkvine leaf blades have rounded to cordate (heart) shaped bases and acuminate (pointed) tips, with entire (smooth) margins. Leaves may be opposite on the stem. In rare instances, leaves have also been found in whorls of three. Leaves and flowers are on petioles about 2 ½ inches long. Skunk vine flowers are small, light grayish pink or lilac, with red centers. The fruit are small, spherical, shiny brown having 2 black, non-winged seeds. Skunkvine is able to reproduce vegetatively and via seed. Its stems are able to root readily in soil. It is thought that seeds are eaten by frugivorous birds and spread, but has not yet been verified.

IMPACTS

Skunkvine is able to survive in a variety of Florida habitats including hardwood, mixed, and pine forests, sandhill, and floodplain forest and marsh. A serious invasive weed, skunkvine is able to

displace native vegetation. The dense layer of vegetation created by skunkvine can both damage and kill native vegetation. Climbing vines can engulf and cover trees and shrubs. The weight of the vine mass climbing over vegetation can cause branches or entire trees to break or collapse. Crawling vines can form a dense layer of vegetation, smothering many shrubs and other plants growing in the understory.

MANAGEMENT

Preventative: Care must be taken when disposing of skunkvine since it is able to regrow when cut back, and produce new plants from stem fragments. Seeds are also able to germinate in brush piles. Prevent the transport of stem fragments and seed to other locations by ensuring machinery is free of seed and stem fragments. Flooded conditions can decrease the vigor of skunkvine; however skunkvine can live in marsh like conditions, able to survive for approximately 190 days under water.

Cultural: Weeds such as skunkvine generally invade open or disturbed areas – following a burn, clearing mowing, etc., so these areas are particularly vulnerable to invasion. Therefore, a healthy ecosystem with good species diversity will help to deter infestation.

Mechanical: Mowing and tillage will provide some measure of control, but are impractical in most situations.

Biological: There is much hope in biological control agents collected in Japan and Nepal by Agricultural Research Service Entomologists Robert Pemberton and Paul Pratt. Chrysomelid leaf beetles and two sawfly species were found feeding on the leaves of skunkvine. A stem gallmaker and a moth in the Sessiidae family were also found to attack skunkvine by causing the formation of galls on vine stems. The flea beetle, *Trachyaphthona sordida*, has the greatest potential of all of the biological control agents listed to potentially control skunkvine. Flea beetles damage the host root system by feeding on roots and root hairs, leading to reduced uptake of nutrients and water by the host plant.

Chemical: Chemical control is one of the most effective means of control for skunkvine, but single applications will generally not provide complete control. This is due to resprouting from rootstocks or root crowns. A dilution of triclopyr (Garlon 3A at 1 to 2% solution or Garlon 4 at 0.5 to 2% solution) in water can be an effective control for skunkvine when applied as a foliar application. Be sure to include a non-ionic surfactant at 0.25% (10 mls or 2 teaspoons per gallon of spray solution). A 2 to 3% solution of glyphosate (Roundup, etc.) may also be effective. These herbicides are systemic (move throughout plant tissue) so care must be exercised to minimize off-

target damage. If skunkvine is growing up into trees or other desirable species, vines should be cut or pulled down to minimize damage to the desirable vegetation. Pulling the vines down without severing them from the root crown will allow the herbicide to move into the root and provide better control. The best time to apply an herbicide is in the spring and summer when skunkvine is actively growing. Be sure to allow adequate time for the plant to regrow from the winter to ensure movement of the herbicide back into the roots. (As plants grow and mature, they begin to move sugars back into the roots).

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Invasive Plants of the Eastern United States:

<http://www.invasive.org/eastern/biocontrol/27SkunkVine.html>

Florida Exotic Pest Plant Council: <http://www.fleppc.org/>

Tropical Soda Apple

***Solanum viarum* (Dunal) Solanaceae**

INTRODUCTION

Solanum viarum or Tropical soda apple (TSA) is a native to Brazil and Argentina. Since its discovery in the United States, it has been found in many southern states including Florida, North Carolina, and Mississippi. It was first collected in Glades County, Florida in 1988. It is estimated that approximately one million acres of pasture, sod farms, forests, ditches, natural areas, etc. are covered with TSA in Florida.

Tropical soda apple is extremely prolific, producing roughly 40,000 to 50,000 seeds per plant. Seed is spread primarily via livestock and wildlife, such as raccoons, deer, and birds that consume the fruit. If TSA is not controlled in pastures it can lead to reduced yields in terms of lower stocking rates, lower forage quality, and lower profitability. Dispersal is also accomplished through contaminated equipment, hay, seed, sod, and composted manure. Cattle, sod, as well as other transported goods carry the potential of spreading this invasive weed to other parts of the state and country. This concern and its rapid spread throughout Florida caused TSA to be placed on the Florida Noxious Weed List in 1994 and the Federal Noxious list in 1995.

DESCRIPTION

Tropical soda apple is in the family Solanaceae, or Nightshade family. This family also contains potato, eggplant, and tomato. TSA is an herbaceous perennial, growing 3-6 feet tall. Leaves are pubescent, deeply divided into pointed lobes. White to yellowish thorns up to 0.4 inch-long are found on the stems, flower stalks, leaves (both upper and lower surfaces), and calyxes. Flowers are white with yellow stamens and are found on the stem below the leaves. Fruits are globular in shape and are green in color when young, yellow at maturity.

IMPACT

Tropical soda apple is able to flower (primary production from May-September) and set fruit continuously throughout the year. Each TSA fruit contains 400 to 500 viable seeds, with 75% or more germination. Each plant contains between 40,000 to 50,000 viable seeds. New plants can emerge from seed or roots. Root buds on existing plants are able to generate shoots, producing new plants. Root systems can be fairly extensive, reaching as far as 3 to 6 feet into the ground. Because

of its invasive potential, many states are considering banning the import of cows. This is dramatically affecting the beef cattle industry in Florida.

MANAGEMENT

Preventative: The most effective means of controlling TSA is the *prevention of fruit production*. In addition, tropical soda apple has been regulated by the prevention of cattle movement and transport of contaminated seed, sod, hay, manure, and soil from infested areas to areas that are not infested.

Cultural: Maintaining a quality forage crop through proper fertilization, watering, insect and disease control is the first step in tropical soda apple suppression. Proper cutting and/or stocking rate will also maintain good growing conditions for the forage and keep TSA from gaining a foothold.

Mechanical: Mowing will greatly suppress the growth of tropical soda apple and may kill seedling plants. Tillage will also provide good control but is impractical in situations where soda apple is problematic. Mowing is often the best method of control for dense infestations. Plants should be mowed to a height of 3 or 4 inches to prevent the production of flowers, fruit and seed. TSA should be mowed again in April as plants approach flowering.

Biological: Tropical soda apple is a member of the Solanaceous family, which also includes potato, eggplant and tomato. *Gratiana boliviana* is an adventive tortoise beetle that feeds specifically on the foliage of TSA. The Technical Advisory Group (TAG) for Biological Control Agents of Weeds approved the release of this biological control agent from quarantine in April 2002. This beetle has the potential to reduce the competitive advantage of TSA, which will enable native species to flourish.

Another biological control agent that is under investigation is the flower bud weevil, *Anthonomus tenebrosus*. This weevil develops inside flower buds causing premature abortion of flowers, leading to the inhibition of fruit production. Requests for the release of the flower bud weevil will be submitted to the TAG if further testing indicates this species is specific to TSA. In addition, Dr. Charudattan at the University of Florida is developing a plant pathogenic virus specific to TSA. Preliminary results indicate good control, but further testing is necessary to ensure specificity.

Chemical: For sparse infestations including pastures, vegetable fields, sod fields, hammocks, ditch banks, and roadsides TSA plants should be individually sprayed for control and to prevent additional seed and fruit production. Herbicide treatments should be applied to ensure adequate

coverage, resulting in maximum uptake and control. Treated areas should be monitored on a monthly basis. New seedlings should be sprayed and TSA should not be allowed to set fruit. This is an important preventative control that will help limit the spread of this weed. Triclopyr and glyphosate at a 0.5% and 3% solution respectively are recommended.

For dense infestations, mowing should be performed first and an herbicide application should follow 50 to 60 days after the first mowing. Follow up broadcast herbicide applications with spot treatment herbicide applications. Broadcast herbicide applications are limited to triclopyr (Remedy) at 1.0 quart per acre with 0.25% non-ionic surfactant in 40 gallons of water per acre total solution volume. This will aid in the control of newly emerged seedlings and escape plants. Pastures should be checked monthly for 12 months. Again, it is extremely important to prevent TSA from producing fruit.

HELPFUL LINKS AND REFERENCES:

Environmental Protection Agency: <http://www.epa.gov/>

Florida's Division of Plant Industry: <http://www.doacs.state.fl.us>

Florida's Cooperative Extension Electronic Data Information Source: <http://edis.ifas.ufl.edu/>

University of Florida: <http://www.ufl.edu>

United States Department of Agriculture (USDA)/ Animal and Plant Health Inspection Service (APHIS): www.aphis.usda.gov

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Torpedograss

Panicum repens (L.) *Poaceae*

INTRODUCTION

Torpedograss is one of the most serious weeds in Florida. It grows in or near shallow waters forming monocultures where it can quickly displace native vegetation. It can also be found in more upland situations and is a frequent problem in sod production. Native to Africa and/or Asia, it was introduced to the United States before 1876, primarily through seed used for forage crops. In the early 1900's the United States Department of Agriculture imported and distributed torpedograss seed for planting in pasturelands, providing forage for cattle. Torpedograss has not yet been listed on the Federal or State Noxious Weed List.

DESCRIPTION

Torpedograss is in the family Poaceae, including grasses such as cogongrass and bermudagrass. It is called torpedograss because of its sharply pointed or torpedo-like growing tips. Torpedograss can grow up to 3 feet tall, with hairy leaf sheaths and hair on the upper margins of the leaves. Leaf blades are stiff, linear, flat or folded; the surface often with a waxy or whitish coating. Torpedograss has a panicle-type inflorescence, 3-9 inches long. The spread of torpedograss is limited to rhizomes either by rhizome expansion or fragmentation. Seed does not germinate well under Florida conditions.

IMPACT

By 1992, torpedograss had taken over 70% of Florida's public waters. The largest infestations can be found in Lake Okeechobee where it displaces close to 7,000 acres of native marsh. Torpedograss management costs approximately \$2 million a year in flood control systems. In Florida, torpedograss is also a major problem for the citrus and golf course industries. The denseness of the mats may impede water flow in ditches and canals and restrict recreational use of shoreline areas of lakes and ponds.

MANAGEMENT

Preventative: Preventive control can be accomplished by preventing the spread and fragmentation of rhizomes. This can be very difficult because if even a tiny fragment of rhizome is left in an area, it will reestablish itself. Control of infestations near waterways will prevent long-range spread via water and this should be a priority. If mowing or tillage is used, care must be taken to prevent transport of rhizome or stolon fragments.

Cultural: Weeds such as torpedograss generally invade open or disturbed areas – following a burn, clearing mowing, etc., so these areas are particularly vulnerable to invasion. Therefore, a healthy ecosystem with good species diversity will help to deter infestation.

Mechanical: Mechanical control is only moderately effective for torpedograss control. Continuous tillage will provide good control, but is often impractical in many natural areas. A single tillage operation may help to enhance herbicidal effectiveness, but disking alone may increase infestation levels through rhizome fragmentation. Mowing is only marginally effective.

Biological: There are limited agents being studied for biological control of torpedograss, although Dr. Charudattan at the University of Florida has been evaluating a species of fungus. Torpedograss is very palatable for cows and goats, and grazing may be integrated in an overall management scheme.

Chemical: Glyphosate has been the most effective herbicide used to control torpedograss. A 2 to 3% solution of glyphosate (Roundup, etc.) is very effective. Imazapyr (Arsenal, Chopper, Habitat) is also very effective at 0.5 to 1% solution. Be sure to include a non-ionic surfactant at 0.25% (10 mls or 2 teaspoons per gallon of spray solution). These herbicides are systemic (move throughout plant tissue) so care must be exercised to minimize off-target damage. In addition, imazapyr has tremendous soil activity, so care must be exercised around sensitive species such as oaks (*Quercus* spp.).

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Wisteria

***Wisteria spp.* Fabaceae**

INTRODUCTION

Wisteria is found from Maine to Florida, and as far west as Arkansas. There are native, *W. frutescens*, and non-native types of wisteria, including Japanese wisteria (*W. floribunda*) and Chinese wisteria (*W. sinensis*). Wisteria is sold in garden centers and nurseries and can be found in numerous home gardens across the country. The problem with wisteria lies in its growth habit. Wisteria is a vine that will grow virtually up anything in its path. By climbing into the canopy of trees or plants, it can shade them out, impairing those plants from effectively growing. Over time, wisteria will climb and twine around other plants, eventually shading and girdling native plants.

DESCRIPTION

Wisteria is an ornamental vine with fruit characteristic of the Legume Family (Fabaceae). Growth of the wisteria vine is limited to the height of the plant that it climbs, often growing more than 65 feet in length. Reaching a diameter of up to 15 inches, Japanese wisteria will twine clockwise around its host while Chinese wisteria will twine counter-clockwise.

The stem of Japanese wisteria is white in comparison to the dark gray bark of Chinese wisteria. Its leaves are pinnately compound, 4 to 16 inches long arranged alternately on stems, containing 13 to 19 leaflets. Leaflets are ovate in shape with wavy margins.

Flowers of wisteria are borne on 4 to 20 inch long racemes that hang when leaves are newly emerged. Japanese wisteria flowers typically flower from the base to the tip of the raceme and are lavender in color. Flowering in Florida occurs in April and May. Velvety brown seedpods are produced after flowering. The pods are 4 to 6 inches long and the seed are poisonous.

Wisteria prefers full sun and well-drained soils, but will grow in less than desirable conditions. It is mainly found growing along roadsides, forest edges, and rights-of-ways.

IMPACT

Wisteria was introduced to the United States from Japan and China in the 1800's for use as ornamental plants. Individual wisteria plants can survive for more than 50 years. Wisteria can reproduce by rooting at each node, via stolons, and will produce new shoots if cut back or

trimmed. Wisteria is highly aggressive and can displace native species. Sizable trees have been killed by vining wisteria. When these large trees are killed, it opens the forest floor to sunlight, which allows seedlings to grow and flourish.

CONTROL

Preventative: Wisteria can grow from seed or rooted stolons, so care must be taken to avoid cuttings and/or seeds being deposited in natural areas. Most infestations occur near homesites, where the plant has spread from an ornamental planting into the surrounding wooded areas.

Cultural: Weeds such as wisteria generally invade open or disturbed areas following a burn, clearing mowing, etc., so these areas are particularly vulnerable to invasion. Therefore, a healthy ecosystem with good species diversity will help to deter infestation.

Mechanical: Mechanical methods are commonly used for wisteria management. For small wisteria infestations, cut climbing or trailing vines as close to the root as possible. Although this may be labor intensive it is a feasible pretreatment for larger infestations or in areas where herbicides cannot be used. Because wisteria will continue to sprout after it has been cut, it should be cut back early in the season, cutting sprouts every few weeks until the fall. This will stop growth of existing vines and prevent seed production. Wisteria vines should be removed from bases of trees and shrubs to prevent girdling as the trees and shrubs grow.

Another control tactic for small infestations is the removal of entire plants. Any type of digging tool can be used to remove the entire plant (roots and runners). It is important to know that any root pieces remaining in the soil may resprout to produce new plants. Fruit, roots, and other plant parts should be disposed of properly to prevent reinfestation.

Biological: There is limited research and data on biological control of wisteria.

Chemical: In areas with established wisteria, a cut stump treatment is effective. Cut stems as close to the ground as possible and immediately apply a 25% solution of glyphosate or triclopyr to the stem. A foliar application of glyphosate may be necessary for sprouts. For larger infestations of wisteria foliar herbicide applications may be necessary. To avoid damaging nontarget species, stump treatments should be administered before foliar treatments. A solution of water and a 2% concentration of glyphosate or triclopyr with a 0.5% nonionic surfactant should be applied. If wisteria vines are growing up into trees or other desirable species, vines should be cut or pulled

down to minimize damage to the desirable vegetation. Pulling the vines down without severing them from the underground rootstocks will allow the herbicide to move into the root and provide better control. The best time to apply an herbicide is in the spring and summer when wisteria is actively growing. Be sure to allow adequate time for the plant to regrow from the winter to ensure movement of the herbicide back into the underground portion. (As plants grow and mature, they begin to move sugars back into the roots).

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USDA NRCS - PLANTS Database <http://plants.usda.gov/index.html>

Southeast Exotic Pest Plant Council Invasive Plant Manual

<http://www.invasive.org/eastern/eppc/japwisteria.html>

The Plant Conservation Alliance's Alien Plant Working Group: Weeds Gone Wild:

<http://www.nps.gov/plants/alien/index.htm>