



2019

# Vegetation Management Plan

FDOT District 4



District 4 Offices:

DISTRICT MAINTENANCE, BROWARD OPERATIONS, PALM BEACH OPERATIONS, TREASURE COAST OPERATIONS

# DISTRICT 4 VEGETATION MANAGEMENT PLAN

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# DISTRICT 4 VEGETATION MANAGEMENT PLAN

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## INTRODUCTION

District 4 understands the importance and value of maintaining our roadside vegetation in a way that will preserve, enhance and protect natural assets while keeping our staff and patrons safe. FDOT Environmental Policy, 000-625-001-I reads that the “Department will: utilize methods to preserve, enhance, and protect trees and other vegetation as valuable natural resources” and District 4 will strive to execute this mission. The District will adhere to all FDOT Standards, Policies, and Procedures in the development and execution of its Roadside Vegetation Management Plan.

The Florida Department of Transportation (FDOT) Procedure 850-000-015 Roadway and Roadside Maintenance requires that “each district shall prepare a comprehensive and balanced roadside vegetation management plan” and “address soil testing, seeding, soil amendments, aeration, herbicides, tree trimming, control of invasive species and proper mowing techniques.” This document was created to fulfill that requirement. The purpose of our plan is to protect and enhance our vegetative assets, to ensure a safe and aesthetic transportation system for our patrons.

## PURPOSE

1. To efficiently and effectively manage the activities that will achieve and maintain a healthy roadside landscape and a high level of turf quality.
2. To establish and maintain a safe, aesthetically pleasing and stable roadside along the District 4 State Highway System.
3. To establish uniformity of maintenance operations throughout District 4.
4. To provide for safe, effective, and efficient use of equipment and personnel in District 4.

## GENERAL

Having a comprehensive vegetation management program significantly reduces the cost of maintaining state highways. When applicable, all maintenance work shall be done in accordance with the maintenance activity standards as defined by Standard Specifications for Road and Bridge Construction, as modified or amended (by Special Provisions or other means), Standard

Plans, the Manual on Uniform Traffic Control Devices, FDOT Loss Prevention Manual, and AASHTO policies and procedure. Any deviation from these standards must be approved by the District Maintenance Engineer.

## REFERENCES

The following shall be used for reference and guidance when more details about particular maintenance operations are needed:

- A Guide for Roadside Vegetation Management
- A Guide for Tree, Palm Maintenance for Urban Roadsides and Landscape Areas
- Wildflower Management Program 650-030-001
- Maintenance Rating Program Handbook
- Vegetation Management at Outdoor Advertising Signs 575-070-055
- Roadway and Roadside Maintenance 850-000-15
- Florida Highway Landscape Guide
- Environmental Policy 000-625-001
- Maintenance Handbook "A Guide for Roadside Vegetation Management"
- Standard Specifications for Road and Bridge Construction
- Standard Plans
- Manual on Uniform Traffic Control Devices
- UF IFAS Invasive Plant Management Plans: <http://plants.ifas.ufl.edu/invasive-plant-management-plans/>
- Florida Exotic Pest Plant Council Invasive Plant Lists: <https://www.fleppc.org/list/list.htm>

## TURF MANAGEMENT

The District 4 Maintenance Office strives to achieve and maintain the highest quality turf possible. Well-managed turf can and will lessen the extent and frequency of other maintenance activities. Shoulder work, ditch cleaning, mowing, pipe cleaning, use of herbicides and other roadside activities can all be reduced. Well-managed turf will also improve the roadway aesthetics.

Turf management consists of the activities used to establish and sustain a turf stand at a desired level of quality. High quality turf is usually the result of correct grass selection for the site



conditions, proper establishment procedures, and effective cultural practices. Emphasis shall be placed on soil testing, sodding, soil amendments, fertilization, proper mowing techniques, and the restricted use of herbicides where special conditions exist.

District 4 will monitor turf areas and remove competing vegetation, exotic or invasive pest plants, and noxious weeds with priority given to those identified by the Department Office of Maintenance and remove such vegetation regularly by manual, mechanical, or chemical control means, as necessary. When selecting herbicides, applicators will pay particular attention to ensure use of chemicals that will not harm desired turf or wildflower species.

## TURF TYPES

Most turf managed by District 4 is used primarily for soil stabilization along roadways. The binding effect of the below ground roots helps prevent erosion from wind and water. The leaf blades provide additional soil stabilization and help reduce temperature during periods of extreme heat.

The primary permanent turfgrasses used by District 4 are Bahia and Common Bermuda.

### 1. Bahia

Selected as the choice of grasses to be used in construction and by maintenance, two (2) varieties are used by District 4: Argentina and Pensacola. Bahia grass forms a tough, coarse-textured, wear resistant utility turf. Bahia grass is susceptible to damage from mole crickets. During the summer months Bahia grass grows continuously and forms tall seed heads. Bahia grass is a low-growing exotic or non-native perennial grass that spreads slowly by short, below-ground runners called rhizomes. When mowed at its proper height and frequency, Bahia grass forms a tough, coarse-textured, wear-resistant utility turf especially well-suited for use along roadways.

- Argentine Bahia grass – forms a dense, low-growing turf, and remains green longer in winter. It is commonly used around buildings and facilities.
- Pensacola Bahia grass – has a finer leaf texture, and grows taller than the Argentine variety. It is better at withstanding drought, poor soil, and soil compaction, making it more suitable for roadside use.

### 2. Common Bermuda

Selected by maintenance as the choice of grasses to be used within a twenty-five-mile range of Lake Okeechobee in western Palm Beach County, Bermuda grass grows well in almost any soil. It tolerates a wide range of pH, and is very salt tolerant. Bermuda grass

has a high tolerance for herbicides, which are common in this predominantly agricultural locale. Common Bermuda is an exotic or non-native warm season perennial grass that forms a low, dense, wear-resistant turf. It spreads primarily by rhizomes and stolons. It grows best in full sun on sandy soils. Common Bermuda grass has an excellent ability to recover after drought conditions.

## TURF INSTALLATION & MAINTENANCE

All areas of disturbed soil or bare areas are to be reseeded or sodded. These areas may result from shoulder repair by either mechanical or manual methods, soil aeration, utility systems work, herbicide application, and numerous other types of activities. Turf maintenance methods vary depending on site specific site conditions.

### SEEDING

Permanent grass seed (Bahia or common Bermuda) and a quick growing temporary grass (annual rye) will be used in accordance with the Guide for Roadside Vegetation Management. Other types of fast growing seed may be approved based on a location by location basis. Contractors must submit for approval by the DME prior to a variance being granted. Rates of application shall be in accordance with specifications in the Guide for Roadside Vegetation Management. Seed planters and/or seed drills will be monitored and maintained to ensure proper calibration of seed to soil placement. Hay mulch will be placed over newly seeded areas to protect the seed and seedlings from excessive drying and heat.

Seeding at the correct time, using the correct quantity of seed per unit of area, and proper distribution, covering, and soil preparation. The potential for success is greatest when seeding is performed under conditions that favor rapid germination and vigorous seedling growth. Seeding should be performed in warm weather with adequate moisture after seeding to help promote rapid growth. Seeding should not be performed later than early July for most warm-season grasses. Late summer seeding may result in germination, but establishment may not have time to occur before cooler temperatures prevail.

Seed can be sown using a variety of equipment including a broadcast spreader, a cultipacker seeder, hydroseeder, seed drill, or a slit-seeder. These methods are commonly used by FDOT. Research and experience have shown that best results are achieved when permanent grass seed is placed 0.25" to 0.50" below the soil surface with a seed drill, rake or other appropriate implement. If seed is not placed into the soil, it is usually washed away by surface water runoff or eaten by birds. When seed is placed too deep into the soil, the growing seedling's food reserves may be depleted before the seedling reaches the surface or before it can develop enough for photosynthesis (food production within the plant) to begin. After seeding, the planting site should be lightly rolled to ensure firm contact between the seed and soil particles.

It may be necessary to use an erosion-control material during or after seeding to help protect the soil from erosion and ensure seed germination.

## SODDING

Sodding is the preferred method to establish turfgrass along our facilities. Sodding forms an established turf soon after planting. In South Florida, sod may be planted year-round. However, sod should not be planted during very dry weather or when freezing temperatures are expected. Sod deteriorates very rapidly and must be laid within 48 hours after cutting.

Sodding will be required to restore all disturbed established turf areas within 2 weeks from the last date an area is disturbed or final grading has been achieved or as approved in writing by the Engineer. This will include shoulder repair or any other work that involves disturbing the established turf. Bahia or Common Bermuda sod will be used for all grassing activities as outlined. Any soil preparatory work needed will be performed as outlined in the Turf Establishment - Site Preparation section of *A Guide for Roadside Vegetation Management*.

The preferred method the solid-sodding sod placement method. When the solid-sod placement method is used, stagger the joints between the blocks of sod perpendicular to the roadway for best erosion control. The individual blocks should be firmly fitted against adjacent blocks and lightly tamped or rolled to provide uniform contact with the soil. Placing soil in the joints between the blocks of sod will help them knit (grow) together. When sod is placed on steep slopes, secure with wooden stakes or sod staples to prevent it from slipping. Every effort should be made to secure sod free of cogon grass and other invasive vegetation.

## MOWING

Mowing will be the primary method of controlling roadside vegetation in District 4. Mowing will be performed on a consistent basis to control grasses and undesirable vegetation for safety reasons, as well as for aesthetics. Mowing standards and procedures shall be strictly adhered to as outlined in *A Guide for Roadside Vegetation Management*. Frequency of mowing cycles will be based on contract requirements or an "as needed" policy and shall be at the discretion of the Operations Engineer and designated staff. Factors affecting the frequency of cycles are the following:

1. Safety of motoring public
2. Rural versus urban (urban requiring a higher level of maintenance)
3. Weather conditions (rate of growth will be determined by temperature, length of daylight, and moisture).

4. The minimum mowing height of six inches will be maintained for all rural mowing areas. A lower mowing height may be required for office complexes, sites within urban limits, and when necessary to control invasive species.

All mowing equipment will be cleaned of all invasive weed seeds, spores and active rhizome at designated containment areas before use and when departing the State right of way.

When areas that are typically maintained by mechanical means become excessively wet or flooded, small or hand-held equipment will be used to avoid rutting.

### Mowing Frequency

Mowing frequency will be on an as-needed basis or at the direction of the District Maintenance Engineer and staff. The following factors determine frequency:

- Safety, staff, contractors, integrity of roadside;
- Aesthetics;
- Weather conditions – growth is determined by temperature, hours of daylight, and moisture;
- Presence of invasive vegetation.

### Mowing Height

Maintaining the proper turf height helps establish and maintain a healthy stand of turfgrass. Mowing height is the height of the turfgrass immediately after mowing. Scalping (mowing too close to the ground line) is **extremely** detrimental to turfgrass. When too much leaf area is removed through mowing, the plant loses its carbohydrate reserves and the ability to replace those reserves. Removing too much leaf area also stops root growth. Plants that are cut too close to the ground line are less able to tolerate heat, cold, and drought; more prone to disease; less able to compete with undesirable vegetation; and more dependent on a carefully implemented and managed cultural program. Never scalp the turf.

Rural areas: For rural areas the mowing height should be six inches or higher. Plants at this height can retain enough leaf growth to carry out photosynthesis and adequate food reserves to persist through stress periods. They also can help abate the erosion of the soil from rain and wind. In addition, this height range provides a visually pleasing roadside for motorists traveling at highway speeds.

Urban areas and lawn turfs: A higher standard of maintenance is usually desired for Bold Landscape sites. A general rule for determining the mowing height and frequency for moderately to intensively cultivated turf areas is to remove no more than one-third of the blade height per mowing. Removing more than one-third of the blade height suppresses plant growth and makes the plant more susceptible to disease and stress. For Bold Landscape sites mowing height will be 4".

When clippings are not uniformly distributed behind the mower, large clumps of clippings may remain on the surface of the grass. These clumps can shade the grass underneath, causing it to die. Clumps may occur when mowers are set too low for the grass height or when improper fertilization results in excessive leaf growth. To reduce clumping, set the mowing height so that no more than 1/3 of the leaf portion is removed at one time.

Mowers shall avoid wildflower stands and other desirable vegetation during periods of bloom until plants have gone to seed. If a contractor mows a wildflower site at the wrong time it will destroy the stand. The contractor will be required to restore the wildflower site.

## SOILS

Turfgrass and other plants depend on soil for nutrients, physical support and moisture. How well the turfgrass grows in a certain type of soil is determined by the soil's characteristics. Soil characteristics include the soil's composition, texture, structure, fertility, and pH level.

### Soil Fertility

Fertility is one of the most important chemical properties of soil. The more nutrients in the soil the more fertile the soil is and the better it will be able to sustain plant growth. Unless replaced, the nutrients will decrease over time as they are used by the plants or leached from the soil. Commercial fertilizers are generally effective and efficient in restoring nutrients to the soil and maintaining a healthy turf.

### Soil pH

Soil pH is the potential level of hydrogen ions. A low pH indicates the soil is acidic; a high pH indicates the soil is alkaline. Most turfgrasses thrive best in soils with a pH range of 6.5 to 8.0 Soil pH also dictates the bioavailability of nutrients in the soil to turf.

### Soil Testing

Soil analysis will be considered for all areas that do not meet applicable standards for establishment of healthy turf or vegetation. Adequate representative samples from each section of roadway will be taken to provide sufficient representation of existing soil conditions. Soil testing will include pH, organic and nutrient measurements.

### Soil Amendments

Soil amendments will be used as necessary to improve existing soil composition. Soil amendments shall include, but are not limited to:

- Agricultural or dolomitic lime to raise pH levels

- Soil Sulphur to lower pH levels
- Muck blanket or composted organic waste to improve organic content
- Fertilizer to improve plant nutrition

Most turfgrasses thrive best in soils with a pH range of 6.5 to 8.0. Applications of lime increase soil pH (decrease acidity). Acidifying fertilizers, such as those containing ammonium sulfate, decrease the pH (increase acidity) in areas where it is higher than desired. Applications of sulfur also reduce soil pH levels. However, such applications have been shown to have only short-term effects. Test results will be used to determine the amounts of lime or Sulphur necessary to add per acre to reach the acceptable pH level.

## AERATION

Aeration is the process of mechanically loosening or breaking up the compacted soil to allow air, water, and nutrients to penetrate and thus to improve growing conditions. It is often performed through coring, slicing, or spiking of the soil. Use of soil aeration is rare in District 4, due to the sandy soils commonly found in the district. Potential use of soil aeration would likely only be in the District's northern counties. This operation is necessary where severe compaction has occurred due to heavy traffic, topsoil erosion, or continued close mowing. Soils may require aeration in high clay soils, compacted soils, and rock soils. Soils of a loose, sandy nature usually will not require aeration.

Aeration improves water, oxygen and nutrient penetration into the root zone of the turf. Additional benefits include:

- Improved wetting of dry soils
- Increased root strength
- Increased shoot growth
- Improved response to fertilizers

## PEST MANAGEMENT

The most common insect pests encountered in managing turf are red fire ants and mole crickets. Red Imported Fire Ants (RIFA) commonly infest roadside turf. The large mounds of soil they excavate look unsightly, disturb the roots of the turfgrass, and may smother and damage the grass. In addition, RIFA inflict painful bites when disturbed. If only a few nests are present in an area, insecticide should be used to spot-treat around the openings of the individual nests. If a general area is infested, a broadcast treatment may be necessary. For more information on RIFA, refer to [http://edis.ifas.ufl.edu/document\\_lh059](http://edis.ifas.ufl.edu/document_lh059).

Mole crickets feed on the roots of turfgrass and their burrowing also uproots plants and allows the soil to dry out. Newly seeded turf can be seriously damaged by only a few mole crickets. Areas infested with mole crickets should be treated as soon as possible after the damage is noticed. Bahiagrass is particularly impacted by mole crickets. For more information on mole crickets, refer to [http://edis.ifas.ufl.edu/document\\_lh039](http://edis.ifas.ufl.edu/document_lh039).

## FERTILIZATION

Fertilization shall be used to establish new sod or seed after soil testing to determine the type of fertilizer required. Proper fertilization is a primary determinant of turfgrass persistence and quality. It is also one of the least time consuming and least costly components of a complete turf management program and should be a primary tool in roadside vegetation management. Properly fertilized grass makes more efficient use of water. A thick turf with dense root system helps slow water movement and keeps it in the root zone. Grass which is properly fertilized develops a deep root system which is very important under roadside conditions.

The need for fertilizer depends on the turfgrass species. Certain species, such as Bahiagrass have relatively low requirements, while others like Bermudagrass grow best with higher rates of nutrients. For newly seeded sites, research has shown that fertilizer should be applied approximately five weeks after the seed has germinated. Excessive fertilization may cause chemical burning or overstimulation of top growth to the detriment of the rest of the plant. The application of fertilizer to areas of established turf should be based on an evaluation of the turf quality and should take place only when a need has been identified.

In accordance with the FDOT Statewide Stormwater Management Plan (SSMP) Section 3.6, and Procedure 850-000-015, District 4 will limit use of fertilizers to initial periods of seeding and/or turf and vegetation establishment to initiate growth and reduce potential erosion unless otherwise directed by the District Landscape Architect.

Application of all fertilizers used within state right of way will be documented using FDOT form number 850-000-26 located in the Department forms library and copies will be retained for review.

All personnel applying fertilizer will be trained through the Green Industry (GI) Best Management Practices (BMP) Program. All contractors and/or permittees who contract the application of fertilizer shall ensure and verify they use licensed commercial applicators who have been trained through the Green Industry BMP Program, and have obtained a limited certification for urban landscape commercial fertilizer application under section 482.1562, F.S. with a current copy of the license on file.

Fertilizer applications, if any, will be conducted in accordance with all department procedures and guidance, including the SSMP. Reference SSMP 3.6.3 for guidelines on fertilizer application, storage and handling methods, cleaning of equipment, and container disposal.

To reduce the amount of fertilizer needed, nurse crops (such as clover) and/or soil aeration may be used (reference SSMP 3.6.5). A muck blanket or other acceptable organic materials will be used to increase organic levels in existing soils. Fertilizer or other approved material will be used to increase nutrient levels in the soil.

Fertilization activities for all Trees, Palms, Shrubs and Groundcovers will be completed in accordance with the District Landscape Maintenance Plan and in coordination with the District Landscape Architect, as incorrect fertilization practices have been proven to be harmful to trees and palms.

## HERBICIDES

The use of high volume broadcast application of herbicides is prohibited and has been discontinued in District 4. Herbicides should only be considered for use on vegetation which cannot be controlled by mechanical methods. The use of herbicides is allowed around obstructions only when the cost of controlling by other means is prohibitive. The use of herbicides will be restricted to localized treatment of vegetation control around obstructions such as guard rails, signs, mitered ends, curb edging, grass encroachment on the pavement, and other areas where mechanical methods are not applicable. This work will be done only with handgun or back pack equipment. The limited use of broadcast applications shall be considered for control of certain noxious species. This work shall be performed only with the approval from the Office of Maintenance. It is the intent of this plan to assist the maintenance units in their everyday endeavor to accomplish the goals set forth by the Department. Only through the unified effort of all concerned will this happen. Use of non-chemical control methods are encouraged and preferred to reduce the environmental impact caused from chemical applications.

When herbicides are used to control non-desirable vegetation growing on fence lines adjacent to department roadways, the dead vegetation will be removed within 7 days of the application. No fence will have more than one third of its surface area between any two poles covered in any vegetation—dead or living. Additionally, when herbicide is used on MSE walls and slope pavement, the dead vegetation will be removed within 10 days of successful application. (Successful application means that the plants treated are dead.)



When chemical wiping treatments are used, chemicals will not be allowed to drip onto turf when equipment is moving or stopped. Some areas receiving herbicide-wiping treatments may require two applications due to vegetation species or density. Second applications, when determined necessary by the Engineer, will be applied in the opposite direction and within the same day as the initial treatment.

Where herbicide root control fabric is used, a long-term root control fabric system containing time-release nodules consisting of 18.9% active ingredient of trifluralin (a, a, a-triflioro-2, 6-dinitro-N, N-dipropyl-p-toluidine) and 81.1% inert ingredients consisting of spunbonded polypropylene, polyethylene, and carbon black will be used. The root control fabric will be placed vertically in the trench, attached in place, and back-filled with dirt so that the top of the fabric barrier is equal to the top level of the surrounding area. The width of the fabric will be 20 inches unless otherwise approved by the Engineer.

When basal bark application is needed herbicide will be applied directly to the bark around the circumference of each stem/tree up to 16 inches above the ground using an herbicide solution formulated with penetrating oil. The sprayers and spray guns will have chemical resistant seals for the herbicides and carriers being used.

Where frill and girdle application is needed, downward cuts will be made into the tree's bark and cambium layer completely around the circumference of the tree with no more than three-inch intervals between cut edges. Large trees with a circumference greater than 12 inches require continuous cuts (girdle). A backpack or handheld sprayer will be used to apply herbicide to each cut until the exposed area is thoroughly wet.

When treating stumps, spray or paint herbicide onto the cut surface within 15 minutes of cutting and removing large trees and brush. Cut surfaces will be free of dirt and sawdust and as level as possible to minimize runoff.

All personnel and contractors applying pesticides or herbicides require proper certification and licensing from the Florida Department of Agriculture and Consumer Services (FDACS). Applicators will hold a current license or work directly under a currently licensed applicator. Licenses are required to include the categories of: core curriculum, right of way and aquatic. Daily logs (Herbicide Application Log, Form No. 850-000-15) and reports of herbicide applications will be kept and will include items as listed under SSMP 3.6.2. Reference SSMP 3.6.3 and 3.6.4 for guidelines on herbicide application, storage and handling methods, cleaning of equipment, and container disposal.

In designated areas remove and dispose of dead plant material flush with the ground or pavement in accordance with the herbicide manufacturer's recommendations or when the plant material is dead.

With the approval of the District Engineer or designee, dead plant material may be shredded and distributed evenly in designated areas. Material used must be 100% free of invasive weed species.

## Herbicide Application Log

The Roadway and Roadside Maintenance Procedure section 3.5 states: “a daily Herbicide Application log (form No. 850-000-15) shall be required for any herbicide application.” In order to conform to the requirement in a consistent manner, District 4 provides training to staff on how to perform quality control reviews to ensure all logs are completed accurately, completely, and uniformly for all herbicide application performed by in-house or contract forces.

The following are some of the guidelines provided:

- WHO?
  - Form to be filled out/signed by applicator
  - Form to be initialed by the License Holder
  - Form to be Quality Checked by DOT Project Manager
- WHAT?
  - Used for all Herbicide application on the State Right of Way
- WHEN?
  - Should be completed Daily when spraying
  - Should be submitted to the DOT Project Manager monthly whenever MMS activity 494 is used
- WHERE?
  - Official Record to be kept on file at Ops Centers or District Office (only for District administered contracts)
- Was the Correct Form Version Used, Form Header information not cut off?
- Is All information legible?
- Is the Applicator’s Name Printed and Signed?
- Does the Applicator have a Valid License Holder? Go to the following to confirm: <http://ceupublicsearch.freshfromflorida.com/PersonSearch.asp>
- Product Type, acreage treated, gallons applied, location, wind speed, Tank Mix System or Calibration System need to be filled out and information checked for validity
- Wind speed should be checked to ensure it is being reported hourly.
- Sample form included in Appendix A of this Plan

## Herbicide Log Review Process

Herbicide logs will be submitted to and reviewed by a single designated person at each Operations Center for all work performed by in-house forces and contracts managed by the Operations Center. Contracts managed by the District Office will report through the assigned

Project Manager. Logs will be examined and deficiencies found will be noted and returned to contract manager for correction by the contractor. The reviewer will ensure that the applicator has or is supervised by someone with the proper FDAC pesticide license, as determined by contract and 850-000-15. Types of herbicides used will be checked to ensure no FDOT prohibited herbicide is being used in the ROW. Herbicide logs will be turned in for review at a minimum monthly schedule.

## CONTROL OF INVASIVE SPECIES

Each Operation Center will develop a plan to control invasive species and quantify the removal of acreage within their assigned areas. The removal acreage shall be reported annually to the District Landscape Architecture Unit. The plan should include the method and product to use to accomplish this task. This plan may identify the most cost-effective herbicide to reach the desired level of quality.

The list of target species shall include, but are not limited to, the following. Please see the State Office of Maintenance (OOM) web site (<http://www.fdot.gov/maintenance/invasivesinfo.shtm>) for the most current list.

1. Cogongrass (*Imperata cylindrica*)
2. Tropical soda apple (*Solanum viarum*)
3. Brazilian pepper (*Schinus terebinthifolius*)
4. Australian pine (*Casuarina equisetifolia*)
5. Melaleuca (*Melaleuca quinquenervia*)
6. Hydrilla (*Hydrilla verticillata*)
7. Hyacinth (*Eichhornia crassipes*)
8. Climbing fern (*Lygodium japonicum* and/or microphyllum)
9. Air-potato (*Dioscorea bulbifera*)
10. Kudzu (*Pueraria montana*)
11. Torpedo grass (*Panicum repens*)
12. Waterlettuce (*Pistia strtiotes*)
13. Alligator weed (*Alternanthera philoxeroides*)
14. Castor bean (*Ricinus communis*)
15. Chinese Tallow tree (*Sapium sebiferum* / *Triadeca sebifera*)

Each maintenance unit shall document and maintain in writing the location of Cogongrass and Tropical Soda Apple sites, to include Global Positioning System (GPS) location data, the total amount of area infested at each site, date, and type (method used) of last treatment (to include percent of active ingredient).

## AQUATIC MANAGEMENT

District 4's control of invasive aquatic weeds is intended to provide both an aesthetic and ecological benefit to the District's natural and man-made water bodies. Control of aquatic invasives helps reduce water volume attenuation, pipe obstruction and release of excessive nutrients.

- **Attenuation** - Stormwater facilities (SWFs) are designed to hold or carry certain volumes of water to prevent flooding. Aquatic invasives can accumulate quickly if not managed. Over time excessive vegetation can consume capacity within the system. The volume reduction will happen slowly, but it will happen. During a heavy rain, accumulated detritus could be washed downstream, causing flooding by blocking weirs or pipes, and/or water quality problems by discharging plant and sediment debris to lagoon, Intracoastal Waterway, estuary, ponds, rivers or streams.
- **Obstructions** - Aquatic vegetation that is allowed to propagate can accumulate quickly if not monitored. Both living and dead vegetation can accumulate within our drainage systems creating blockages, increased opportunity for sediment accumulation and reduced capacity. If vegetation is treated with herbicide, the dead vegetation must be removed or it will cause blockages in systems.
- **Excessive Nutrients** - The Indian River Lagoon and St Lucie River and Estuary have Basin Management Action Plans to reduce nutrients because excess nutrients cause poor water quality, fish kills and algal blooms. Live plants hold nutrients. Dead plants release nutrients. Removing vegetation before it dies and removing dead vegetation before it decomposes keeps unwanted nutrients from being released.

Each waterbody, and each aquatic weed infestation, has unique characteristics. By keeping invasive plants at low levels, it is possible to schedule management efforts around fish spawning seasons, waterfowl or wildlife migrations and nesting patterns, manatee foraging needs, special recreational events such as bass tournaments, and even weather patterns. When a waterbody is well-maintained, flexibility exists to introduce new and innovative control strategies which will further reduce the use of herbicides. This 'maintenance control' is the preferred method of managing invasive species.

In the case of aquatic vegetation such as hydrilla, water-hyacinth and water-lettuce maintenance control refers to not allowing our bodies of water to become overrun with noxious aquatic weeds. Letting aquatic weeds take over may not only render that water body virtually unusable establishing desirable native plants but also adversely affect fish and wildlife populations, interfere with drainage systems, flood control, irrigation, and potable water uses. In Florida water hyacinth populations can double every 7-14 days, outcompeting and displacing native plants, adversely impacting both fish and wildlife habitats. Water hyacinth infestations also

interfere with the nesting and feeding habits of the endangered Everglades snail kite, and in extreme cases can push over or uproot emergent vegetation in which kites build their nests. Additionally, some aquatic plants can build up to levels that provide habitat for disease carriers such as some species of mosquitoes.

The organic material deposited in water bodies by aquatic weeds also has another impact. Organic material in water decomposes, or rots, just as it does on land. This process consumes dissolved oxygen. When combined with other factors which naturally reduce the oxygen content of water (warm temperatures, cloudy days, and heavy rains), oxygen levels can be reduced to the point that fish become stressed and can die in large numbers. This is referred to as a "fish kill." Maintaining invasive aquatic weeds at low levels reduces large scale mechanical removal and chemical treatment efforts that can have sudden impacts on oxygen levels. It is also easier for aquatic plant managers to control small infestations of weeds allowing for more routine mechanical removal efforts in place of excessive chemical applications. Under these conditions there is less likelihood that nearby beneficial aquatic plants will be adversely affected.

Water hyacinth and other invasive plants left unmanaged, or controlled only on a "crisis" basis, accelerate the transformation of a lake into a marsh. Research at the University of Florida (Joyce, 1985) has shown that water hyacinth can add up to four times the organic sediment to waterbodies when managed on a "crisis" basis than when managed on a continuous and routine basis.

Aquatic invasives as well as other vegetation encroaching along or within water bodies such as ponds, canals, and ditches will be removed on a regular basis no less frequently than every 2 years or as needed to maintain these facilities functioning as intended as per their design. These maintenance efforts will include addressing accumulated debris and soil to ensure cross-sections and capacity of each facility is maintained per its approved design.

Proactive, consistent maintenance is imperative to avoid the serious problems that allow many aquatic weeds to become serious problems in Florida's semi-tropical, shallow, nutrient rich waters. Maintenance control is a consistent and active approach intended avoid crisis management of these or other health and safety dangers to the public.

## NPDES IMPACTS AND TIME FRAMES

Control of invasive species also impacts compliance with the National Pollution Discharge Elimination System (NPDES) Municipal Separate Storm Sewer System (MS4) permits. Management of affected areas are required to meet compliance with the NPDES MS4 permits as specified in the FDOT Statewide Stormwater Management Program. Corrective actions include

but are not limited to removing obstructions and nuisance vegetation in and around water control structures, removing of sediment and debris from surface water or storm water management basins, scarifying retention basins and in swales, back flushing filtration systems or replacing clogged filter sand/filter fabric with new filter sand/filter fabric, maintaining the integrity of control and conveyance structures, ditch block reconstruction, erosion stabilization, maintaining proper vegetative cover, and maintaining the pond fence and gate. Work identified as NPDES Corrective Actions will be addressed and completed within 45 days of issuance of notification.

## WILDFLOWERS

In accordance with the Wildflower Management Program Procedure 650-030-001, District 4 has identified and designated wildflower areas. Areas will be managed to minimize the effects of routine roadside maintenance activities. The District Wildflower Coordinator (DWC), in coordination with the District Maintenance Engineer, will ensure that mowing frequencies for identified Wildflower Areas are included in maintenance contractor documents. Mowing frequencies will be coordinated with each Operation Center for each wildflower area. Designated Wildflower Areas shall be identified and marked with permanent signs in accordance with Department standards and procedures. These areas will be evaluated annually by the DWC, to develop and improve this Vegetation Management Plan.

Areas identified as wildflower sites will not be mowed, treated with any incompatible herbicides, or otherwise disturbed during their growing, blooming, and seed-ripening seasons. Areas designated as wildflower sites will not be allowed to develop to the extent that they pose a safety hazard.

Below is a list of the currently designated/established wildflower areas within the District. The list will be updated annually with the update of this plan:

- I75 @ MM 44 Snake Road Interchange, Broward County
- I75 @ MM 30 near Recreational Area, Broward County
- I75 @ MM 29.5 near Rest Area, Broward County
- SR7@ MM 11.5 Median near 120<sup>th</sup> Street, Palm Beach County
- I95 @ MM 27, SR704/Okeechobee Blvd. Interchange, Palm Beach County
- I95 @ MM 45, N of SR706, Palm Beach County
- I95 @ MM 16, Martin County
- I95 From MP 106 to MP 110, Martin County

The DWC will monitor and monthly provide updates to the Operations Centers regarding progress of the wildflower areas and when mowing cycles might be expected to commence.

When it is time to mow the wildflowers, the DO NOT MOW signs will be bagged or removed before mowing begins.

## TREE MAINTENANCE

“Trimming” and “pruning” are different activities that require a different level of expertise. Trimming is done primarily for hedges, shrubs and brush; whereas pruning is for trees and palms. Shrub and brush trimming activities will be planned to achieve compliance with standards set forth in the MRP Handbook, and can typically be accomplished by un-licensed maintenance personnel.

Tree Maintenance activities for all Trees, Palms, Shrubs and Groundcovers will be completed in accordance with the District Landscape Maintenance Plan and in coordination with the District Landscape Architect, as incorrect tree maintenance practices have been proven to be harmful to trees and palms.

Dead trees can pose significant hazards to the traveling public. The weakened root structures of dead/dying trees may cause the trees to become uprooted and fall into travel ways, or onto fence. These uprooted trees may fall onto otherwise healthy living trees causing a domino effect of damage. Dead/dying trees may have branches which are weakened and subject to being blown off and into travel ways during South Florida’s hurricanes and even during severe storms which occur outside of the hurricane season window. When dead or dying trees are within a distance that could violate a clear zone, impact a fenceline or present a hazard or impediment to a travel way (pedestrian, automobile or other) they will be removed within 24 hours of discovery. Dead or dying trees that fall outside of the zone of immediate threat to travel ways will be removed within two weeks (14 calendar days) of discovery.

Trimming large brush will be accomplished with suitable equipment to provide an aesthetically pleasing cut. Boom mowers with rotary or flail cutting heads shall not be used for tree trimming or brush control. At no time shall boom mower cutting heads be operated higher than twelve inches above ground level.

### Pruning

Pruning of trees and palms requires the supervision of a Certified Arborist and must be completed in accordance with ANSI A300. Different types of trees and palms requires different methods of pruning. For guidance, Department personnel and Contractors should coordinate with the District 4 Landscape Architecture Unit.

The main reasons for pruning trees include safety and health. Pruning for *safety* involves removing branches that could fall and cause injury or property damage, trimming branches that

interfere with lines of sight on streets or driveways, and removing branches that grow into utility lines.

Pruning for *health* involves removing diseased or insect-infested wood, thinning the crown to increase airflow and reduce some pest problems, and removing crossing and rubbing branches. Pruning can best be used to encourage trees to develop a strong structure and reduce the likelihood of damage during severe weather. Removing broken or damaged limbs encourages wound closure. To maintain the health of the pruned trees and palms, the pruning equipment will be properly cleaned between each tree and palm as specified by ANSI A300.

The following are pruning techniques used:

- Cleaning – removes dead, dying, diseased, damaged, rubbing, broken, and out of place branches. This pruning technique is most commonly practiced on mature trees because it improves their value, appearance, health, and reduces risk.
- Thinning – has been the conventional method to minimize damage caused by storm winds. Thinning removes lateral and parallel branches, especially from the end portion of limbs. It allows the wind to pass through the canopy and improve durability in a storm. Proper thinning retains crown shape and size and should provide an even distribution of foliage throughout the crown.
- Reduction – the selective removal of branches and stems to decrease the height and/or the spread of a tree. This technique is used to minimize risk of failure, to reduce height or spread, to clear vegetation from buildings or other structures, and improve the appearance of the tree.
- Raising – is the selective removal of branches to provide vertical clearance. Crown raising shortens or removes lower branches of a tree to provide clearance for buildings, signs, vehicles and pedestrians. When raising, the desired clearance must be specified.
- Structural – is the removal of live branches to influence the orientation, spacing, growth rate, and strength of attachment and ultimate size of branches. Structural pruning is used on young and medium-age trees to help engineer a sustainable trunk and branch arrangement.
- Pollarding – is a training system that involves maintaining a tree at a specified height by annual pruning to a single point on main branches. Once begun, it is essential that pollarding continue. Pollarding is not topping and will only be used on Crape Myrtle tree.
- No topping, lions-tailing, flush cuts, hat racking will be allowed
- When removing a live branch at its point of origin on the trunk or from a parent branch the final pruning cut will be made in branch tissue just outside



the branch bark ridge (bbr) and collar. No stubs will be left. Do not make flush cuts.

- When removing a dead branch, the final cut will be made outside the collar of the living wood tissue. If the collar has grown out along the dead branch stub, only the dead stub will be removed; the living collar will remain intact and uninjured regardless of its length.
- Pruning cuts will be smooth and clean, leaving the bark at the edge of the cut firmly attached to the wood.
- Only sharp pruning tools will be used to ensure cuts will not leave jagged, rough, or torn bark around cuts.

For more detail about these techniques review Best Management Practices: Tree Pruning from the International Society of Arboriculture, ANSI 300, Part 1, An Illustrated Guide to Pruning 2nd Edition by Dr. Ed Gilman.

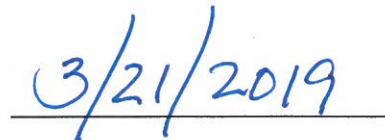
Boom mowers with rotary or flail cutting heads will not be used for tree pruning/trimming or brush control. At no time shall boom mower cutting heads be operated higher than 12" about the ground level

APPROVED



Morteza Alian, P.E  
District Maintenance Engineer  
District 4

Date



# APPENDIX A

HERBICIDE APPLICATION LOG

STATE OF FLORIDA DEPARTMENT OF TRANSPORTATION  
**HERBICIDE APPLICATION LOG**

FORM 850-000-15  
 MAINTENANCE  
 01/13

Date \_\_\_\_\_ Name/Signature of applicator \_\_\_\_\_ License # \_\_\_\_\_

Name of license holder responsible \_\_\_\_\_ License holder approval \_\_\_\_\_

Contract number \_\_\_\_\_ Company name \_\_\_\_\_

Location of the herbicide mixing and loading area \_\_\_\_\_

Description of application equipment used (include DOT no.) \_\_\_\_\_

Trade name of herbicide \_\_\_\_\_ Active Ingredient \_\_\_\_\_ Formulation \_\_\_\_\_ Manufacturer \_\_\_\_\_

Trade name of herbicide \_\_\_\_\_ Active Ingredient \_\_\_\_\_ Formulation \_\_\_\_\_ Manufacturer \_\_\_\_\_

Trade name of herbicide \_\_\_\_\_ Active Ingredient \_\_\_\_\_ Formulation \_\_\_\_\_ Manufacturer \_\_\_\_\_

List adjuvants used (if applicable) and rate \_\_\_\_\_

Percent of active ingredient applied per acre/gallon \_\_\_\_\_

Amount of product applied per acre \_\_\_\_\_

Total acreage treated \_\_\_\_\_ Total gallons of solution applied \_\_\_\_\_

List target species or roadway structures/facilities treated \_\_\_\_\_

County Section No. \_\_\_\_\_ SR No. \_\_\_\_\_

From/To or GPS Location \_\_\_\_\_

Time(s) of application \_\_\_\_\_

Average hourly wind speed and direction

Time	Speed	Direction	Time	Speed	Direction	Time	Speed	Direction
_____	_____	_____	_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____	_____	_____	_____

Nozzle type \_\_\_\_\_

Application angle (0 to 30 Downward - 31 to 90 Outward - 91 to 180 Upward) \_\_\_\_\_

**CALIBRATION**

**TANK MIX SYSTEM**

**INJECTION SYSTEM**

Total gallons per minute collected \_\_\_\_\_

Spray swath \_\_\_\_\_

Speed \_\_\_\_\_ Spray swath \_\_\_\_\_

Distance calibration no. \_\_\_\_\_

Gallons per acre of solution \_\_\_\_\_

Pump no. \_\_\_\_\_

Tank size \_\_\_\_\_ Tip size \_\_\_\_\_

Tube size \_\_\_\_\_

Pressure \_\_\_\_\_

Pump calibration no. \_\_\_\_\_

Amount of water in tank \_\_\_\_\_

Ounces collected \_\_\_\_\_

Amount of herbicide per tank \_\_\_\_\_

Acres to be treated per tank \_\_\_\_\_

# APPENDIX B

## TOP 15 INVASIVE SPECIES

(Reference: <https://www.fdot.gov/maintenance/invasivespecies.shtm>)

## 1. Cogongrass (*Imperata cylindrica*)

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.
- Seed production predominately occurs in the spring, with long, fluffy-white seedheads. Mowing, burning or fertilization can also induce sporadic seedhead formation.
- 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.

### MANAGEMENT:

- In the Southeastern United States, state governments have various eradication efforts in place, and deliberate propagation is prohibited by some authorities. Control is typically by the use of herbicides. Currently, the most effective herbicides used to control growth are glyphosate and imazapyr. Burnoff is seldom successful since the grass burns at a high temperature causing heat damage to trees which would ordinarily be undamaged by a controlled burn and recovers from a burn quickly. Quarantine and extermination of this plant is especially difficult because cogongrass establishes root systems as deep as four feet, and regrowth can be triggered by rhizome segments as small as one inch.





## 2. Tropical soda apple (*Solanum viarum*)

Tropical soda apple is a perennial weed that is a serious problem in many perennial grass pastures of Florida and throughout the southeastern United States. Tropical soda apple (TSA) is unpalatable to livestock and can infest a pasture or native area in 1-2 years resulting in loss of forage production and lower stocking rate. TSA also reduces biodiversity in natural areas, ditch banks, and roadsides by displacing native vegetation.

- At maturity, TSA is from 3 to 6 ft tall. Stems, leaves, flower-stalks, and calyxes have broad-based white to yellowish prickles. Leaves are pubescent (contain hairs), 4 to 8 in long and 2 to 6 in wide, and are moderately to deeply divided into broad pointed lobes. The fruit is globular, about 1 in diameter and yellow when mature. The immature fruit is green with white mottling like a watermelon and serves as a distinguishing characteristic.
- Though TSA is an indeterminate plant, flowering and fruit production in Florida is concentrated from September through May. Throughout the year, this plant will have immature and mature fruit present that ensures large numbers of viable seeds. Seedling emergence in south Florida primarily occurs from August through March. The plant has an extensive root system which will extend 3 to 6 ft horizontally from the crown of the plant.

### MANAGEMENT:

- TSA Management practices in Florida pastures primarily involve herbicide applications and mowing which provide temporary weed suppression.

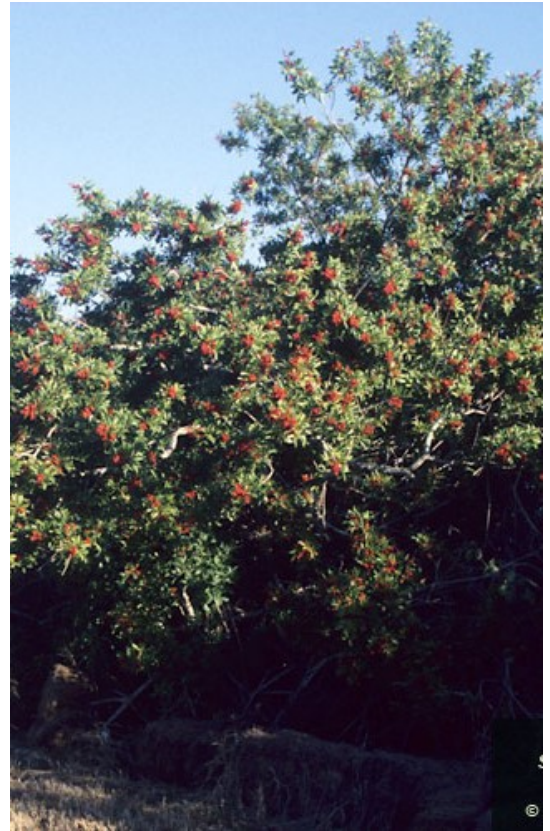


### 3. Brazilian pepper (*Schinus terebinthifolius*)

Brazilian pepper is a shrub or small tree that reaches over 30 feet in height, typically with a short trunk hidden in a thicket of branches. Some trees can live over 30 years. Leaves are alternately arranged with 1-2inch long, elliptic, finely toothed leaflets. The leaves are reddish, often possessing a reddish mid-rib. Flower clusters are white, 2-3 inches long with male and female flowers that look very similar. The glossy fruits are borne in clusters that are initially green, becoming bright red when ripe. Seeds are dark brown and 0.3 mm in diameter. Flowering occurs from September through November and fruits are usually mature by December.

#### MANAGEMENT:

- When utilizing mechanical methods, the entire plant, particularly the root system, should be removed. Roots  $\frac{1}{4}$  inch in diameter and larger are able to re-sprout and produce new plants.
- **CHEMICAL CONTROL**
  - **Soil residual** - beneficial for long-term control but can pose problems to non-target species.
  - **Foliar Herbicide Application** - Foliar applications can also be very effective, but thorough coverage is essential. Due to their large size and often-inaccessible habitat, these types of applications are limited in scope. However, foliar treatments are very good on seedlings.
  - **Basal Bark/Cut Stump Treatments** - Brazilian pepper-trees can be effectively controlled by cutting and treating the stumps with herbicide. The trunk should be cut as close to the ground as possible. Within 5 minutes, a herbicide containing glyphosate or triclopyr should be applied as carefully as possible to the thin layer of living tissue, called the cambium, which is just inside the bark of the stump. The best time to cut Brazilian pepper-trees is when they are not fruiting, because seeds contained in the fruits have the capability of producing new Brazilian pepper-trees.





#### 4. Australian pine (Casuarina equisetifolia)

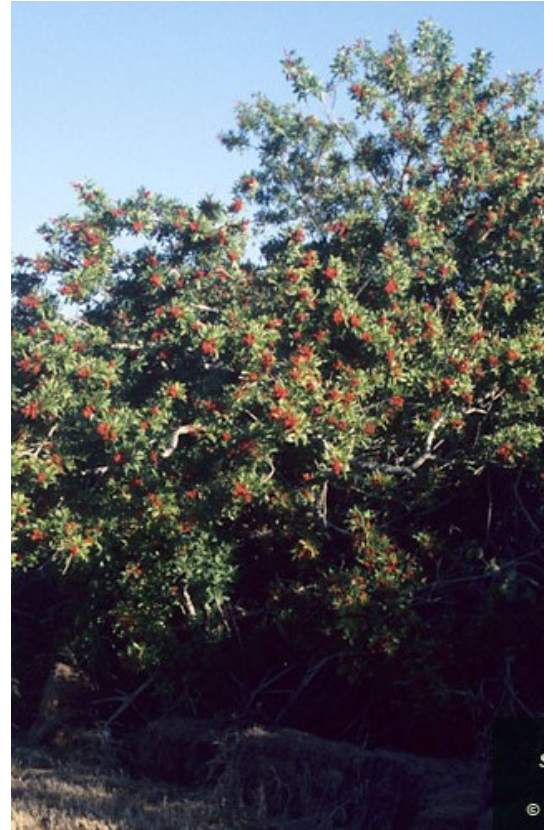
In Florida, Australian pine occurs predominantly south of Orlando. The fast growth, prolific seeding and thick litter accumulation of Australian pine impedes the establishment of native plant species and their associated herbivores, disrupting natural processes. Australian pine readily establishes on sandy shores which leads to increased beach erosion and interference with the nesting of endangered sea turtles and crocodiles. The foliage occurs as branchlets that are slender and jointed, producing short segments or nodes. The segmented branchlets are angular with longitudinal ridges separated by furrows containing stomata. The branchlet furrows are usually filled with dense hairs.

##### MECHANICAL CONTROL

- **Feller-bunchers**, commonly used in commercial forest harvesting, are machinery heads that grasp, cut, and stack trees.
- **Forestry mowers or mulching heads** attach to excavators (also called track-hoes) or four-wheeled loaders and mow trees to the ground.

##### HERBICIDAL CONTROL

- **Foliar herbicide application.** Herbicide is diluted in water and applied to the leaves of target plants with aerial or ground equipment.
- **Soil herbicide application** can be used to control dense populations of seedlings and/or saplings.
- **Basal bark herbicide application** uses herbicide product that diluted in a commercial penetrating oil applied directly to the bark around the circumference of each trunk up to 15 inches above the ground (depending on label instructions). The herbicide must be in an oil-soluble formula (emulsifiable concentrate) used on trees with a diameter of six inches or less.
- **Stump application of herbicide.** After felling, a solution of herbicide product is applied to the surface of the stump.
- **Frill or girdle herbicide application.** A continuous cut (girdle) or individual cuts (frill) with no more than 3-inches between cut edges is made into the cambium (living tissue) completely around the circumference of the tree. Do not make multiple cuts directly above or below each other because this will inhibit movement of the herbicide. Incisions should be angled downward to form a reservoir that will help hold herbicide and deep enough to penetrate into the cambium layer. Herbicide is applied to each cut until the exposed area is thoroughly wet.





## 5. Melaleuca (Melaleuca quinquenervia)

Melaleuca is a hardy, fast-growing tree imported from Australia and has papery white bark resembling the white birch. Melaleuca readily invades canal banks, buffer zones between pinelands and cypress areas, and uninterrupted sawgrass prairies. It is easily recognized by its white, spongy flaking bark, lanceolate, longitudinally, parallel-veined leaves, and clusters of woody seed capsules along the stems.

### MECHANICAL CONTROL

- Mechanical removal using heavy equipment is not appropriate in most natural areas because of disturbances to soils and non-target vegetation. However, this method of control can be applied along canal and utility rights-of-way and other similar areas adjacent to infested wetlands. Stumps left after any mechanical operation would require a herbicide application to prevent root sprouts and re-growth from cut surfaces.

### HERBICIDAL CONTROL

- Exotic woody vegetation is most commonly managed by herbicide application. There are various methods by which herbicides can be applied to woody exotic pest plants. These are: basal bark, foliar, frill or girdle (hack-and-squirt). Labor intensive, manual herbicide applications to individual "outlier" trees and small tree groups continue to be the primary melaleuca control method throughout south Florida.
- **Ground Application:** There are several methods by which herbicides can be safely applied for the management of invasive plants. To date, the "girdle" application technique of applying herbicide to cambium exposed around a tree's entire circumference, and the cut stump application have been the method of choice with the U.S. National Park Service in Everglades National Park, the U.S. Fish and Wildlife Service in the Arthur R. Marshall Loxahatchee National Wildlife Refuge and the SFWMD in the Everglades Water Conservation Areas and Lake Okeechobee, as well as many other resource management initiatives in the region.



## 6. Hydrilla (Hydrilla verticillata)

As an invasive species in Florida, *Hydrilla* has become the most serious aquatic weed problem for Florida and most of the U.S. Because it was such a threat as an invasive species, restrictions were placed to allow only a single type of chemical, fluridone, to be used as a herbicide. This was done to prevent the evolution of multiple mutants, and resulted in fluridone resistant *Hydrilla*. "As *Hydrilla* spread rapidly to lakes across the southern United States in the past, the expansion of resistant biotypes is likely to pose significant environmental challenges in the future."

- The stems grow up to 1–2m long. The leaves are arranged in whorls of two to eight around the stem, each leaf 5–20 mm long and 0.7–2 mm broad, with serrations or small spines along the leaf margins; the leaf midrib is often reddish when fresh. It is monoecious (sometimes dioecious), with male and female flowers produced separately on a single plant; the flowers are small, with three sepals and three petals, the petals 3–5 mm long, transparent with red streaks. It reproduces primarily vegetatively by fragmentation and by rhizomes and turions (overwintering), and flowers are rarely seen.<sup>[2][4][5][6]</sup> They have air spaces to keep them upright. *Hydrilla* has a high resistance to salinity compared to many other freshwater associated aquatic plants.

### MANAGEMENT:

- *Hydrilla* can be controlled by herbicides, as well as grass carp,<sup>[13]</sup> itself an invasive species in North America. Insects used as biological pest control for this plant include weevils of the genus *Bagous* and the Asian hydrilla leaf-mining fly (*Hydrellia pakistanae*).<sup>[13]</sup> Tubers pose a problem as they can lie dormant for a number of years, making it even more difficult to remove from waterways and estuaries. *Hydrilla* holds the advantage in that it can spread efficiently through both tubers and turions





## 7. Hyacinth (*Eichhornia crassipes*)

Water hyacinth has been widely introduced in North America, Europe, Asia, Australia, Africa and New Zealand. In many areas it has become an important and pernicious invasive species. Water hyacinth is a free-floating perennial aquatic plant (or hydrophyte) native to tropical and sub-tropical South America. With broad, thick, glossy, ovate leaves, water hyacinth may rise above the surface of the water as much as 1 meter in height. The leaves are 10–20 cm across on a stem which is floating by means of buoyant bulb like nodules at its base above the water surface. They have long, spongy and bulbous stalks. The feathery, freely hanging roots are purple-black. An erect stalk supports a single spike of 8–15 conspicuously attractive flowers, mostly lavender to pink in colour with six petals. When not in bloom, water hyacinth may be mistaken for frog's-bit (*Limnobium\_spongia*) or Amazon frogbit (*Limnobium\_laevigatum*). The water hyacinth was introduced in 1884 at the World's Fair in New Orleans. The plants had been given away as a gift by a group of visiting Japanese. Soon after, the water hyacinth was choking rivers, killing fish and stopping shipping in Louisiana, and an estimated 50 kg/m<sup>2</sup> choked Florida's waterways.

### MANAGEMENT:

- As chemical and mechanical removal is often too expensive, polluting, and ineffective, researchers have turned to biological control agents to deal with water hyacinth. The effort began in the 1970s when USDA researchers released three species of weevil known to feed on water hyacinth into the United States, *Neochetina bruchi*, *N. eichhorniae*, and the water hyacinth borer *Sameodes albiguttalis*.

### MECHANICAL CONTROL

- Physical control is performed by land-based machines such as bucket cranes, draglines, or boom or by water based machinery such as aquatic weed harvester, dredges, or vegetation shredder. Mechanical removal is seen as the best short-term solution to the proliferation of the plant.

### HERBICIDAL CONTROL

- Chemical control is the least used out of the three controls of water hyacinth, because of its long-term effects on the environment and human health.





## 8. Climbing fern (*Lygodium japonicum* and/or *microphyllum*)

*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. 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.

### MECHANICAL CONTROL

- ▶ Hand pulling is one mechanical strategy for the removal of small patches of these climbing ferns, 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.

### CHEMICAL CONTROL

- ▶ Some research has been conducted on both climbing ferns, 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 mL or 2 teaspoons per gallon of spray solution)





## 9. Air-potato (*Dioscorea bulbifera*)

*Air potato is a glabrous, twining, vine with alternate heart-shaped leaves. The vines may reach 20 m in length during a growing season, which in Florida begins with the increase in precipitation in late spring/early summer. Vines continue to grow through the summer and into fall/early winter when they senesce. Air potato is dioecious, although only female plants have been observed in North America. Reproduction in the native range is achieved sexually and vegetatively through the production of bulbils - bulblike growths produced in the leaf axils. Although flowering in Florida is uncommon. bulbifera reproduces quickly and prolifically by bulbil propagation. As an aggressive high-climbing vine, air potato grows into and often over the tops of low-lying vegetation and into tree canopies. Leaves are cordate-shaped with elongated tips, thin and glabrous, and range from 10-20 cm in length and 5-15 cm in width. Leaves are long-petioled, often  $\geq 8$  cm on mature leaves and between 2-3 cm on newer leaves nearest the terminal bud, and occur in an alternate arrangement along a branching, hairless, stem. Leaves are generally a vibrant green on the upper surface and a lighter green on the lower surface depending upon conditions. Basal lobes of leaves are broadly rounded. Leaf margin is entire. Leaf venation is parallel and converges at the leaf base.*

### MANAGEMENT:

- *If you don't want to spray or cannot spray because the air potato vine is in close proximity to desirable plants, there is a relatively new approach to reducing the growth of air potato to more manageable levels. It's called the air potato leaf beetle, and was introduced into Florida from China in 2012 for biological control of air potato.*

### CHEMICAL CONTROL

- *Herbicides containing the active ingredient glyphosate (such as Roundup) are effective for controlling air potato when sprayed onto the foliage.*



## 10. Kudzu (*Pueraria montana*)

*The name is derived from the Japanese name for the plant East Asian arrowroot (*Pueraria montana* var. *lobata*), or (kuzu). Where these plants are naturalized, they can be invasive and are considered noxious weeds. The plant climbs over trees or shrubs and grows so rapidly that it kills them by heavy shading. The plant is edible, but often sprayed with herbicides. Kudzu was introduced from Japan into the United States at the Japanese pavilion in the 1876 Centennial Exposition in Philadelphia. In the 1930s and 1940s, the vine was rebranded as a way for farmers to stop soil erosion. Workers were paid \$8 per acre to sow topsoil with the invasive vine. The cultivation covered over one million acres of kudzu. It is now common along roadsides and other disturbed areas throughout most of the southeastern United. Estimates of its rate of spreading differ wildly; it has been described as spreading at the rate of 150,000 acres (610 km<sup>2</sup>) annually, although in 2015 the United States Forest Service estimated the rate to be only 2,500 acres per year.*

### MANAGEMENT:

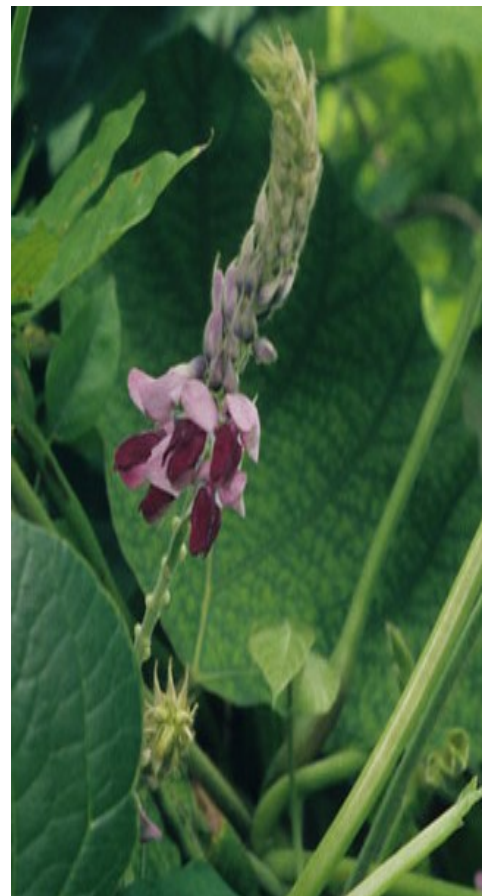
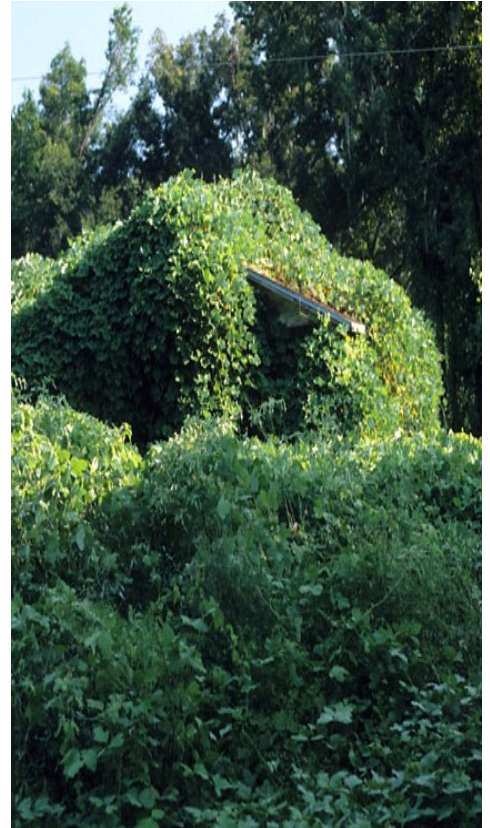
- **Crown removal**-For successful long-term control of kudzu, it is not necessary to destroy the underground system, which can be extremely large and deep. It is only necessary to use some method to kill or remove the kudzu root crown and all rooting runners. The root crown is a fibrous knob of tissue that sits on top of the roots. Crowns form from multiple vine nodes that root to the ground, and range from pea- to basketball-sized. The older the crowns, the deeper they tend to be found in the ground. Nodes and crowns are the source of all kudzu vines, and roots cannot produce vines. If any portion of a root crown remains after attempted removal, the kudzu plant may grow back.

### MECHANICAL CONTROL

- **Mechanical methods** of control involve cutting off crowns from roots, usually just below ground level. This immediately kills the plant. It is necessary to destroy all removed crown material. Buried crowns can regenerate into healthy kudzu. Transporting crowns in soil removed from a kudzu infestation is one common way that kudzu unexpectedly spreads and shows up in various locations.
- **Mowing**-Close mowing every week, regular heavy grazing for many successive years, or repeated cultivation may be effective. Cut kudzu can be fed to livestock, burned, or composted.

### HERBICIDAL CONTROL

- A systemic herbicide, for example, glyphosate, triclopyr, or picloram (as allowable), can be applied directly on cut stems, an effective means of transporting herbicide into the extensive root system. Herbicides can be used after other methods of control, such as mowing, grazing, or burning, which weaken the plants. After initial herbicidal treatment, follow-up treatments and monitoring are usually necessary up to 10 years after the initial chemical placement to make sure the plant does not return.





## 11. Torpedo grass (*Panicum repens*)

*This perennial grass spreads via its large, branching rhizomes, which are thick and pointed. The pointed shape of the rhizome tip gives the plant the name torpedograss. The rhizomes creep along the ground or float in water, forming floating mats. They can reach a length of 6 meters (20 ft) and a soil depth of 7 meters (23 ft), and they can form a mat 15 centimeters (5.9 in) thick. The spreading rhizomes sprout repeatedly to form colonies of stems. The stems are 20 to 90 centimeters (7.9 to 35.4 in) tall, sometimes reaching 1 meter (3 ft 3 in). They grow erect or bend down. The leaves are stiff and straight, linear in shape, and flat or folded. They are sometimes white in color and waxy in texture. This grass grows throughout the world in tropical and subtropical areas. It was introduced to the United States in seed for forage grasses and probably in ballast water from ships. It was also imported by the United States Department of Agriculture to grow as a forage grass for cattle. It was deliberately planted throughout southern Florida and it easily escaped cultivation, eventually becoming "one of the most serious weeds in Florida," spreading to more than 70% of the waterways in the state. In Lake Okeechobee it has invaded more than 16,000 acres of marsh. It displaces native plants, growing colonially in thick monotypic stands. Dense mats or stands of the grass cause hypoxia in the water. Torpedograss management in flood control systems costs an estimated US\$2 million per year.*

### **MANAGEMENT:**

*The grass can grow in a variety of habitats, but it does not tolerate cold and it is rarely found above subtropical latitudes or at altitude.*

### **MECHANICAL CONTROL**

- ▶ *Cut torpedo grass with a [lawn mower](#) if patches are larger than about 6 square feet.*
- ▶ *Chop up the soil with a shovel or hoe and remove as much of the torpedo grass and underlying [root](#) structure as possible.*

### **HERBICIDAL CONTROL**

- ▶ *Spray the torpedo grass with an herbicide containing glyphosphate or imazapyr. Other herbicides may not be effective at controlling torpedo grass, as it is resistant to many herbicides.*



## 12. Waterlettuce (Pistia strtiotes)

Commonly referred to as Waterlettuce, It is now present, either naturally or through human introduction, in nearly all tropical and subtropical fresh waterways and considered an invasive species as well as a mosquito breeding habitat. It is a perennial monocotyledon with thick, soft leaves that form a rosette. It floats on the surface of the water, its roots hanging submersed beneath floating leaves. The leaves can be up to 14 cm long and have no stem. They are light green, with parallel veins, wavy margins and are covered in short hairs which form basket-like structures which trap air bubbles, increasing the plant's buoyancy. The flowers are dioecious, and are hidden in the middle of the plant amongst the leaves. Small green berries form after successful fertilization. The plant can also undergo asexual reproduction. Mother and daughter plants are connected by a short stolon, forming dense mats.

### MANAGEMENT:

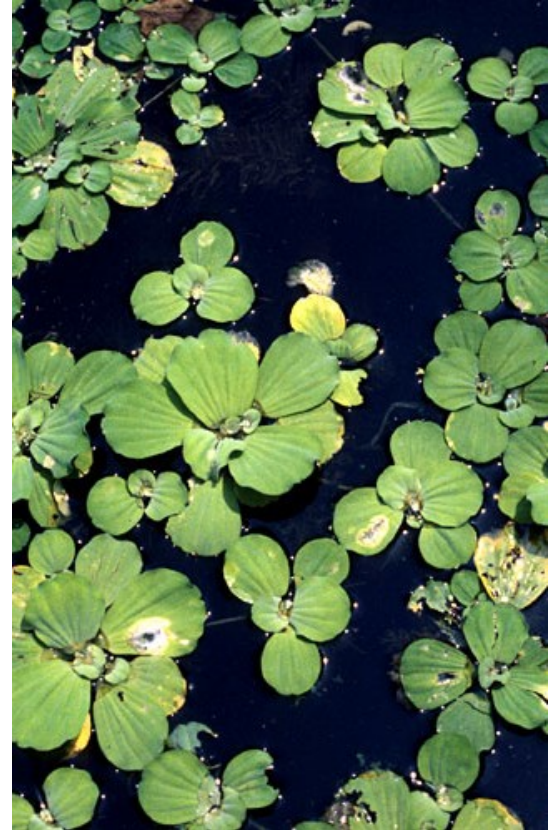
- ▶ *Pistia* can be controlled by mechanical harvesters that remove the water lettuce from the water and transport it to disposal on shore. Aquatic herbicides may also be used. Two species of insects are also being used as a biological control. Adults and larvae of the South American weevil *Neohydronomus affinis* feed on *Pistia* leaves, as do the larvae of the moth *Spodoptera pectinicornis* from Thailand. Both are proving to be useful tools in the management of *Pistia*.

### MECHANICAL CONTROL

- ▶ Cut torpedo grass with a lawn mower if patches are larger than about 6 square feet.
- ▶ Chop up the soil with a shovel or hoe and remove as much of the torpedo grass and underlying root structure as possible.

### HERBICIDAL CONTROL

- ▶ Spray the torpedo grass with an herbicide containing glyphosate or imazapyr. Other herbicides may not be effective at controlling torpedo grass, as it is resistant to many herbicides.





### 13. Alligator weed (*Alternanthera philoxeroides*)

*Alternanthera philoxeroides*, commonly referred to as **alligator weed**, is a native species to the temperate regions of South America, which includes Argentina, Brazil, Paraguay and Uruguay. Argentina alone, hosts around 27 species that fall within the range of the genus *Alternanthera*. Its geographic range once used to cover only the Parana River region of South America, but it has since expanded to cover over 30 countries, such as the United States, New Zealand, China and many more. This invasive species is believed to have been accidentally introduced to these non-native regions through sediments trapped/attached to tanks and cargo of ships travelling from South America to these various areas. *Alternanthera philoxeroides* can thrive in both dry and aquatic environments and is characterized by whitish, papery flowers along its short stalks, irregular, or sprawling hollow stems, and simple and opposite leaf pattern sprouting from its nodes. The species is dioecious. It is also considered a herbaceous plant due to its short-lived shoot system. It produces horizontal stems, otherwise known as stolons, that can sprout up to 10 m in length and thanks to its hollow stems, floats easily. This results in large clusters of stem to amass and create dense mats along the surface. The plant flowers from December to April and usually grows around 13 mm in diameter and tend to be papery and ball-shaped. The weed's intricate root system can either allow them to hang free in the water to absorb nutrients or directly penetrate the soil/sediment and pull their nutrients from below.

#### MANAGEMENT:

- Early detection is the best bet to ensure that the invasive species does not successfully colonize a non-native region because of its persistent to regenerate and propagate from small portions of its stem or leaf cuttings This plant can only establish itself in shallow waters no deeper than 2 meters, so one method of control is to erect barriers in shallower areas to limit the amount of suitable space the plant has.



Alligator weed  
*Alternanthera philoxeroides*  
Photo by Vic Ramey  
© 2000 University of Florida

## 14. Castor bean (*Ricinus communis*)

*Ricinus communis* can vary greatly in its growth habit and appearance. The variability has been increased by breeders who have selected a range of cultivars for leaf and flower colours, and for oil production. It is a fast-growing, suckering shrub that can reach the size of a small tree, around 12 m (39 ft), but it is not cold hardy. The glossy leaves are 15–45 cm (5.9–17.7 in) long, long-stalked, alternate and palmate with five to twelve deep lobes with coarsely toothed segments. In some varieties they start off dark reddish purple or bronze when young, gradually changing to a dark green, sometimes with a reddish tinge, as they mature. The leaves of some other varieties are green practically from the start, whereas in yet others a pigment masks the green color of all the chlorophyll-bearing parts, leaves, stems and young fruit, so that they remain a dramatic purple-to-reddish-brown throughout the life of the plant. Plants with the dark leaves can be found growing next to those with green leaves, so there is most likely only a single gene controlling the production of the pigment in some varieties. The stems and the spherical, spiny seed capsules also vary in pigmentation. The fruit capsules of some varieties are more showy than the flowers. The flowers are borne in terminal panicle-like inflorescences of green or, in some varieties, shades of red, monoecious flowers without petals. The male flowers are numerous, yellowish-green with prominent creamy stamens; the female flowers, borne at the tips of the spikes, lie within the immature spiny capsules, are relatively few in number and have prominent red stigmas. The fruit is a spiny, greenish (to reddish-purple) capsule containing large, oval, shiny, bean-like, highly poisonous seeds with variable brownish mottling. Castor seeds have a warty appendage called the caruncle, which is a type of elaiosome. The caruncle promotes the dispersal of the seed by ants (myrmecochory).

### MANAGEMENT:

- Castor bean plants (*Ricinus communis*) contain toxic compounds that can be deadly to wildlife, pets and people. Because of these toxins it is imperative that these plants be removed from your property to protect your children and pets. Removing castor bean plants from your yard involves destroying the entire plant while taking precautions to keep yourself safe during the process. Destroying the plants can be best accomplished by boiling the entire plant for an extended period to break down the toxins into harmless compounds.





## 15. Chinese Tallow tree (*Sapium sebiferum* / *Triadeca sebifera*)

*Chinese tallow, Sapium sebiferum* (L.) Roxb. (Euphorbiaceae) is an aggressive woody invader of wetland, coastal, and disturbed habitats, and has been shown to reduce native species diversity and richness, and alter ecosystem structure and function in Florida's natural areas. *Sapium sebiferum* (L.) Roxb. is a rapidly-growing, subtropical, monoecious, deciduous, polycarpic tree with caustic milky latex capable of attaining heights of 10 to 13 meters. Essentially glabrous, unarmed, weak-stemmed, with arcuate and often drooping slender branches, the stems and branches brittle. Bark is grayish-brown with extensive fissures and, when water-stressed, is characterized by hypertrophied lenticels. Leaves are alternate; blades rhombic, 3-7 cm long, basally biglandular and rounded to acute, marginally entire, apically acuminate; petioles longer than their blades; stipules subulate, caduceous. The leaves exhibit a wide range of autumnal coloration.

### MECHANICAL CONTROL

- ▶ Mechanical removal involves the use of bulldozers and similar heavy equipment to remove vegetation.
- ▶ Woody vegetation can be physiologically stressed or sometimes killed by hydrologic manipulation or fire.

### HERBICIDAL CONTROL

- ▶ *Herbicide Control: Large areas: Make basal bark application, according to label instructions, of triclopyr ester-containing herbicide such as Garlon 4™ or Pathfinder II™ or cut stump application of triclopyr ester or triclopyr amine containing herbicide such as Garlon 3A™. Use at least 20% dilution in oil for basal bark application and at least 10% dilution (water for triclopyr amine) for cut stump application. For cut stump application, apply herbicide solution immediately after cutting.*



# APPENDIX C

ADDITIONAL INVASIVE SPECIES TO WATCH FOR

## Vaseygrass (*Paspalum urvillei*)

- Native to South America, but introduced as a forage plant, and now spread throughout the southern half of the U.S. from Virginia to California.
- A tall perennial grass which forms thick clumps up to 6 feet tall. Propagation is by seeds, and plants may occur in most habitats, but prefer moist to wet soils.
- Mature plants have erect, thick stems, although as the seed heads mature their weight may cause the stems to bend at an angle. Leaves are very long and drooping, and may be over a half inch wide. Leaves are smooth but with a fringe of hairs at their base. The ligule is membranous and long. Seed heads can be very long, with up to 30 long spikelets off the main stem, and these give a very hairy, soft appearance as they mature.





## Johnsongrass

(*Sorghum halepense*)

- ▶ *Johnsongrass, a coarse and generally clumping grass, is one of the most troublesome of perennial grasses. It rapidly produces colonies, is very competitive with crop plants.*
- ▶ *Mature johnsongrass grows in spreading, leafy tufts with shoots (tillers) sprouting from the base (crown). Stems stand erect, from 6 to 7 feet (1.8–2.1 m) tall, and are unbranched. Leaves are rolled in the bud. The blade is flat, hairless to sparsely hairy, especially near the ligules. Sheathes are open, hairless to sparsely hairy near the collar, and pale green to reddish. The leaf has a prominent whitish midvein, which snaps readily when folded over. Underground stems are thick, fleshy, and segmented. Roots and shoots can sprout from these segments.*





## Broomsedge (*Andropogon*)

- *Broomsedge bluestem* is a native warm season perennial bunchgrass that grows 2 to 4 feet tall. The leaves are flat to partly folded 10 to 15 inches long and approximately 1/8 inch wide. The fringed ligule is 1/16 inch long. The flattened basal leaf sheaths are colorless or yellow. The rest of the plant is a pale greenish yellow. Broomsedge bluestem produces many seeds on the upper half of the plant that are distributed by the wind. At a distance the inflorescence may appear silvery in the sunlight.
- Broomsedge bluestem grows where average rainfall is greater than 25 inches. It is found throughout the eastern portion of the United States. The grass is found in open areas such as abandoned fields, overgrazed pastures, cut-over timber sites, and rights of way. Broomsedge grows on a wide variety of soils, preferring loose, sandy, moist sites with low fertility and is an indicator of low phosphorus soils. It also is a shallow rooted plant.



## Dogfennel (*Eupatorium capillifolium*)

- ▶ *Dogfennel (Eupatorium capillifolium)* is an aggressive native perennial found throughout much of the Southeast. Dogfennel is particularly troublesome in unimproved or overgrazed pastures where it adds to the decline of forage yield and quality. Although dogfennel is generally considered to be only unsightly, research has shown that significant bahiagrass yield loss will be observed when dogfennel infestations are not removed prior to July 1. Cattle do not normally feed on dogfennel, but they may eat it when more suitable forages are lacking. However, the leaves contain low levels of the toxin tremitol, which causes dehydration when ingested by cattle. Dogfennel is currently the number one most commonly occurring pasture weed in Florida.
- ▶ Dogfennel growth frequently occurs from overwintering rosettes, but seeds will also sprout and grow when soil temperatures reach 65°F. The growth will generally consist of a single, non-branching shoot that can exceed 8 feet in height. The leaves are very thin (Figure 1) and emit a strong odor when crushed. Near Gainesville, Florida.





## Ragweed (*Ambrosia*)

- Ragweeds are [annual](#) and [perennial herbs](#) and [shrubs](#). Species may grow just a few centimeters tall or well exceed four meters in height. The stems are erect, decumbent or prostrate, and many grow from [rhizomes](#). The leaves may be arranged alternately, oppositely, or both. The leaf blades come in many shapes, sometimes divided pinnately or palmately into lobes. The edges are smooth or toothed. Some are hairy, and most are glandular.
- Ragweeds are [monoecious](#), most producing [inflorescences](#) that contain both staminate and pistillate flowers. Inflorescences are often in the form of a spike or [raceme](#) made up mostly of staminate flowers with some pistillate clusters around the base. Staminate flower heads have [stamens](#) surrounded by whitish or purplish florets. Pistillate flower heads have fruit-yielding [ovules](#) surrounded by many [phyllaries](#) and fewer, smaller florets. The pistillate flowers are [wind pollinated](#), and the fruits develop. They are [burs](#), sometimes adorned with knobs, wings, or spines.



## Maidencane (*Panicum hemitomon*)

- ▶ ***Panicum hemitomon*** is a species of grass known by the common name **maidencane**. It is native to North America, where it occurs along the southeastern coastline from New Jersey to Texas. It is also present in South America.
- ▶ This plant is a rhizomatous perennial grass with stems reaching up to 2 meters in height. It is aquatic or semi-aquatic, growing in water or wet soils. It spreads via its rhizome to form large colonies. The cane-like roots are filled with air and form a mass up to 46 centimeters wide. The stems may be erect or spreading; if nodes on the stem contact moist substrate they will root. Stems that break off and float away may root where they land. There are fertile and sterile stems. The leaves are up to 35 centimeters long by 1.5 wide and have tapering tips. The inflorescence is a panicle with upright branches.
- ▶ This species is a common grass in coastal wetlands. It is only found in freshwater, not sea water or brackish water. It can be found in many types of freshwater wetlands as well as in ditches and disturbed or cultivated areas. It is less sensitive to grazing than many associated species, but growth is reduced by competition from neighboring plants. It is common in the Everglades and other regions in Florida. It may form large monotypic stands which are rooted or floating free to form a floating marsh. It forms its most dense stands on the drier sites in wet habitats. It can tolerate several months of flooding. The rhizome network helps to stabilize soil and prevent erosion. Some biologists therefore refer to it as a keystone species
- ▶ This grass sprouts from the rhizome in the winter and grows over the course of the year. It is most dense in summer and fall. The aboveground parts die and break off, forming floating mats. Then the rhizome becomes dormant.
- ▶ Maidencane is good for cattle forage, and there are maidencane-dominated marshes in Florida which are used for cattle grazing. It can be used as hay. It is also eaten by deer and utilized by the Florida panther, which lives in the marshes. The American alligator also lives in maidencane wetlands. Many other animals are found in these habitat types.
- ▶ The plant is considered a weed in some places, such as cultivated crop fields. It is also considered a nuisance species when it becomes very dense. It may compete with food plants for waterfowl. Controlled burns are sometimes initiated to thin the plant.



## Rhodes grass (*Chloris gayana*)

- ▶ *'Callide'* rhodesgrass (*Chloris gayana* Kunth.) is a robust warm-season perennial grass native to Africa. It was first imported to the United States in 1903. Rhodesgrass cultivation is limited to peninsular South Florida because of severe winter killing at northern locations in the state. It has both erect stems and stolons. It is commonly established from seed. At full seed, plant height can vary from about 2 feet in the cool season (short days) to about 6 feet in the summer (long days). *Callide* rhodesgrass is better adapted to flatwoods than upland sands in central and south peninsular Florida. *Callide* can tolerate periodic flooding but does not tolerate long periods of standing water. It is a productive, good quality grass with better cool-season growth than bahiagrass and similar to limpograss (*Hemarthria* sp.), which may make *Callide* especially useful in southern Florida for fall and winter grazing. *Callide* can also be used as a hay crop. As with most tropical grasses, frost will damage *Callide* foliage, but regrowth after a frost or freeze can be rapid.





## Goosegrass (*Galium aparine*)

- *Goosegrass (Galium aparine) is an annual weed found in warm season turf grasses. The grass seeds readily and spreads on the wind from lawn to lawn. Find answers to what is goosegrass and learn how to control it in order to grow a healthier lawn. The methods on how to kill goosegrass range from cultural to herbicidal. Goosegrass weed control is essential because the rapidly spreading plant can take over entire areas of the lawn.*
- *If you have identified the splayed tufts of grass with numerous finger-like blades in your lawn, you will need to investigate how to kill goosegrass. The plant can become established even in hard, compacted soils and is very resilient. The thick leaf blades are difficult to cut with a mower and even after a close trim, lawn grass will look ragged and unkempt if goosegrass is present.*
- *The plant is most obvious in warm summer periods, but may persist into winter in temperate zones. The thick, rough blades radiate from a central area in spikes of 2 to 13. Each blade is flat with slight serration at the edges. The color is emerald green with older blades bearing a touch of white on damaged edges.*





## Sand spurs (*Cenchrus*)

- ▶ Sandspurs are a nuisance because while alive, their burs, which contain their seeds, cling to passing objects: fur, clothes, shoes, or basically anything can catch on the spiky, spiny burs. When the sandspurs die, the burs dry and their spiky husks fall to the ground, where anyone can step on them and injure themselves. Each plant has its own method of propagating its species, and the sandspurs' method is to ensure that their seeds are spread as far and wide as possible by hitching rides with unsuspecting passersby.
- ▶ Sandspurs start growing in the late spring until the end of the fall, or in tropical countries, all year long. They are categorized as weeds and are notoriously hard to get rid of.



## Spanish Needle (*Bidens alba*)

- ▶ ***Bidens alba***, which belongs to the family Asteraceae, is most commonly known as shepherd's needles, beggarticks, Spanish needles or butterfly needles. *Bidens* means two-toothed, describing the two projections found at the top of the seeds, and *alba* refers to the white ray florets. This plant is found in tropical and subtropical regions of North America, Asia, South America, and Africa, situated in gardens, road sides, farm fields and disturbed sites. *B. alba* is an annual or short-lived perennial, which is considered an weed in the United States. However, *B. alba* leaves are edible and can be used as medicinal remedies.
- ▶ *Bidens alba* is a vascular plant. It has a similar root and stem system to others in the dicot family Asteraceae. After germinating, the roots progress into a tap root that grows vertically in the ground. The primary tissue of the apical meristems increases the length of the plant and the secondary roots of the lateral meristems give rise to the width. *B. alba* grows to a height of approximately five feet tall.
- ▶ The stem of *B. alba* plant emerges from the taproot, yet the bent stem at the base also has the ability to grow into roots at the lower nodes. Stems are mostly hairless and green to purplish in color. The vascular bundle provides nutrients throughout the plant, with the phloem transporting water from the roots and the xylem obtaining food from the leaves.
- ▶ *Bidens alba* leaves, which are simple on the opposite side and compound on the underneath, are 2–10 centimetres (0.8–3.9 in) long and 1.0–3.5 cm (0.4–1.4 in) wide. The underside leaf is hairy, and has toothed edges. The leaves may be lobed, depending on the species. Some have teeth and some do not; each node produces two leaves along the stem.
- ▶ Each flowering head of *B. alba*, which is small, appears in radial symmetry. The flowers on this plant are depicted as daisy-like due to the larger white petals and the very small yellow flowers which are located at the end of the branches. Colors of the flower-heads of *Bidens alba* vary depending on the subspecies; some *B. alba* have yellow, tubular central blossoms and others may have flower-heads with white or cream petals (1.5 cm or 0.6 in long); eventually they form black linear seeds, yielding approximately 1200 seeds per plant



## Crowsfoot (Ranunculus)

- *Crowsfoot grass is not a true member of the grass family but does produce similar blade-like foliage covered in fine hairs. Blades are flat with rolled ligules. It is characterized by unique five-spiked flowers that resemble a crow's foot. The roots form a mat with rooting nodes on each lower culm. The plant grows up to 2 feet tall and reduces light to the intended grass species.*
- *Crowsfoot grass weed is an annual grass that thrives in warm climates and is present in summer. The flowers produce prolific seeds, which spread and establish quickly. It is found in ditches, scrub and disturbed areas, especially in [sandy soil](#).*



# APPENDIX D

FIELD REFERENCE 'FOLD-N-GO' CARDS



*Imperata cylindrica* cogon grass

*Imperata cylindrica*cogon grass



**Appearance:** Perennial grass growing in loose or compact tufts; grows from stout, extensively creeping, scaly rhizomes with sharp-pointed tips.

**Leaves:** Sheaths relatively short, glabrous or pubescent; ligule a membrane, 0.5-1 mm (0.2-0.4 in) long. Blades erect, narrow and pubescent at base; flat and glabrous above, to 1.2 m (4 ft) tall and to 2 cm (< 1 in) wide, with whitish midvein noticeably off-center; blade margins scabrous, blade tips sharp pointed.

**Flowers:** In a plume-like, silky panicle, to 21 cm (8 in) long and 3.5 cm (1.4 in) wide; several per branch, base circled by long hairs.

**Fruit:** 3.5-4.3 mm (0.14-0.17 in)



**Ecological threat:** Considered one of the top ten worst weeds in the world. Has invaded dry to moist natural areas, including habitats of federally listed endangered and threatened native plant species. FLEPPC Category I

**Distribution:** NW, NE, C, SW, SE

<http://plants.ifas.ufl.edu>

*Solanum viarum* tropical soda apple



*Solanum viarum* tropical soda apple

**Appearance:** Bushy, prickly herbaceous perennial, to 2 m (6 ft) tall, more commonly 1 m (3 ft) tall; stems armed with broad-based, straight or downward-pointing prickles.

**Leaves:** Alternate, simple, clearly petioled (these also prickly); blades oval-triangular, nearly as broad as long, to 20 cm (8 in) long and 15 cm (6 in) wide, angular-lobed; surfaces dense with fine soft hairs giving blades a velvety sheen (hairs a mix of types as on stems); veins prickly.

**Flowers:** White, in small terminal clusters; 5 petals white, recurved; stamens with prominent cream-colored anthers.

**Fruit:** A globose berry, 2-3 cm (0.8-1.2 in) wide, green with dark veining, like a tiny watermelon, when immature; dull medium yellow when ripe; seeds about 400 per berry.

**Ecological threat:**  
Outcompetes native plants, crowding or shading them out. Becoming a major concern of agriculture and a serious threat to Florida natural areas.  
FLEPPC Category I

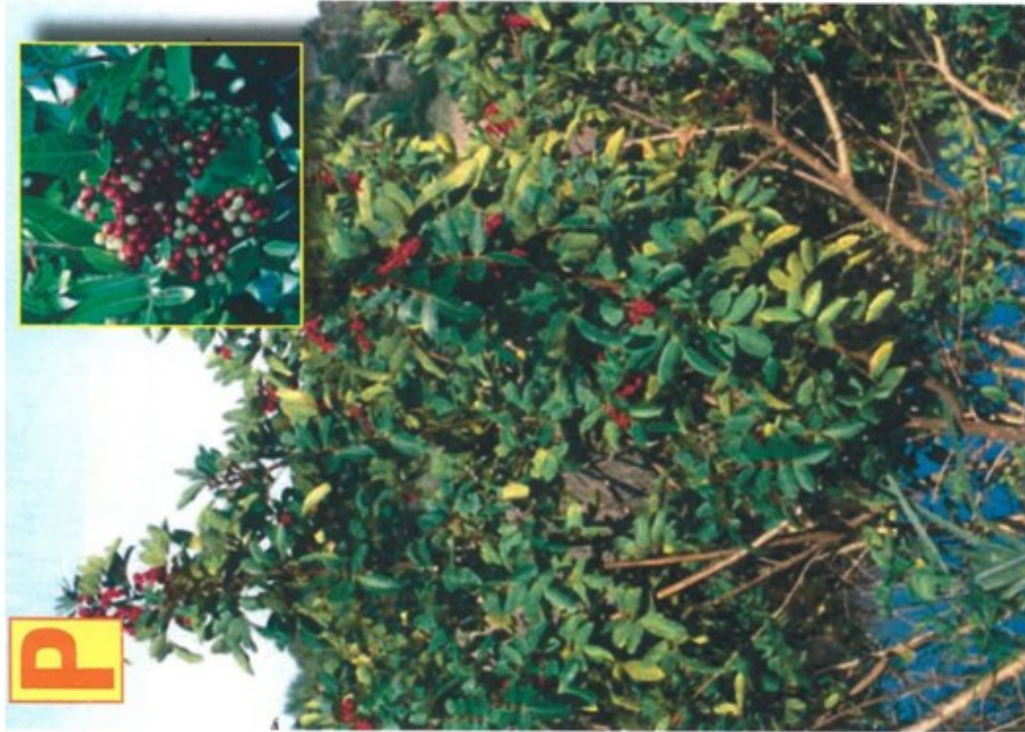


**Distribution:** NW, NE, C, SW, SE

<http://plants.ifas.ufl.edu>



*Schinus terebinthifolius* Brazilian pepper



*Schinus terebinthifolius* Brazilian pepper

**Appearance:** Evergreen shrub or tree to 13 m (43 ft) tall, often with multi-stemmed trunks and branches arching and crossing, forming tangled masses.

**Leaves:** Alternate, odd-pinnately compound with 3-11 leaflets (usually 7-9); elliptic-oblong, 2.5-5 cm (1-2 in) long, with upper surfaces dark green, lower surfaces paler, and leaflet margins often somewhat toothed. Leaves aromatic when crushed, smelling peppery or like turpentine.

**Flowers:** Unisexual (dioecious), small, in short-branched clusters at leaf axils of current-season stems; 5 petals, white to 2 mm (0.07 in) long.

**Fruit:** A small, bright-red spherical drupe.

**Ecological threat:**

Forms dense thickets of tangled woody stems that completely shade out and displace native vegetation. Has displaced some populations of rare listed species. Produces certain agents, which appear to suppress other plants' growth. FLEPPC Category 1

**Distribution:** NW, NE, C, SW, SE



<http://plants.ifas.ufl.edu>

**Casuarina equisetifolia** Australian pine



**Casuarina equisetifolia** Australian pine\*

**Appearance:** Evergreen tree to 46 m (150 ft) tall, single-trunked; reddish brown to gray bark, rough, brittle, peeling.

**Leaves:** Tiny scales, whorled around long, grayish-green branchlets (resemble pine needles); scales 1-3 mm (0.11 in) long, 6-8 per whorl.

**Flowers:** Unisexual, inconspicuous, female contained in cylindrical to almost round cone-like clusters, to 2 cm (<1 in) long; male in small terminal spikes, 1.3 cm (0.5 in) wide.

**Fruit:** Tiny, 1-seeded, winged nutlet contained in the cone.

**Ecological threat:**

Invasive exotics that are altering native plant communities by displacing native species, changing community structures or ecological functions, or hybridizing with natives. FLEPPC Category I



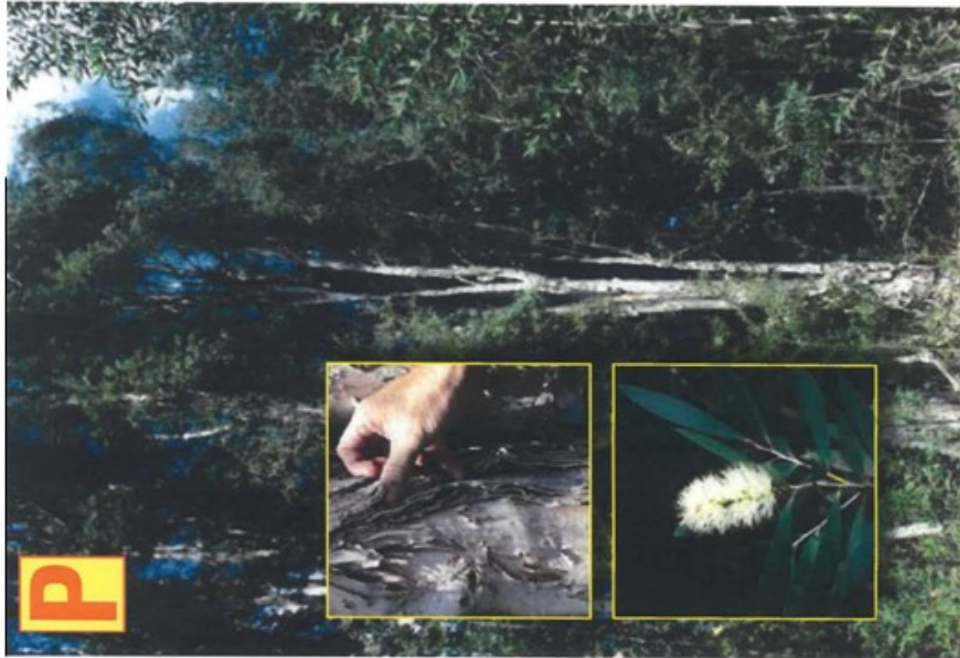
\*Additional Casuarina species are listed on FLEPPC's Category II list of invasive exotics: C. glauca and C. cunninghamiana.

**Distribution:** NW, NE, C, SW, SE

<http://plants.ifas.ufl.edu>



*Melaleuca quinquenervia* melaleuca



*Melaleuca quinquenervia* melaleuca

**Appearance:** Evergreen tree to 33 m (100 ft) tall, with a slender crown and soft, whitish, many-layered, peeling bark.

**Leaves:** Alternate, simple, grayish green, narrowly lance shaped; to 10 cm (4 in) long and 2 cm (0.75 in) wide, with a smell of camphor when crushed.

**Flowers:** Creamy white "bottle brush" spikes to 16 cm (6 in) long.

**Fruit:** A round, woody capsule, about 3 mm (0.12 in) wide, in clusters surrounding young stems, each capsule holding 200-300 tiny seeds.

**Ecological threat:**

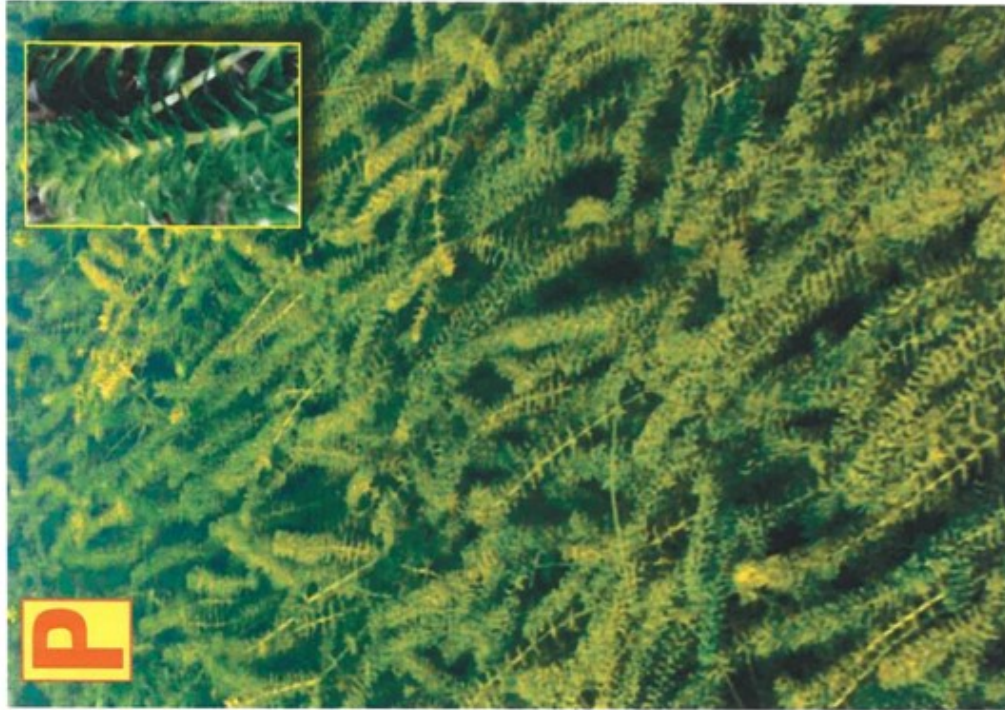
Grows extremely fast, producing dense stands that displace native plants, diminish animal habitat, and provide little food for wildlife. Has become abundant in pine flatwoods, sawgrass marshes, and cypress swamps of south Florida. FLEPPC Category 1



**Distribution:** C, SW, SE

<http://plants.ifas.ufl.edu>

**Hydrilla verticillata** hydrilla



**Hydrilla verticillata** hydrilla

**Appearance:** Submersed, usually rooted, aquatic perennial herb with slender ascending stems to 9 m (30 ft) long; heavily branched.

**Leaves:** Whorled, 3-8 per whorl; 2-4 mm (0.1-0.2 in) wide and 6-20 mm (0.2-0.8 in) long, bearing coarse (visible) teeth along the margins and usually 1-4 small conical bumps along underside of midrib, which is often red.

**Flowers:** Male flowers detached and free floating at maturity, with 3 sepals and 3 petals, white to reddish brown; about 2 mm (0.7 in) long; releasing floating pollen from stamens when flower pops open at water surface.

**Fruit:** N/A

**Ecological threat:**

Competitively displaces native submersed plant communities. In dense stands, it alters fisheries populations, causes shifts in zooplankton communities, and affects water chemistry. FLEPPC Category I

**Distribution:** NW, NE, C, SW, SE



<http://plants.ifas.ufl.edu>

*Eichhornia crassipes* water hyacinth



*Eichhornia crassipes* water hyacinth

**Appearance:** Floating aquatic herb; rooting in mud if stranded, usually in dense mats with new plantlets attached on floating green stolons.

**Leaves:** Formed in rosettes; petioles to 30 cm (12 in) or more; spongy, usually inflated or bulbous, especially near base; leaf blades roundish or broadly elliptic, glossy green, to 15 cm (6 in) wide.

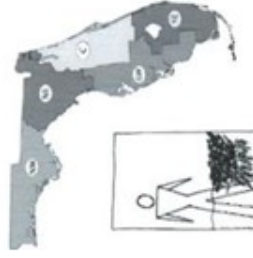
**Flowers:** Lavender-blue with a yellow blotch; up to 5 cm (2 in) wide, somewhat 2-lipped; 6 petals, 6 stamens.

**Fruit:** A 3-celled capsule with many seeds.

**Ecological threat:**

Grows at explosive rates exceeding any other tested vascular plant; doubles its populations in as little as 6-18 days. In large mats, degrades water quality and dramatically alters native plant and animal communities. FLEPPC Category

**Distribution:** NW, NE, C, SW, SE



**Field Notations**

EICHCRAS/EICR

<http://plants.ifas.ufl.edu>



*Lygodium japonicum* Japanese climbing fern *Lygodium japonicum* Japanese climbing fern



**Appearance:** Fern with climbing, twining fronds of indeterminate growth, to 30 m (90 ft) long; main rachis wiry, stemlike.

**Leaves:** Leafy branches off main rachis (constituting the pinnae) are compound, triangular in overall outline, 10-20 cm (4-8 in) long and about as wide. Leaflets (pinnules) lobed, stalked, with terminal lobes often dissected. Basal lobes irregularly lobed or dissected; leaf-blade tissue pubescent below with short, curved hairs.

**Spores:** Sporangia on the margins of the fertile part of the leaf (pinnae). Wind- and water-dispersed.

**Ecological threat:**

Can form tangled masses over ground cover and shrubs, its dense canopy eliminating the underlying vegetation. Reportedly forming sun-blocking "walls" of fern in tributary floodplains of the Apalachicola River, and smothering seedlings of overstory tree species. FLEPPC Category 1

**Distribution:** NW, NE, C, SW, SE



Field Notations

LYGOJAPO/LYJA

<http://plants.ifas.ufl.edu>



*Dioscorea bulbifera* air-potato



*Dioscorea bulbifera* air-potato

**Appearance:** Vigorously twining herbaceous vine, with small or absent underground tubers. Aerial tubers (bulbils) freely formed in leaf axils.

**Leaves:** Long petioled, alternate; blades to 20 cm (8 in) or more in length; broadly heart shaped, with basal lobes usually rounded.

**Flowers:** Rare (in Florida), small, fragrant; male and female arising from leaf axils on separate plants (dioecious), in panicles or spikes to 11 cm (4 in) long.

**Fruit:** a capsule; seeds partially winged.

**Ecological threat:**

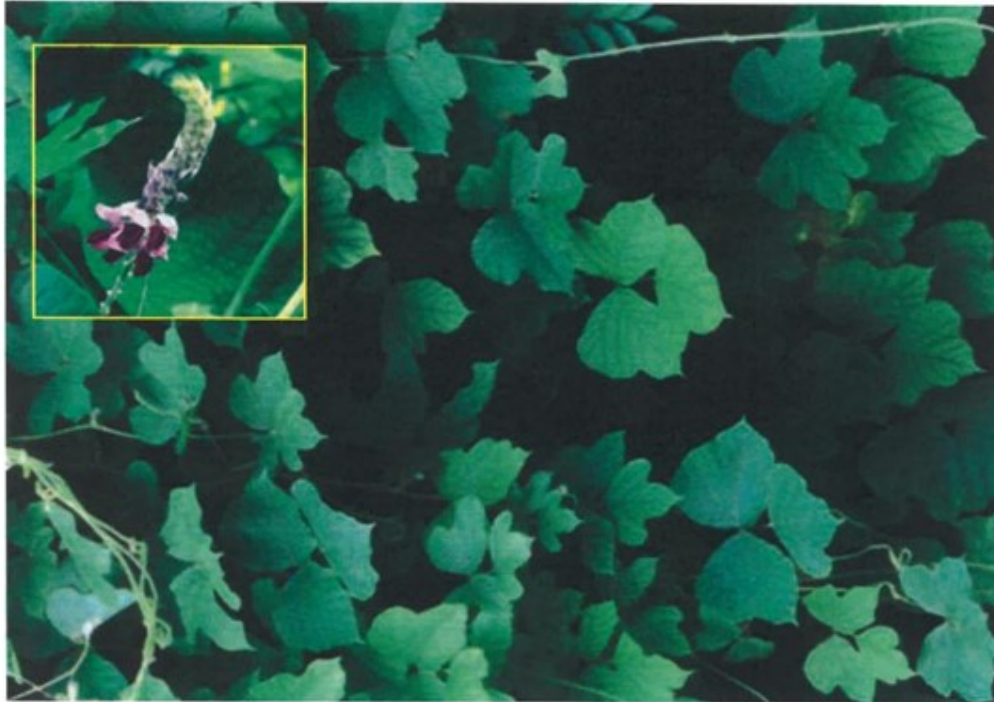
Can quickly engulf native vegetation, climbing high into mature tree canopies. Produces large numbers of aerial tubers, which accelerate its spread. FLEPPC Category I

**Distribution:** NW, NE, C, SW, SE



<http://plants.ifas.ufl.edu>

*Puevaria montana* kudzu



*Puevaria montana* kudzu

**Appearance:** High-climbing, trailing, twining deciduous woody vine; tuberous roots and rope-like, dark brown stems to 20 m (65 ft) long; herbaceous stems markedly hairy.

**Leaves:** Alternate, long petioled, with 3 leaflets (trifoliate); leaflets dark green, hairy on both surfaces, to 15 cm (5.4 in) long; lateral leaflets unequal at base, 1- or 2-lobed; terminal leaflet usually equal at base and 3-lobed.

**Flowers:** Pea-like, reddish-purple, fragrant; 2-2.5 cm (0.7-0.9 in) across, in short-stalked, elongate clusters at leaf axils, to 20 cm (7 in) long.

**Fruit:** A dark brown pod, flat but bulging over seeds; densely covered in long golden-brown hairs, to 8 cm (3 in) long and 0.8 cm (0.3 in) wide.

**Ecological threat:**

Forms large impenetrable masses, growing over woody vegetation and able to completely engulf unwooded areas. Can completely envelop a tree, killing it by shutting out all light. FLEPPC Category 1

**Distribution:** NW, NE, C, SW, SE



<http://plants.ifas.ufl.edu>

***Panicum repens*** torpedo grass ***Panicum repens*** torpedo grass



**Appearance:** Perennial grass to 1 m (3 ft) tall, from sturdy, vigorous, widely creeping or floating rhizomes; overlapping brownish to white scales and rigid sharp-pointed (torpedo-like) growing tips.

**Leaves:** Aerial stems erect or leaning; lower portions often wrapped in bladeless sheaths. Upper leaf sheaths glabrous or hairy, usually at least with hairs on upper margins; ligule a short-ciliate membrane; leaf blades stiff, linear, flat or folded, to 26 cm (10 in) long and 5.3 mm (0.3 in) wide.

**Flowers:** In an open panicle with spreading branches; spikelets stalked, whitish, 2.2-2.8 mm (0.75-1 in) long, smooth.

**Fruit:** 1.8-2.7 mm (0.4-1 in) long, broadly ellipsoid.

**Ecological threat:**

Quickly forms monocultures that displace native vegetation, particularly in or near shallow waters. FLEPPC Category I



**Distribution:** NW, NE, C, SW, SE

<http://plants.ifas.ufl.edu>



*Pistia stratiotes* water lettuce *Pistia stratiotes* water lettuce



**Appearance:** Floating herb in rosettes of gray-green leaves; rosettes occurring singly or connected to others by short stolons.

**Leaves:** Often spongy near base; densely soft pubescent with obvious parallel veins, slightly broader than long, widest at apex, to 15 cm (6 in) long.

**Flowers:** Inconspicuous; clustered on small fleshy stalk nearly hidden in leaf axils, with single female flower below and whorl of male flowers above.

**Fruit:** Arising from female flower as a many-seeded green berry.

**Ecological threat:**

Capable of forming vast mats that disrupt submersed plant and animal communities and interfere with water movement and navigation. Also serves as host for at least two genera of mosquitoes. FLEPPC Category I



**Distribution:** NW, NE, C, SW, SE

<http://plants.ifas.ufl.edu>



*Alternanthera philoxeroides* alligator weed



*Alternanthera philoxeroides* alligator weed

**Appearance:** Sprawling herb, usually in water, often in row crops and gardens. Stems pinkish, can become hollow when larger, to 1 m (3.3 ft) long.

**Leaves:** Opposite, narrowly elliptic or spatulate, to 9 cm (3.5 in) long; occasionally a few indistinct teeth on margin.

**Flowers:** Reduced, bisexual in round white heads on long stalks from upper leaf axils; each flower with 4-5 thin, papery bracts, 5 stamens, 1 pistil.

**Fruit:** Tiny, one-seeded, thin-walled.

**Ecological threat:**

FLEPPC Category II — Invasive exotics that have increased in abundance or frequency but have not yet altered Florida plant communities to the extent shown by Category I species.

**Distribution:** NW, NE, C, SW, SE



**Field Notations**

ALTEPHIL/ALPH

<http://plants.ifas.ufl.edu>

*Ricinus cotinuninis* castor bean



*Ricinus communis* castor bean

**Appearance:** Many-branched; annual or perennial shrub, tree or herb, 1-5 m (3.3-16.5 ft) tall.

**Leaves:** Alternate, simple, coarse, to 40 cm (15.5 in) wide; 7-9 coarsely serrate palmate lobes, with long petiole attached near center of lower leaf surface.

**Flowers:** Conspicuous, upright spikes; sepals 5, petals 0; male flowers yellow; female flowers pink to pinkish red; appearing nearly year-round.

**Fruit:** A red, green, or bluish spiny capsule, 1-2 cm (0.4-0.8 in) in diameter, with white to tan. Very poisonous seeds.

**Ecological threat:**

FLEPPC Category II - Invasive exotics that have increased in abundance or frequency but have not yet altered Florida plant communities to the extent shown by Category I species.

**Distribution:** NW, NE, C, SW, SE



<http://plants.ifas.ufl.edu>

***Sapium sebiferum*** Chinese tallow\*



***Sapium sebiferum*** Chinese tallow\*

\*Also known as: *Triadica sebifera*

**Appearance:** Deciduous tree to 16 m (52 ft), commonly to 10 m (33 ft). Sap milky.

**Leaves:** Simple, alternate; blades entire, broad ovate, 3-6 cm (1-2.5 in) wide, with broad rounded bases and tips that taper abruptly to a slender point. Petioles slender, 2-5 cm (1-2 in) long.

**Flowers:** Small, yellow, borne on spikes to 20 cm (8 in) long with 2-3 sepals (petals absent), 2-3 stamens or 3 styles (plants monoecious).

**Fruit:** A 3-lobed capsule, 1 cm (0.5 in) wide, turning brown and splitting open at maturity to reveal 3 dull white seeds, which remain attached for a time.

**Ecological threat:**

Tends to take over large areas; thrives in areas where the soil stays wet. Also found in upland, well-drained regions and in undisturbed areas such as closed canopy forests, in bottomland hardwood forests, shores of waterbodies, and sometimes on floating islands. FLEPPC Category I

**Distribution:** NW, NE, C, SW, SE



<http://plants.ifas.ufl.edu>



**CATEGORY I**

Invasive exotics that are altering native plant communities by displacing native species, changing community structures or ecological functions, or hybridizing with natives. This definition does not rely on the economic severity or geographic range of the problem, but on the documented ecological damage caused.

Scientific Name**	Common Name	Gov. List	Zone
<i>Abrus precatorius</i>	rosary pea	F	C, S
<i>Acacia auriculiformis</i>	earleaf acacia		C, S
<i>Albizzia julibrissis</i>	mimosa, silk tree	N, C	C, S
<i>Albizia lebeck</i>	worm's tongue		F, U, C, S
<i>Albizia retusa</i>	coral arbutus	F	N, C, S
<i>Andea elliptica</i>	shepherdia andrea	F	C, S
<i>Asparagus adspersus</i>	asparagus-fern	N, C, S	C, S
<i>CA. Sprengeri, A. densiflorus</i>			C, S
<i>Bauhinia variegata</i>	orchid tree		C, S
<i>Biscaya javanica</i>	beehive tree		C, S
<i>Calophyllum antillanum</i>	Santa Maria, mast wood		S
<i>CA. (C. Colabo)</i>			
<i>Casuarina equisetifolia</i>	Australian-pine	F	N, C, S
<i>Cinchona</i>	suckering Australian-pine	F	N, C, S
<i>Cinnamomum amomum</i>	camphor tree		N, C, S
<i>Colobaria esculenta</i>	wild taro		N, C, S
<i>Colobaria asiatica</i>	lilher leaf	F	S
<i>Caponata tomentosa</i>	carrotwood		F, N, C, S
<i>Caponata peterseni</i>	Japanese false spleenwort		F, N, C
<i>Dioscorea alata</i>	winged yam	F	N, C, S
<i>Dioscorea bulbifera</i>	ate-rotate	F	N, C, S
<i>Elchbarrua crassipes</i>	water-hyacinth	F	N, C, S
<i>Eugenia uniflora</i>	Surinam cherry		C, S
<i>Ficus microcarpa</i>	lured fig		C, S
<i>F. runda and F. vesica var. runda</i>			F, U, N, C, S
<i>Hydrilla verticillata</i>	hydrilla		F, U, N, C, S
<i>Hymenocleia amplicornis</i>	green hygro		F, U, N, C, S
<i>Impatiens cylindrica</i>	West Indian marsh grass		F, U, N, C, S
<i>Ipomoea aquatica</i>	cogon grass	F, U, N, C, S	
<i>Jasminum dichotomum</i>	water-spinach	F, U, N, C, S	
<i>Jasminum fluminense</i>	Gold Coast jasmine		C, S
<i>Lantana camara</i>	Brazilian jasmine		C, S
<i>(L. strigosissima)</i>	lantana, shrub verbena		N, C, S
<i>Ligustrum lucidum</i>	glossy privet		N, C
<i>Ligustrum sinense</i>	Chinese privet	F <sup>3</sup>	N, C, S
<i>Lonicera japonica</i>	Japanese honeysuckle		N, C, S
<i>Ludwigia boerhavia</i>	Liquay watercress		N, C
<i>Ludwigia peruviana</i>	Brazilian primrose-willow		N, C, S
<i>Lumnitzera racemosa</i>	black mangrove		S
<i>Lygodium suberectum</i>	tropical American watergrass		S
<i>Lygodium japonicum</i>	Japanese climbing fern	F	N, C, S
<i>Lygodium microphyllum</i>	Old World climbing fern	F, U, N, C, S	
<i>Misgonychia angustis-culm</i>	caulawine		N, C, S
<i>(Dolichandra angustis-culm)</i>			
<i>Marrubium sapida</i>	spoonilla		S
<i>Melaleuca quinquenervia</i>	melaleuca, paper bark	F, U	C, S

<sup>1</sup>Does not include *Ficus microcarpa* subsp. *Javanica*, which is sold as "Green Island Ficus"  
<sup>2</sup>Many names are applied to this species in Florida because of a complicated taxonomic and nomenclatural history. Plants cultivated in Florida, all representing the same invasive species, have in the past been referred to as *Bauhinia brittoniana*, *B. twardiana*, *B. garriana*, and *B. simplex*.  
<sup>3</sup>Chinese privet is a FLDACs Noxious Weed except for the cultivar 'Varegatium'  
<sup>4</sup>Added to the FLEPPC list of Invasive Plant Species in 2017  
<sup>5</sup>Plant names are those published in "Guide to Vascular Plants of Florida Third Edition," Richard P. Wunderlin and Bruce F. Hansen. University of Florida Press, 2011. Plant names in parentheses are synonyms or misspelled names that have commonly occurred in the literature or indicate a recent name change. Not all synonyms are listed.

**CATEGORY II**

Invasive exotics that have increased in abundance or frequency but have not yet altered Florida plant communities to the extent shown by Category I species. These species may become ranked Category I if ecological damage is demonstrated.

Scientific Name**	Common Name	Gov. List	Zone
<i>Akazanthus peruviana</i>	red sandalwood		S
<i>Agave schottiana</i>	sisal hemp		C, S
<i>Alchornea triplaris</i>	tung-oil tree		N, C
<i>(Vernonia fordii)</i>			
<i>Alouata macrophylla</i>	devil tree		S
<i>Alternanthera philoxeroides</i>	alligator-weed	F	N, C, S
<i>Alternanthera versipila</i>	coral vine	N, C, S	C, S
<i>Antigonon leptopus</i>	Chinese chrysanthemum		C, S
<i>Ardisia javanica</i>	Japanese ardisia		N
<i>Ardischia littoralis</i>	elephant Chatham's pipe,		N, C, S
<i>(A. elegant)</i>	calico flower		C, S
<i>Asystasia gangetica</i>	wax begonia		N, C, S
<i>Begonia cucullata</i>	garage primrose		C, S
<i>Braconia papayifera</i>	paper mulberry		N, C, S
<i>Bryopsis gymnorhiza</i>	large-leaved mangrove		S
<i>Calligonum ornatum</i>	booblebush		C, S
<i>(Melaleuca ornata)</i>			
<i>Callisia fragrans</i>	inch plant, spirostema		C, S
<i>Casuarina cunninghamiana</i>	Australian-pine	F	C, S
<i>Cecropia palmata</i>	trumpet tree		S
<i>Cestrum diurnum</i>	day jessamine		C, S
<i>Chamaecrista leffingii</i>	bamboo palm		S
<i>Clematis ternstroemii</i>	Japanese clematis		N, C
<i>Coccoloba maculata</i>	coconut palm		S
<i>Crocosiphium crepidoides</i>	redflower ragwort		C, S
<i>Cryptantha nudicaulis</i>	rubber vine		C, S
<i>Cyperus tenuiflorus</i>	umbrella plant		C, S
<i>(C. alternifolius)</i>			
<i>Cyperus prostratus</i>	dwarf papirus		C, S
<i>Dactyloctenium aegyptium</i>	Durban crowfoot grass		N, C, S
<i>Dalbergia sissoo</i>	Indian rosewood, sissoo		C, S
<i>Eucalyptus pauciflora</i>	silvertree, thorny olive		N, C
<i>Eucalyptus umbellata</i>	silvertree, autumn olive		N
<i>Euphorbia pulcherrima</i>	pothos		C, S
<i>(E. tirucalli)</i>			
<i>Fallopia quinaria</i>	Chinese crown orchid		C, S
<i>Ficus adnata</i>	false banyan, cuneate tree		S
<i>Ficus ventricosa</i>	governor's plum		S
<i>Hemiarthra alisonae</i>	limpo grass		S
<i>Heteropogon bairdii</i>	red wing, Beechey's widge		S
<i>Hyparrhenia rufa</i>	jaraguá		N, C, S
<i>Ipomoea carnea ssp. jamaicensis</i>	shrub morning-glory	F	C, S
<i>(I. pes-caprae)</i>			
<i>Kalanchoe pinnatifida</i>	mother-of-millions		N, C, S
<i>Kalanchoe pinnatifida</i>	lily plant		C, S
<i>(Bryophyllum pinnatum)</i>			
<i>Koeleria elegans</i>	flamegold tree		C, S

<sup>1</sup>Does not include *Ficus microcarpa* subsp. *Javanica*, which is sold as "Green Island Ficus"  
<sup>2</sup>Many names are applied to this species in Florida because of a complicated taxonomic and nomenclatural history. Plants cultivated in Florida, all representing the same invasive species, have in the past been referred to as *Bauhinia brittoniana*, *B. twardiana*, *B. garriana*, and *B. simplex*.  
<sup>3</sup>Chinese privet is a FLDACs Noxious Weed except for the cultivar 'Varegatium'  
<sup>4</sup>Added to the FLEPPC list of Invasive Plant Species in 2017  
<sup>5</sup>Plant names are those published in "Guide to Vascular Plants of Florida Third Edition," Richard P. Wunderlin and Bruce F. Hansen. University of Florida Press, 2011. Plant names in parentheses are synonyms or misspelled names that have commonly occurred in the literature or indicate a recent name change. Not all synonyms are listed.



I. CATEGORY II (continued)

Scientific Name**	Common Name	Gov. List	Zone
<i>Tridacna spathulata</i>	oyster plant		C, S
<i>Gibaea spathulata</i> , <i>Gibaea diochroa</i>			N, C, S
<i>Triplaris scissoides</i>			C, S
<i>Vicia trifida</i>	puncture vine, burr-nut, purple-leaf chaste tree		C, S
<i>Washingtonia robusta</i>	Washington fan palm		C, S
<i>Wisteria sinensis</i>	Chinese wisteria		N, C
<i>Xanthoxylum sagittifolium</i>	malanga, elephant ear		N, C, S

Recent changes to plant names

Old Name	New Name
<i>Aletris fordi</i>	<i>Vernicia fordi</i>
<i>Aristochia littoralis</i>	<i>Aristochia elegans</i>
<i>Bracharia mutica</i>	<i>Urochloa mutica</i>
<i>Hibiscus thiliaceus</i>	<i>Talipariti thiliaceus</i>
<i>Mucubiyenia unguis-cati</i>	<i>Dolichandra unguis-cati</i>
<i>Melaleuca viminalis</i>	<i>Callistemon viminalis</i>
<i>Panicum maximum</i>	<i>Urochloa maximum</i>
<i>Phymatosorus scolopendria</i>	<i>Microsorium grossum</i>
<i>Sesum schimperum</i>	<i>Triplaris schimperiana</i>
<i>Wedelia trilobata</i>	<i>Sphagneticola trilobata</i>

Current nomenclature can be found at [florida.plantatlas.usf.edu](http://florida.plantatlas.usf.edu)

\*\*Plant names are those published in "Guide to Vascular Plants of Florida Third Edition," Richard P. Wunderlin and Bruce F. Hansen, University of Florida Press, 2011. Plant names in parentheses are synonyms or misapplied names that have commonly occurred in the literature and/or indicate a recent name change. Not all synonyms are listed.

**FLEPPC List Definitions:** **Exotic** – a species introduced to Florida, purposefully or accidentally, from a natural range outside of Florida. **Native** – a species whose natural range includes Florida. **Naturalized exotic** – an exotic that sustains itself outside cultivation (it is still exotic; it has not "become" native). **Invasive exotic** – an exotic that not only has naturalized, but is expanding on its own in Florida native plant communities.

**Abbreviations: Government List (Gov. List):** Possession, propagation, sale, and/or transport of these plants is regulated by: F=Florida Department of Agriculture and Consumer Services; U=United States Department of Agriculture



**Citation example**  
FLEPPC. 2017. List of Invasive Plant Species. Florida Exotic Pest Plant Council. Internet: [www.fleppc.org](http://www.fleppc.org)

*Daniel F. Austin and Daniel B. Ward*

Daniel F. Austin (2015) and Daniel B. Ward (2016) recently passed away. Both Dons were instrumental in maintaining, managing, and providing insight into Florida's many invasive plants. They first volunteered for this effort before it was even formalized as the FLEPPC, participating from that beginning through retirement. Their sage comments and wit are missed.

The 2017 list was prepared by the FLEPPC Plant List Committee

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- Arthur Stiles**, Florida Park Service, Florida Department of Environmental Protection, [arthur.stiles@dep.state.fl.us](mailto:arthur.stiles@dep.state.fl.us)
- Daniel B. Ward**, Professor Emeritus, University of Florida Department of Botany (Deceased)
- Richard P. Wunderlin**, Professor Emeritus, University of South Florida, Institute for Systematic Botany, [rwunder@usf.edu](mailto:rwunder@usf.edu)

Florida Exotic Pest Plant Council's 2017 List of Invasive Plant Species

The mission of the Florida Exotic Pest Plant Council is to support the management of invasive exotic plants in Florida's natural areas by providing a forum for the exchange of scientific, educational and technical information. [www.fleppc.org](http://www.fleppc.org)

**Note:** The FLEPPC List of Invasive Plant Species is not a regulatory list. Only those plants listed as Federal Noxious Weeds, Florida Noxious Weeds, Florida Prohibited Aquatics Plants, or in local ordinances are regulated by law.

**Purpose of the List**

To provide a list of plants determined by the Florida Exotic Pest Plant Council to be invasive in natural areas of Florida and to routinely update the list based on information of newly identified occurrences and changes in distribution over time. Also, to focus attention on –

- the adverse effects exotic pest plants have on Florida's biodiversity and native plant communities.
- the habitat losses in natural areas from exotic pest plant infestations.
- the impacts on endangered species via habitat loss and alteration.
- the need for pest-plant management.
- the socio-economic impacts of these plants (e.g., increased wildfires or flooding in certain areas).
- changes in the severity of different pest plant infestations over time.
- providing information to help managers set priorities for research and control programs.



[www.fleppc.org](http://www.fleppc.org)