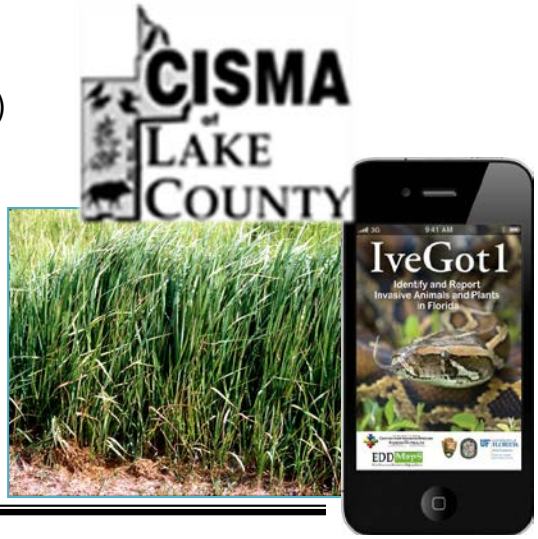
Florida's Forest Stewardship Program &
Lake County Cooperative Invasive Species Management Area

Present:

Invasive Exotic Species and Management Workshop

August 20, 2015; 9:00 am – 3:00 pm ET
UF/IFAS Lake County Extension Auditorium
1951 Woodlea Rd, Tavares, FL 32778-4204 (directions on back)



Many exotic plants are invasive weeds that form expanding populations on our landscape, making land management a challenge. Some exotic animals have also become a problem for land managers. The rapid and effective dispersal characteristics of these invaders make them extremely difficult to eliminate. This program will describe some of the more common and troublesome invasive exotic plants and animals in central Florida, current methods being used to manage them and opportunities to partner and get assistance.

Tentative Agenda:

9:00 am	**Sign-in, meet & greet**
9:15	**Welcome & introduction**, *Brooke Moffis, UF/IFAS Lake County Extension and Chris Demers, UF/IFAS School of Forest Resources and Conservation*
9:30	**Herbicide safety and application techniques**, *Stacey Strickland, UF/IFAS Sumter County Extension*
10:30	**Break**
10:45	**Invasive exotic plant identification and control**, *Ben Gugliotti, Lake County Water Authority*
12:00 pm	**Lunch**
1:00	**Managing invasive vertebrates in Central Florida**, *Steve Johnson, UF/IFAS Dept of Wildlife Ecology and Conservation*
2:00	**Partnerships, mapping invasive species, and assistance opportunities**, *Brooke Moffis and Rose Godfrey, UF/IFAS School of Forest Resources and Conservation*
3:00	**Evaluation, CEUs, CFEs, adjourn**

CISMA of Lake County — Lake County Cooperative Invasive Species Management Area

Florida Forest Stewardship

Florida Forest Service; UF IFAS University of Florida; SFRC School of Forest Resources & Conservation; Florida Fish and Wildlife Conservation Commission; USDA NRCS United States Department of Agriculture Natural Resources Conservation Service; Lake County Florida; SFI Implementation Committee Florida

Funding for Florida's Forest Stewardship Program is provided by the USDA Forest Service through the Florida Department of Agriculture and Consumer Services Florida Forest Service and the Florida Sustainable Forestry Initiative Implementation Committee.

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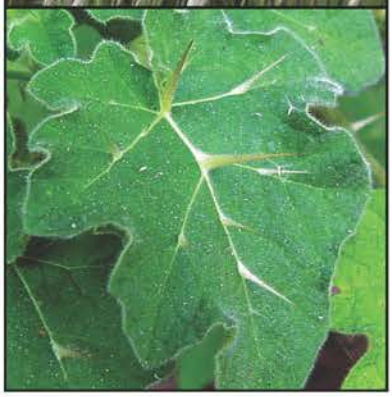
Questions about this or other Forest Stewardship Program activities can be directed to Chris Demers at (352) 846-2375, cdemers@ufl.edu. For more information and events see the UF Forest Stewardship Web site at:

http://www.sfrc.ufl.edu/forest_stewardship







Got Invasives?

Invasive exotic plant problem? Use the Florida Invasives.org website to find financial and or technical assistance to manage or prevent an infestation.

FloridaInvasives.org is an online resource of management assistance programs to help in your fight against problematic plant species. This resource takes the guesswork out of finding the agencies or organizations offering assistance and will direct you to available programs. It will also provide the requirements for each program, to help you decide if they are a good match for your needs.

Why was FloridaInvasives.org developed?

Public and private land managers have identified the high ecological and economic cost of invasive species as a statewide problem in Florida. The Florida Invasive Species Partnership (FISP) is a collaboration of federal, state and local agencies along with nongovernment organizations in Florida, formed to link efforts at preventing and controlling infestations of invasive exotic plants across agency and property boundaries. FISP has developed an on-line tool of available financial and technical assistance sources to make it easier for landowners and land managers to find them.

How does FloridaInvasives.org help you?

Each year, multiple agencies and organizations provide cost-share programs, grants and/or technical assistance to help landowners and land managers with various agriculture or natural resource management practices. Invasive exotic species management is an important practice covered within many of these programs.

FISP has created a searchable database, accessible at FloridaInvasives.org, that allows you to determine which agency or organization(s) might have an assistance program for your needs. Simply provide your county, target species and other pertinent information into the online tool, and you will retrieve a current list of available programs along with the most up-to-date contact information. Floridainvasives.org will help provide focus to your search so that you can get the right person at the right program.

FloridaInvasives.org builds community awareness, leverages limited resources through cooperation and may reduce individual land management costs. This resource will be regularly updated with the most current program information to provide you the most up-to-date opportunities. Log on at http://FloridaInvasives.org to find assistance with your invasive species problem.

Conclusion

The Florida Invasive Species Partnership has created FloridaInvasives.org to help connect Florida's landowners and land managers with available technical and/or financial assistance programs to prevent or control invasive exotic species problems. These programs have been collected, evaluated and categorized in a single resource, making it easier to find the financial and/or technical assistance available to Florida landowners.

Go to FloridaInvasives.org to find out more.

Florida
Invasive Species
Partnership

Think Locally, Act Neighborly
Invasive exotic species know no boundaries!

Florida's Forest Stewardship Program

Forest Stewardship is active management of forests and related resources to keep these lands in a productive and healthy condition for present and future generations, and to increase the economic, environmental and social benefits of these lands. Forest Stewards are landowners who manage their forestlands on a long-term basis by following a multiple resource management plan.

The Forest Stewardship Program addresses the improvement and maintenance of timber, wildlife, soil and water, recreation, aesthetics, as well as forage resources.

Eligibility

Private forest landowners with at least 20 acres of forest land and have a desire to manage their ownerships according to Stewardship principles can participate in the Forest Stewardship Program. Also, adjacent landowners, with similar management objectives, may combine their holdings to meet this acreage limitation.

Benefits to Landowners

- A customized management plan that is based on the landowner's objectives. The plan will include forest stand characteristics, property maps, management recommendations, and a five-year time line for future planning. This plan also serves as documentation of active management on the property that may help reduce tax liability.
- An opportunity for future public recognition as a certified "Forest Steward".
- Educational workshops, tours and a quarterly Stewardship newsletter developed and distributed by the University of Florida, IFAS Cooperative Extension Service.

Getting into the Program

Contact your local Florida Forest Service County Forester and tell them that you would like to have a Forest Stewardship Plan prepared for your property. More information and application here:

http://www.freshfromflorida.com/Divisions-Offices/Florida-Forest-Service/For-Landowners/Programs/Forest-Stewardship-Program

Tree Farm Program

The American Tree Farm System® is a program of the American Forest Foundation and was founded in 1941 to promote the sustainable management of forests through education and outreach to family forest landowners. Nearly 26 million acres of privately owned forestland and 80,000 family forest landowners in 46 states are enrolled in this program and committed to excellence in forest stewardship. About half of all Tree Farms are located in the South.

Eligibility

Private forest landowners with at least 10 acres of forest land and have a desire to manage their ownerships according to sustainable forestry guidelines can participate in Tree Farm.

Benefits to Landowners

Tree Farmers are good stewards of their forestland committed to protecting watersheds and wildlife habitat and conserving soil. They manage their forestland for various reasons, including timber production, wildlife, recreation, aesthetics, and education/outreach. Tree Farmers receive many benefits:

- Representation on local, state, and federal issues affecting forestland owners.
- Exposure to a network of forestry professionals and landowners committed to sustainable forestry.
- Access to seminars, field days, and workshops to help manage their Tree Farm even better.
- Certification that meets international standards of sustainable forest management.
- Participation in local, state, regional, and national Outstanding Tree Farmer of the Year awards and recognition.

Getting into the Program

Contact your local Florida Forest Service County Forester and tell them that you would like to join the Tree Farm program. More information here:

http://floridaforest.org/programs/florida-tree-farm/

Herbicide Hazards and Safety

Dr. J. Stacey Strickland
UF/IFAS Hernando County Extension

Laws and Regulations

- General use versus Restricted use
  - Pesticides are classified due to hazards, toxicity and environmental concerns
  - Restricted use pesticides can only be purchased and used by a licensed applicator
- Emergency Exemptions – address pest problems where there is no registered pesticide
  - A copy of the use approval must be in the applicator's possession

Laws and Regulations

Federal Pesticides Laws

- Environmental Protection Agency (EPA) is responsible for registering or authorizing pesticide products for use
- EPA administers FIFRA - Federal Insecticide, Fungicide and Rodenticide Act
- EPA registration number means that the product has met federal requirement through all testing phases

Types of Pesticide Applicators

Type of Applicator	Occupation or Employer	Pesticide Application site
Private	Nursery, Greenhouse	**Pesticides are applied for agriculture commodity production by a grower or his/her employee** (not allowed to apply pesticides "for-hire")
Public	**City or county government employee**, state agency, school	**Pesticides are applied as part of job-related duties** (not allowed to apply pesticides "for-hire")
Commercial	For-hire contractors	For-hire or contract pesticide applications not regulated by Ch 388 FS or Ch 482 FS

Laws and Regulations

Florida Pesticide Laws

- The state regulatory agency for licensing pesticide applicators is the Florida Department of Agriculture and Consumer Services (FDACS)
- Florida specific rules limit how, when or where specific pesticides can be used in Florida
  - Aldicarb
  - Bromocil
  - Methyl brominde
  - Organotin antofouling paints
  - Organo-auxin herbicides

Environmental Hazards

Will a Pesticide Harm the Environment?

It depends on the chemical make up of the pesticide

- Persistence - the ability of a pesticide to remain active for an extended period before breaking down
- Solubility – Pesticide readily forms a solution
- Adsorbtion – pesticide binds to soil
  - Organic matter – binding site of pesticides in soil
  - Sandy soils – very permeable

Pesticide Movement Off Target

Vapor Drift (Volatility) means the pesticide changes formulation to a gas.

Most likely occurs during high temperatures, low humidity and high winds

Pesticide Movement Off Target

DRIFT means the airborne movement of pesticide particles into non-target areas.

Most like occurs in windy conditions and small spray droplet size

Protection of Honey Bees

- Do not apply pesticides when crops are in bloom
- Bees are most active during the day
- Florida Law requires apiaries and bee yards to be marked with the owner's name, address and phone number

Pesticide Movement Off Target

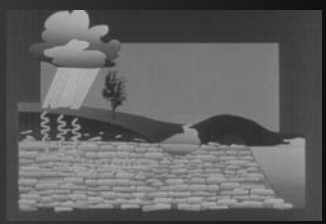
Droplet Diameter in Microns	Droplet Called	Time Required to Fall 10 ft in Still Air	Distance Covered Falling 10 ft in 3mph Breeze
5	Fog	66 min	3 miles
100	Mist	10 seconds	409 feet
500	Light rain	1.5 second	7 feet
1000	Moderate Rain	1 second	4.7 feet

* As the viscosity (thickness) of a spray liquid increases, so does the droplet size and can reduce the potential for off-target movement

Pesticide Movement Off Target

LEACHING means the movement of pesticides into ground water by heavy rains and/or irrigation.

Most likely occurs in coarse soil, low organic matter and shallow water table



Integrated Pest Management

IPM is the combination of appropriate pest control tactics into a single plan (strategy) to reduce pests.

IPM Strategies

5) Understand your options - evaluate the benefits and risks of each

6) Take appropriate action – preventative & least toxic options are usually first

7) Monitor for results - Evaluate the treatment & fine tune

Pest control goals

- Prevention - keeping a predicted pest from becoming a problem
- Eradication - destroying an entire pest population
  - Usually not economical or successful in large areas
- Suppression - reducing pest numbers or damage to an acceptable level

IPM Control Options

- Sanitation
- Cultural controls
- Mechanical controls
- Host resistance
- Biological controls
- Chemical controls

IPM Strategies

1) Accurate identification of the pest
2) Monitor the pest population
3) Determine if control should be taken. Know or set action threshold levels.
4) Determine when control is needed

IPM Control Options

Biological controls
- Often directed at non native pests
- Use natural enemies
- If pesticides are used, select the least toxic to natural enemies
- U.S. has laws to control the importation of biological controls into the country

Reasons for Pesticide Failure

- Incorrect ID of pest
- Incorrect pesticide chosen
- Incorrect type of application
- Incorrect dosage
- Incorrect timing of application
- Pest resistance

The Pesticide Label

It is a violation of Federal Law to use a pesticide in a manner inconsistent with it's labeling.

How do pests become resistant?

When one pesticide with the same mode of action is used repeatedly in the same place against the same pest, the surviving pests may become resistant to the pesticide.

The Pesticide Label

Ingredients
Formulation
Directions for use – Mixing/loading
Safety information
- **avoiding exposure**
- **exposure effects (short term & long term)**
- **medical treatment info for emergency exposure**

Hazard information
Environmental cautions
Storage & disposal information

*** Restricted Use can only be purchased and used by a certified applicator**

The Pesticide Label

The Pesticide Label

Sevin = carbaryl:(1-naphthyl Nmethyl carbamate)

Brand name: The name registered by a company for a specific pesticide formulation. Example: Sevin

Common name: The name of the active ingredient in a pesticide. Example: carbaryl

Chemical name: The chemical parts and structure of the active ingredient. Example: (1-naphthyl Nmethyl carbamate).

Different brand name products may have same ingredients but not be approved for the same sites

The Pesticide Label

Signal Words – indicate how toxic a pesticide is by ingestion

- Caution – slightly toxic
- Warning – moderately toxic
- Danger – highly toxic
- Skull and Crossbones/ Poison - All highly toxic pesticides that are very likely to cause acute illness through oral, dermal or inhalation exposure

Formulations

- Pesticides are a mixture of inert and active ingredients
- The active ingredients are the chemicals that control the pests
- Inert ingredients make product safer, easier to apply and more accurate to measure
- An adjuvant is a chemical either premixed or added to a pesticide or tank to increase effectiveness or safety
  - includes solvents, wetting agents, spreader-stickers, anti-foaming agents, buffers
- Ready to use products can be expensive

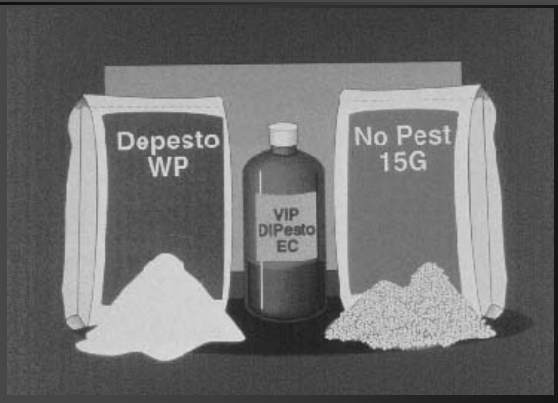
Material Safety and Data Sheets (MSDS)

OSHA Hazard Communication Standard requires pesticide manufacturers to have a MSDS for any chemical determined to be hazardous

Formulations

- The amount of active ingredient and the kind of formulation are listed on the label
- Example: an 80% WP contains 80 % by weight of active ingredient and is a wettable powder
- If it is a 100 pound bag, it contains 80 lbs of active ingredient and 20 lbs of inert ingredients.
- Liquid formulations indicate amount of active ingredient in pounds per gallon
- Example: 1E means 1 lb of active ingredient per gallon in an emulsifiable concentrate

Formulations



Liquid Formulations (L)

- **Emulsifiable concentrate (E or EC)**
  - a.i. in a petroleum solvent with an emulsifier
  - diluted with a liquid carrier
  - high concentration (2 – 8 lbs. a.i./gallon)
  - requires little agitation, not abrasive but corrosive
  - danger of skin absorption and phytotoxicity
- **Solutions (S)**
  - readily dissolves in water
  - no agitation required

Liquid Formulations (L)

- **Low concentrate solutions (S)**
  - often formulated in petroleum solvents and used without diluting
- **Ultra low volume concentrate solutions (ULV)**
  - highly concentrated, safety hazard, use with specialized application equipment
- **Flowables (F)**
  - has some of the same features as an EC and similar disadvantages
  - a.i. is an insoluble solid, ground and mixed with liquid to form a suspension
  - may leave a visible residue

Dry Formulations (D)

- **Wettable Powders (WP or P)**
  - dry, finely ground, usually greater than 50% a.i.
  - mixed with water and applied as a spray
  - constant agitation needed (particles do not dissolve)
  - abrasive on equipment
- **Soluble Powders (SP or WSP)**
  - look like wettable powders but from a true solution when mixed with water
  - no agitation required

Liquid Formulations (L)

- **Aerosols**
  - low percent a.i., drift hazard
  - used as is or in smoke or fog generators, good penetration in enclosed areas
- **Fumigants**
  - form poisonous gases when applied, highly toxic
  - area must be enclosed
  - good penetration
  - target a wide range of pests

Dry Formulations (D)

- **Water Dispersible Granules or Dry Flowables (WDG or DF)**
  - like a wettable powder
  - must be mixed with water to be applied
  - requires agitation
  - can cause phytoxicity
- Water Soluble Packets
  - have less mixing and handling hazards
- **Microencapsulated Pesticides (M)**
  - pesticides surrounded by a plastic coating; mixed with water applied as a spray
  - provides a time release of active ingredient
  - dangerous for bees

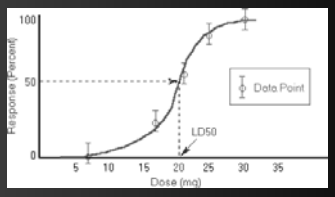
Dry Formulations (D)

- **Dusts (D)**
  - ready to use, no mixing, drift hazard, poor crop coverage,
  - low percent a.i. (1-10%) mixed with dry inert carriers like talc, chalk, clay, etc.
- **Baits (B)**
  - mixed with attractants, ready to use, no mixing
  - low percent a.i. (1 – 5%)
- **Granules (G) or Pellets (P or PS)**
  - ready to use, require no mixing
  - water is required to activate them
  - can pose a hazard to non-target organisms

Harmful Effects, Emergency Response and PPE

Protecting Yourself from Pesticide Exposure

- LD50 measures acute toxicity
- Describes the lethal dose to 50% of the test animals
- Based on the active ingredient
- The lower the number, the more toxic the pesticide



Protect Yourself from Pesticide Exposure

Dermal exposure most common

1) Skin - 97% of the time

2) Hands & feet most often exposed

3) head & neck are next most often

WHAT IS PPE?

PPE is…Personal Protective Equipment

Clothing and devices worn to protect the body from exposure to pesticides and residues.

PPE Requirements

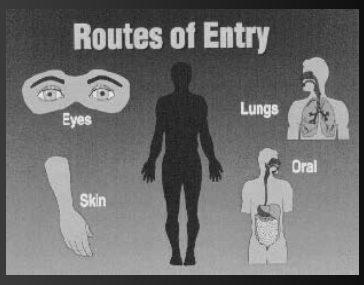
Read The Label!

- The label lists the minimum PPE you must wear.
- The part of the label with PPE information is usually following the acute, delayed and allergic effects statements
- Sometimes the label requires different PPE for different applications

Protect Yourself from Pesticide Exposure

Routes of Entry

- Oral
- Dermal
- Ocular
- Inhalation – "Do not breathe vapors or spray mist" is an example of a route of entry statement on the label



MAINTAINING PPE

- Respirators must be NIOSH-approved
- OSHA requires a fit test each time the respirator is used
- Cartridges should be replaced at the end of the workday, if no instructions are provided

What is the first thing to do if someone has been exposed to pesticides?

Stop the source of the exposure to prevent further exposure!

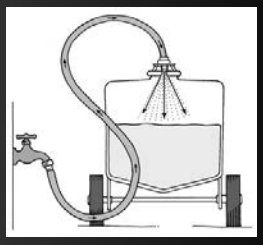
Mixing, Loading and Applying

What to do if someone has been exposed to pesticides?

- **If a pesticide is on the skin, remove clothing**
- **If the pesticide is inhaled, get to fresh air**
- **If the pesticide is in the eyes, flush for 15 minutes with clean water**
- **Antidotes should only be administered by a physician**

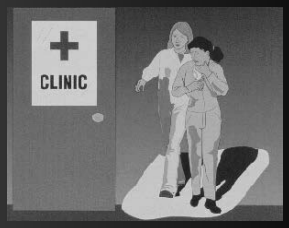
Mixing Basics

- Wear a chemical-resistant suit or apron when mixing concentrates
- Keep all pesticide containers below face level
- Maintain an air gap or use an anti-siphoning device



Possible Effects of Pesticide Exposure

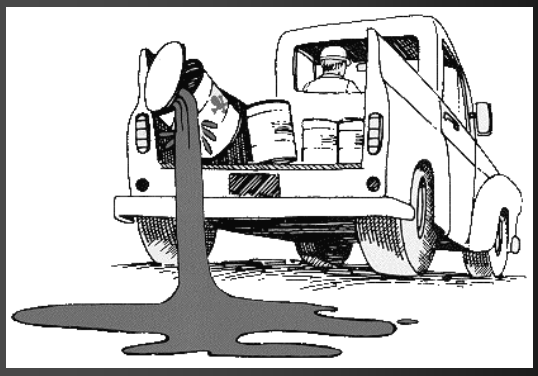
- Acute
  - Symptoms in 24 hours
  - Take label or MSDS to medical facility
- Chronic
  - Long term exposure
- Allergic



Calibration Basics

- Calibration – measuring and adjusting the amount of pesticide your equipment will apply to the target site
- The application rate is affected by: speed, pressure and nozzle size

Transportation, Storage, Disposal, & Spills



PESTICIDE STORAGE

- Pesticides storage areas should be kept locked
- Keep labels legible
- Keep containers closed
- Store in original containers
- Keep an updated inventory
- Spill kit should be available

Transporting Pesticides

Department of Transportation

- Pesticides regulated as hazardous material
- Few pesticides require placards
- The regulator section of the MSDS lists if the pesticides is a DOT regulated product

UF UNIVERSITY of FLORIDA
IFAS Extension

Updated in 2011 by

Celeste White

Orange County Extension

Transporting Pesticides

- Keep pesticides secure when transporting
- Never transport pesticides in the passenger section of a car or trunk
- Always carry a copy of all product labels and MSDSs of pesticides that are being transported

Invasive Exotic Plant Identification and Control

Ben Gugliotti
Lake County Water Authority
Lake County CISMA

Lake County Water Authority

- Established in 1953 by the State Legislature to control and conserve the freshwater resources of Lake County through a more efficient use of the streams, lakes and canals.
- Preserve, protect, and improve the fish and wildlife of the County by protecting the freshwater resources.

Land Resources

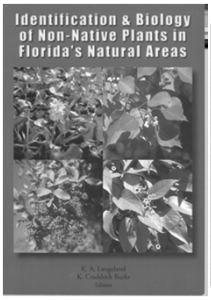
- 20 Preserves
- 6747 Acres
- 13 Preserves Opened to the Public
- Hiking, Picnicking, Geo-caching, Biking, Birding, Fishing, Camping, Canoeing, and Horse Back Riding
- Maintain Facilities and Trails, Conduct Prescribed Fires, Control Nuisance Species

Nuisance Species

- Exotic – Not from Around Here
- Invasive – Out of Control
- Invasive Exotic – Kill on Sight

Plant Books

Exotic Plant Books



Skunk Vine
Paederia foetida

- Imported from Asia before 1897
- FLEPPC Category 1
- Florida Noxious Weed
- Climbing Vine can smother and displace native vegetation.

Skunk Vine

- Perennial vine form woody rootstock
- Leaves entire, oval to linear lanceolate
- Leaves opposite on long petioles
- Stipules
- Clusters of small white flowers with purple centers

Skunk Vine
Control

- Mechanical Treatment (cutting and tilling) may be effective but is not often practical
- Chemical Treatment most effective
  - Triclopyr Amine 1-2% with 0.25% NIS
  - Triclopyr Ester 0.5-2% with 0.25% NIS
  - Glyphosate 2-3% with 0.25% NIS

  All chemical treatments enhanced with a poodle cut

  Be careful disposing of all vegetative material

Surinam Cherry
Eugenia uniflora

- FLEPPC Category 1
- Large, evergreen shrub similar to native Eugenias
- Small, shiny leaves with a distinctive smell
- New leaves often have a red tint
- Smooth, light colored bark
- Distinctive Pumpkin shaped fruits

Surinam Cherry

- Basal Bark stems up to 0.5 inch with a 10% solution of Triclopyr Ester mixed with Bark Oil
- Cut Stump treatment with 50% Triclopyr Amine or 10% Triclopyr Ester
- Hand pull seedlings

Glossy Privet
Legustrum lucidum

- FLEPPC Cat. I
- From China
- In Florida since 1936
- Hammock and hardwood forest

Glossy Privet

- Evergreen shrub or small tree to 10m
- Leaves opposite, entire, ovate to elliptic
- Thin, translucent vein along margin
- Clusters of small, white flowers
- Fruit a black/purple drupe

Glossy Privet
Control

- Mechanical:
  - Mowing or cutting
  - Remove all root material
- Chemical:
  - Foliar application of 3% glyphosate or 2% Triclopyr
  - Cut stump application of 25% glyphosate or 25% Triclopyr ester and bark oil

Kudzu
Pueraria montana var. lobata

- FLEPPC Category I
- FDACS Noxious Weed List
- From Eastern Asia
- Introduced in Florida in 1899

Kudzu

- Climbing, perennial vine
- Can reach lengths of 30 meters
- 3, lobed leaflets
- Margins hairy
- Hanging cluster of purple flowers
- Mostly spread through runners, rhizomes and vines

Kudzu
Control

- Glyphosate may be used for small areas but is not the most effective herbicide for Kudzu
- Foliar application of 5% Glyphosate
- Foliar application of 2% Triclopyr Amine
- Metsulfuron
- Aminopyralid

Praxelis
Paxelis clematidea

- FLEPPC Cat. II
- Native to South America
- Also a weed in Australia

Praxelis

- Erect, perennial herb 8-30 inches tall
- Opposite leaves with deeply toothed margins
- Small clusters of purple flowers
- Stem and leaves hairy

Praxelis
Control

- ???
- Foliar application of 3% Glyphosate with 0.25% NIS
- Easy to kill, hard to control

Benghal Day Flower
Commelina benghalensis

- USDA Noxious Weed
- FDACS Noxious Weed
- Native to Asia and tropical Africa
- Introduced into US in 1928

Benghal Day Flower

- Herbaceous monocot
- Leaves with parallel veins
- Violet flowers
- Leaves ovoid, wider than native species
- Leaf surface and margins hairy
- Underground stems and flowers

Benghal Day Flower
Control

- Prevention in best control
- Glyphosate resistant
- 2, 4-D amine
- Can grow from plant fragments so clean equipment. Bag and dispose of any collected material.

Marabou
Dichrostachys cinerea ssp. africana

- From Africa
- Florida Vouchered Specimen from 1929
- Grows in dense thickets

Marabou

- Semi-deciduous tree to 7 meters tall
- Brown bark
- New branches green and hairy
- Leaves bipinnatly compound, hairy
- Alternate spikes to 8 cm
- Hanging spike of pink flowers

Marabou
Control

- No Specific Recommendations Available!

Old World Climbing Fern
Lygodium microphyllum

- FLEPPC Cat. I
- USDA Noxious Weed
- FDACS Noxious Weed
- From Old World
- Even better climber than the Japanese Climbing Fern
- Ladder Fuel
- Spores may be carried by fire

Old World Climbing Fern

- Single-compound leaf structure
- Introduced in southern Florida and working it's way north

Old World Climbing Fern Control

- Poodle Cut
- Foliar application of 1-2% Glyphosate
- Foliar application of 2% Triclopyr amine
- Catch it early
- Decontaminate Equipment

Japanese Climbing Fern
Lygodium japonicum

Japanese Climbing Fern

- FLEPPC Cat. I
- FDACS Noxious Weed
- From Eastern Asia
- Introduced in 1932 as an ornamental
- Reproduces by spores

Japanese Climbing Fern Control

- Foliar application of 2-3% Glyphosate
- Foliar application of 3% Triclopyr amine

Air Potato

Dioscorea bulbifero

Air Potato

- FLEPPC Cat. 1
- FDACS Noxious Weed
- Climbing vine
- Heart shaped leaves
- Parallel veins
- Potatoes come in all shapes and sizes!

Air Potato

Air Potato

- Originated in Tropical Asia
- Introduced to the Americas from Africa
- Related to Yams
- Edible Tuber
- Aerial Tubers are not Edible

Air Potato Control

- Poodle Cut
- Foliar herbicide application of 1-3 % Glyposate
- Cut Stem application of 10 % Triclopyr ester
- Collect Potatoes

Camphor Tree
Cinnamomum camphora

- FLEPPC Cat I
- From eastern Asia
- Introduced to Florida in 1875 for camphor production
- Still sold in nurseries

Camphor Tree

- Leaves entire
- Shiny, dark green above, light green and waxy below
- New stems green or reddish green
- Smell it!

Camphor Tree Control

- Basal Bark application of 10-20% Triclopyr ester
- Cut Stump application of 20% Triclopyr ester
- Frill and Girdle application of 20% Triclopyr ester

Chinaberry Tree
Melia azederach

- FLEPPC Cat. II
- Originally from Asia
- Introduced in U.S. around 1830 as an ornamental

Chinaberry Tree

- Fruit poisonous to humans and other mammals, but eaten & distributed by birds.
- Double-Compound Leaves
- Leaf margins serrated

Chinaberry Tree Control

- Basal Bark application of 10-20% Triclopyr ester
- Cut Stump application of 20% Triclopyr ester
- Frill and Girdle application of 20% Triclopyr ester

Chinese Tallow Tree
Sapium sebiferum

- FLEPPC Cat. I
- FDACS Noxious Weed
- Native to Eastern Asia
- Grows in a variety of habitats

Chinese Tallow Tree

- Spade shaped leaves with beautiful fall color
- Still sold in nurseries
- Seeds dispersed by wildlife

Chinese Tallow Tree Control

- Basal Bark application of 10-20% Triclopyr ester
- Cut Stump application of 50% Triclopyr amine
- Cut Stump application of 10% Imazapyr
- Frill and Girdle application of 20% Triclopyr ester

Brazilian Pepper
Schinus terebinthifolius

- FLEPPC Cat. I
- FDACS Noxious Weed & Prohibited Aquatic Plant
- From South America
- Related to Poison Ivy, Mango and Cashews

Brazilian Pepper

- Leaves odd-pinnate
- Winged projections along the stem of the leaf

Brazilian Pepper

- Seeds often distributed by wildlife.
- Seeds sometimes sold as pink peppercorns

Brazilian Pepper Control

- Basal Bark application of 10-20% Triclopyr ester
- Cut Stump application of 10% Triclopyr ester or 50% Triclopyr amine
- Frill and Girdle application 10-20% Triclopyr ester

Coral Ardisia

Ardisia crenata

- FLEPPC Cat. I
- FDACS Noxious Weed
- Originally found from Japan to northern India.
- Introduced into Florida in early 1900s as an ornamental.

Coral Ardisia

- Dominates understory, displacing native vegetation
- Scalloped leaf margin

Coral Ardisia Control

- Collect Seeds
- Basal application of 10% Triclopyr ester
- Foliar application of 5% Triclopyr ester
- Foliar application of 3-5% Triclopyr amine

Primrose Willow

Ludwigia peruviana

- FLEPPC Category I
- From South America
- Aquatic Weed
- High seed production

Primrose Willow

- Entire leaf
- Plant pubescent
- Flowers yellow with four pedals

Primrose Willow Control

- Foliar application of 3-5 % Glyphosate (aquatic?)
- Cut surface application of 5-10% Glyphosate
- Spray before they set seed!

Rosary Pea
Abrus precatorius

- FLEPPC Cat. I
- FDACS Noxious Weed
- Native to Asia
- Introduced as Ornamental
- Seeds are poisonous

Rosary Pea

- Even-pinnate leaves
- Climbing vine that overtakes native vegetation

Rosary Pea

- Acts as ladder fuel
- Changing the effects of fire on a plant community

Rosary Pea Control

- Collect seeds!
- Foliar herbicide application with 5 % Glyphosate
- Basal application with 10-20 % Triclopyr ester
- Repeat!

Caesar Weed
Urena lobata

Caesar Weed

- FLEPPC Cat. I
- Originally from Asia
- Related to hibiscus
- Common in disturbed sites

Caesar Weed Control

- Foliar application of 3-5% Glyphosate
- Basal application of 10% Triclopyr ester
- Collect seeds by walking through the woods while wearing a snuggie!

Torpedo Grass
Panicum repens

Torpedo Grass

- FLEPPC Cat. I
- From the Old World
- Reproduces primarily by rhizomes and fragmentation, but also seed production.

Torpedo Grass

- Introduced in U.S. before1876
- Brought to south as forage crop by 1926
- Usually a wet species, but drought tolerant

Torpedo Grass Control

- Foliar application of 1-5% Glyphosate (aquatic?)
- Repeat

Cogon Grass
Imperata cylindrica

- FLEPPC Cat. I
- From Southeast Asia
- Considered one of the top 10 worst weeds in the world
- Introduced into the U.S. in 1911

Cogon Grass

- Erect grass
- Light green leaves
- Leaf margins scabrous
- Leaf keeled
- Light mid-vein off center
- Leaf U-shaped just above sheath

Cogon Grass Control

- Foliar application of 3-5% Glyphosate
- Foliar application of 1% Imazapyr (bare earth!)
- Spray in conjunction with burning or disking.
- Be careful when burning!

Natal Grass
Melinis repens

- FLEPPC Cat. I
- Easy to kill but hard to control
- High seed production rate
- Short germination period

Natal Grass

- Native to the Natal region of South Africa
- Introduced as a forage species but lacks nutritional value

Natal Grass Control

- Foliar application of 2-5% Glyphosate
- Spray monthly to break reproductive cycle

Lantana

- FLEPPC Cat. I
- Cultivated as an ornamental
- Distinctive veins on leaves
- Smell it
- Highly toxic

Lantana
Lantana camara

- Common in old orange groves and under planted pines.
- Use of Prescribed Fire

Lantana Control

- Burn or Mow if Possible
- Basal Bark application of 10% Triclopyr ester
- Cut Stump application of 10% Triclopyr ester or 50% Triclopyr amine

CISMA Cooperative Invasive Species Management Area of Lake County

- http://www.floridainvasives.org/Lake/
- Get Active – Stay Informed

Center for Aquatic and Invasive Plants
Institute of Food and Agricultural Sciences
University of Florida

- http://aquat1.ifas.ufl.edu

Florida Exotic Pest Plant Council ...an organization concerned with Florida's Environmental Future.

- www.fleppc.org
- Invasive Plant List

- http://www.fnai.org/invasivespecies.cfm
- Species Information

- http://fnps.org/
- Good information and fun field trips!

Thank You

Managing Invasive Vertebrates in Central Florida

Lake County CISMA
August 20th, 2015

Dr. Steve A. Johnson
tadpole@ufl.edu
http://ufwildlife.ifas.ufl.edu/

Presentation Outline

- Defining 'invasive species'
- Invasive vertebrates in FL
- Focal species for Central FL
- Watch lists for Central FL
- Resources

Invasive Species

- Invasives are species, including their seeds, eggs, spores, or other biological material capable of propagating that species, that are not native to the ecosystem in which they are found *(human mediated movement implied)*; and whose introduction *does or is likely to cause environmental or economic harm, or negatively impact human health or quality of life*.

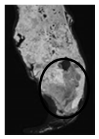
National Invasive Species Council
http://www.invasivespecies.gov/

Executive Order 13112: "*An alien species whose introduction does or is likely to cause economic or environmental harm or harm to human health.*"

Problems Caused by Invasives

- Ecological
  - Pathogens and disease
  - Predation
  - Competition
  - Major habitat modification
  - Hybridization
- Economic
  - Damage
  - Control
- Quality of life
  - Nuisance
  - Disease vectors

Florida's Unique Situation



- Florida is among the top 3 states in the US with regard to numbers of invasive species
- A lot of disturbed and human modified habitats
- A moderate climate
- Booming ornamental horticulture and pet trades
- Miami/Tampa/Jax are major ports of entry
- Florida is hub for tourism
- Florida has an abundance of habitats (terrestrial, freshwater, marine)

Introduced Vertebrates in Florida

- Birds:~200 species documented in the state
  - About 15 established and breeding species
- Mammals:~30 species documented
  - About 15 established and breeding species
- Amphibians: ~ 15 species documented
  - Three established and breeding species
- Reptiles: ~140 species documented
  - About 50 established and breeding species
- Fish:~100 species documented
  - About 25 established and breeding species
- *Data from peer-reviewed lit., FWC website, FLMNH, pers. observations, colleagues*

Introd. & Invasive Birds in Florida[1]

Common Name	Scientific Name	EnvD	EconD	HQL	InvNat
Eurasian Collared-dove	*Streptopelia decaocto*	N	N	N	N
European Starling	*Sturnus vulgaris*	Y	Y	Y	Y?
House Finch	*Carpodacus mexicanus*	Y	N	N	Y
House Sparrow	*Passer domesticus*	Y	N	N	N
Mallard Duck	*Anas platyrhynchos*	Y	N	Y	Y
Muscovy Duck	*Cairina moschata*	Y	N	Y	N
Rock Dove (Pigeon)	*Columba livia*	N	Y	Y	N
White-winged Dove	*Zenaida asiatica*	N	N	N	Y
Monk Parakeet	*Myiopsitta monachus*	N	Y	N	N
Nanday Conure	*Nandayus nenday*	N	N	N	N
"Budgie"*	*Melopsittacus undulatus*	N	N	N	N
Hill Myna	*Gracula religiosa*	Y	N	N	N
Red-whiskered Bulbul	*Pycnonotus jocosus*	N	N	N	N
Spot-breasted Oriole	*Icterus pectoralis*	N	N	N	N
White-winged Dove	*Zenaida asiatica*	N	N	N	Y
Purple Swamphen	*Porphyrio porphyrio*	Y	Y	N	Y

Species above dashed line are established statewide, others are locally established

[1]FWC Non-native Species—Established (breeding 10+ yrs)

Introd. & Invasive Mammals in Florida[1]

Common Name*	Scientific Name	EnvD	EconD	HQL	InvNat
Nine-banded Armadillo	*Dasypus novemcinctus*	Y	Y	Y	Y
Feral Pig	*Sus scrofa*	Y	Y	Y	Y
Coyote*	*Canis latrans*	Y	Y	Y	Y
Feral Cat*	*Felis cattus*	Y	Y	Y	Y
Red Fox	*Vulpes vulpes*	Y	Y	Y	Y
House Mouse	*Mus musculus*	Y	Y	Y	Y
Norway Rat	*Rattus norvegicus*	Y	Y	Y	Y
Black Rat	*Rattus rattus*	Y	Y	Y	Y
Pallas's Mastiff Bat	*Molossus m. tropidorhynchus*	?	?	?	Y
Vervet Monkey	*Chlorocebus aethiops*	?	?	Y	Y
Rhesus Monkey	*Macaca mulatta*	?	?	Y	Y
Squirrel Monkey	*Saimiri sciureus*	?	?	Y	Y
Nutria	*Myocastor coypus*	?	?	N	Y
Sambar Deer	*Cervus unicolor*	?	N	N	Y
Elk	*Cervus elephus*	?	N	?	Y
Gambian Pouch Rat	*Cricetomys gambianus*	?	Y	Y	?
Mex. Red-bellied Squirrel	*Sciurus aureogaster*	?	Y	N	Y

**Not listed on FWC site: Coyote, Feral Cat, Feral Dog*

Species above dashed line are established statewide, others are locally established

[1]FWC Non-native Species—Established (breeding 10+ yrs)

Introd. & Invasive Amphibians in Florida[1]

Common Name	Scientific Name	EnvD	EconD	HQL	InvNAt
Cuban Treefrog	*Osteopilus septentrionalis*	Y	Y	Y	Y
Cane/Marine Toad	*Rhinella marina (Bufo)*	Y/?	Y	Y	?
Greenhouse Frog	*Eleutherodactylus planirostris*	?	N	N	Y

[1]FWC Non-native Species—Established (breeding 10+ yrs)

Invasive Reptiles in Florida[1]

Common Name	Scientific Name	EnvD	EconD	HQL	InvNat
Burmese Python	*Python molurus*	Y	Y	Y	Y
Rock Python	*Python sebae*	?	Y	Y	Y
Green Iguana	*Iguana iguana*	Y	Y	Y	Y
Spiny Iguanas	*Ctenosaura sp.*	Y	Y	Y	Y
Nile Monitor	*Varanus niloticus*	Y	Y	Y	Y
Tegu Lizards	*Tupinambis sp*	Y	Y	N	Y
Red-eared Slider	*Trachemys s. elegans*	Y	N	N	Y
Brown Anole	*Anolis sagrei*	Y	N	N	Y

Upper group = S FL; Middle group = S & C FL; Lower group = ~Statewide

[1]FWC Non-native Species—Established (breeding 10+ yrs) & Krysko et al. 2011

Managing Invasive Birds—N FL

- Priority Species: ***Mallard Duck, Starling***
- Potential Impacts: hybridization, competition,
- Management: shoot, trap, destroy eggs, toxicants are discouraged, permits needed
- Seek Assistance: USDA Wildlife Services, FWC

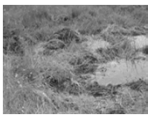

Mallard Ducks


European Starling

Managing Invasive Mammals—N FL

- Priority Species: ***Armadillo, Feral Hog, Feral Cat, Coyote***
- Potential Impacts: predation, habitat alteration, disease, human threat
- Management: shoot, trap, educate, immunocontraception, "ethical" considerations
- Seek Assistance: USDA Wildlife Services, FWC

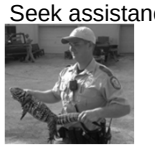

Armadillo

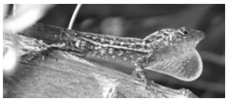

Feral Hog Damage


Coyote

Managing Invasive Reptiles—N FL

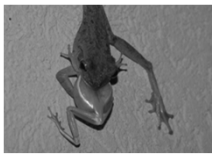
- Priority Species: ***Large Constrictors, Monitors, Tegus, RE-sliders, Brown Anoles***
- Potential Impacts: predation, competition, hybridization, human threat
- Management: trap, hand capture, noose, shoot, report sightings, educate
- Seek assistance: FWC, UF


Tegu


Brown Anole

Managing Invasive Amphibians

- Priority Species: ***Cane Toad, Cuban Treefrog***
- Potential Impacts: predation, competition
- Management: trap, hand capture, destroy eggs, report sightings, proper ID
- Seek assistance: UF, FWC


Cuban Treefrog


Cane aka "Bufo" Toad

Invasive Vertebrate Resources

- eXtension
  - *Feral hogs*, *armadillos*
- Internet Center for Wildlife Damage Management
  - *Armadillos, starlings*
- USDA Wildlife Services
  - *Feral hogs, European Starling*
- Florida Fish & Wildlife Cons. Comm.
  - *Feral cats, armadillos, feral hogs, mallard ducks*
- UF IFAS
  - *Feral hogs, armadillos, coyotes, Cuban treefrogs, Cane toads, large constrictors,*
- Others

Online Resources List for Land Managers

"Watch Lists"

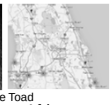
- Stay alert for these species in your area
  - Established species
    - Document and curtail established populations from spreading
  - Documented species
    - Prevent species from establishing
  - New species
    - Be alert for new arrivals

Species Watch Lists

- Birds
  - New arrivals
- Mammals
  - Rhesus macaques, Nutria
  - New arrivals—Sugar Gliders
- Amphibians
  - Cane Toads
  - New Arrivals
- Reptiles
  - Large constrictors, Ball Pythons, Tegus, Monitors, African Spurred Tortoise, Bearded Dragons

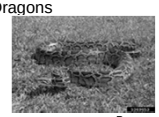

Rhesus Macaque--EDDMapS


Rhesus Macaque



Cane Toad



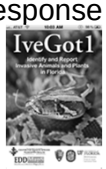
Spurred Tortoise



Burmese Python

Get Involved

- EDRR—Early Detection Rapid Response
  - **1-888-IVE-GOT-1**
    - Report invasive animals in Florida
  - EDDMapS www.eddmaps.org
    - Document observations of invasive animals
  - REDDy http://ufwildlife.ifas.ufl.edu/REDDy/getreddy.shtml
    - Take the free, online training
  - FWC Python Patrol
    - Train to capture large constrictors
- FWC Pet Amnesty Days/Program



REDDy
Introduced Reptile Early Detection & Documentation

Stay Informed

- CISMAs (Comprehensive Invasive Species Management Areas)
  - Email lists
  - Meetings
  - FISP: http://www.floridainvasives.org/cismas.html
- The Invader Updater
  - UF/IFAS Quarterly Newsletter
  - Like on Facebook
  - UF Wildlife: http://ufwildlife.ifas.ufl.edu/InvaderUpdater.shtml
- Florida Chapter of TWS
  - Meetings: http://www.fltws.org/

CISMA of Lake County

The Power of Partnerships

Invasive Species Know No Boundaries, Do We?

Rose Godfrey
Florida Invasive Species Partnership
UF-IFAS School of Forest Resource Conservation

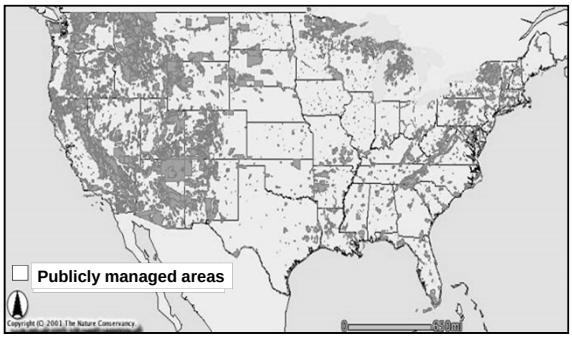
FISP Florida Invasive Species Partnership
Think Locally, Act Neighborly
invasive species know no boundaries!
SFRC School of Forest Resources & Conservation
UF IFAS University of Florida

How FISP Evolved

- 2001 Invasive Species Working Group
  - Federal & state agencies one strategic plan for prevention and management of all biological invasions in Florida
  - Primarily ***public*** lands
- 2006 Private Land Incentive Group
  - Invasive species management on ***private*** lands
  - ***Promoted partnerships*** between public land managers, resource managers and private land managers
- 2008 The Florida Invasive Species Partnership
  - Public *and* private lands
  - Maintains same partnership focus

FISP Florida Invasive Species Partnership
Think Locally, Act Neighborly
invasive species know no boundaries!

60% of Florida is privately owned



Public/Private Partnerships

To achieve long-term success in managing invasive, non-native species in Florida, private landowners and public land managers must:

- Form collaborative relationships with *all* stakeholders
- Focus on comprehensive management, including
  - Prevention
  - Early Detection/Rapid Response (EDRR)
  - Control
  - Applied Research
  - Outreach

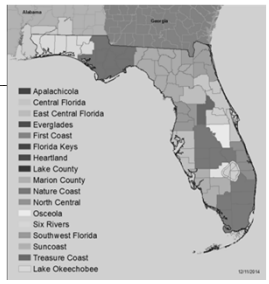
FISP Goals

- Encourage voluntary partnerships to increase effectiveness and decrease costs of comprehensive invasive species management;
- Provide tools and resources that enable the development of unified approaches, bridging the gap between private landowners' and land management agency invasive species efforts; and,
- Encourage the development, implementation and sharing of new and/or innovative approaches to address the threat of invasive species.

FISP Website:
www.FloridaInvasives.org

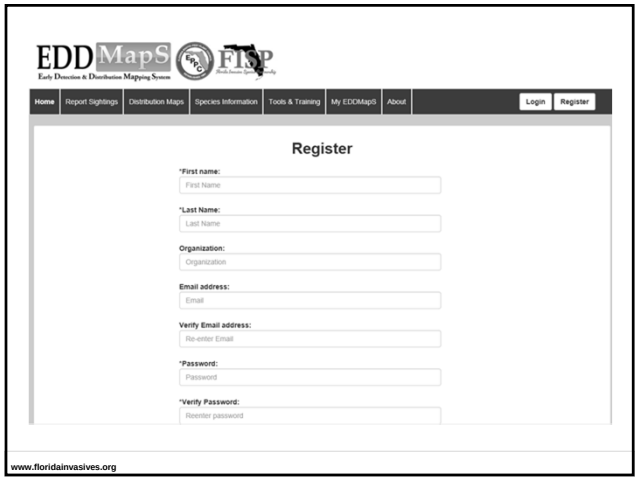
Florida Invasive Species Partnership

EDDMapS: Step-by-Step Instructions

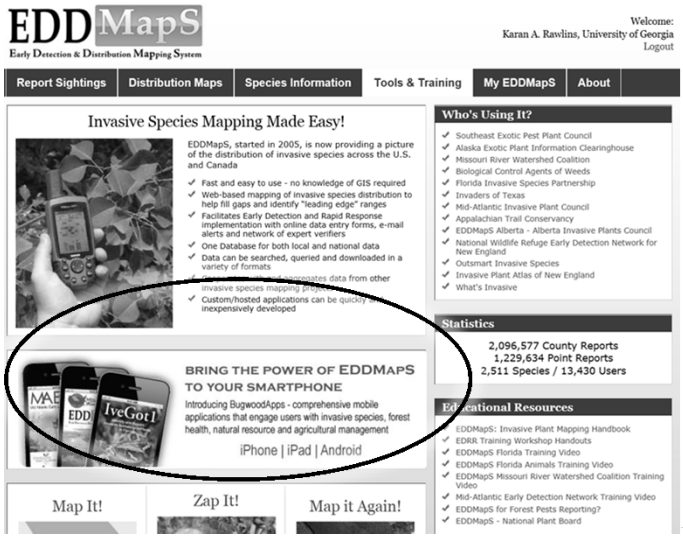


First Things First

Join and Create an Account



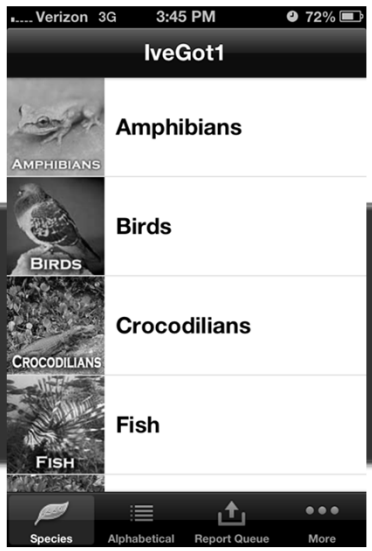
Go to www.EDDMapS.org



www.eddmaps.org

EDDMapS

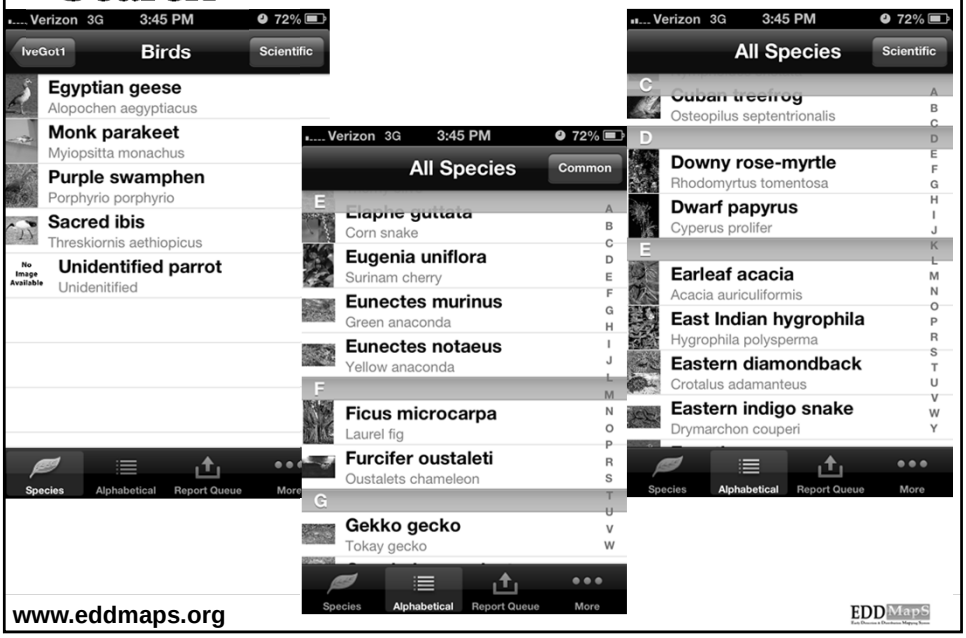
How the App Works



www.eddmaps.org

EDDMapS

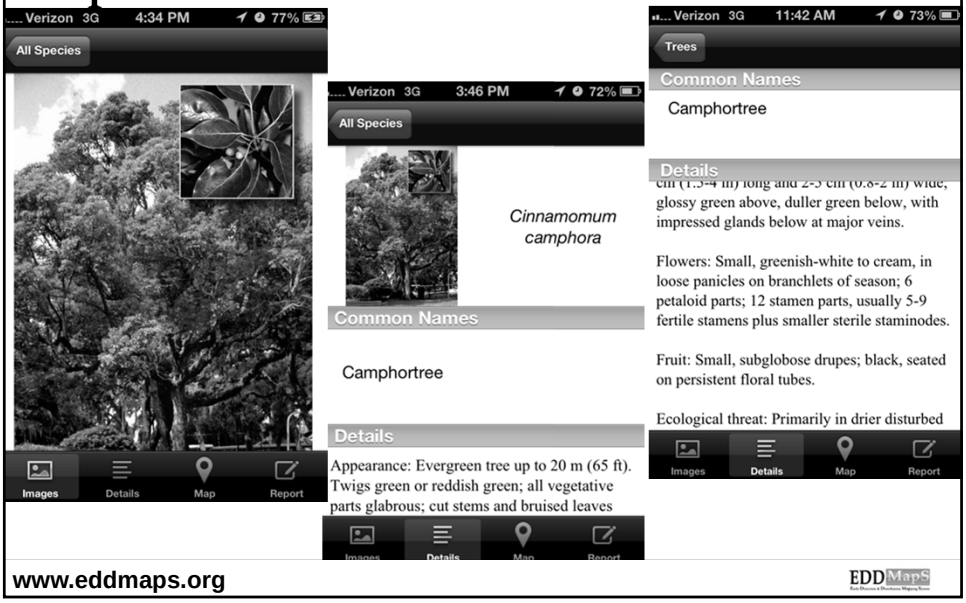
Search



www.eddmaps.org

EDDMapS

Species Information



www.eddmaps.org

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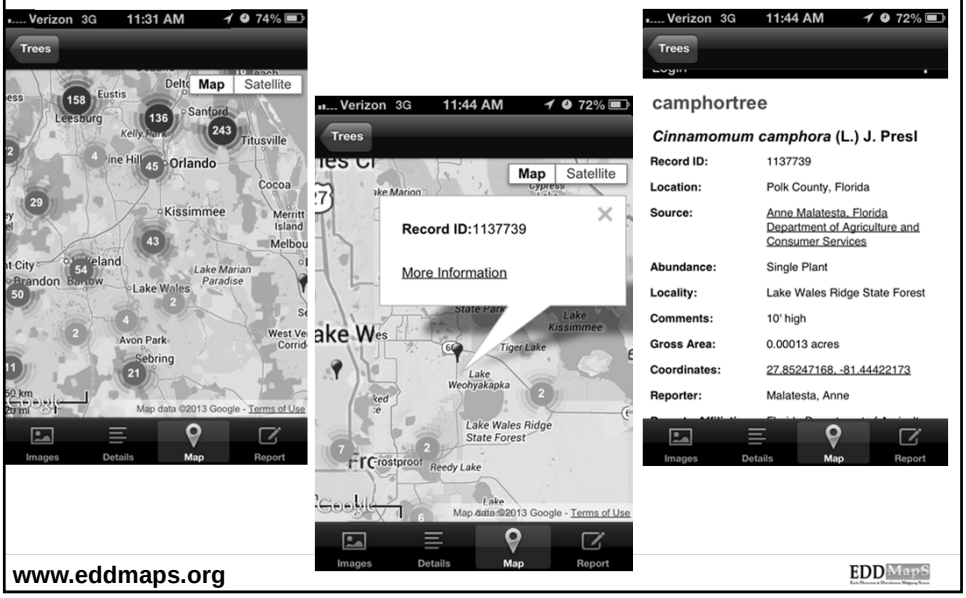
Maps



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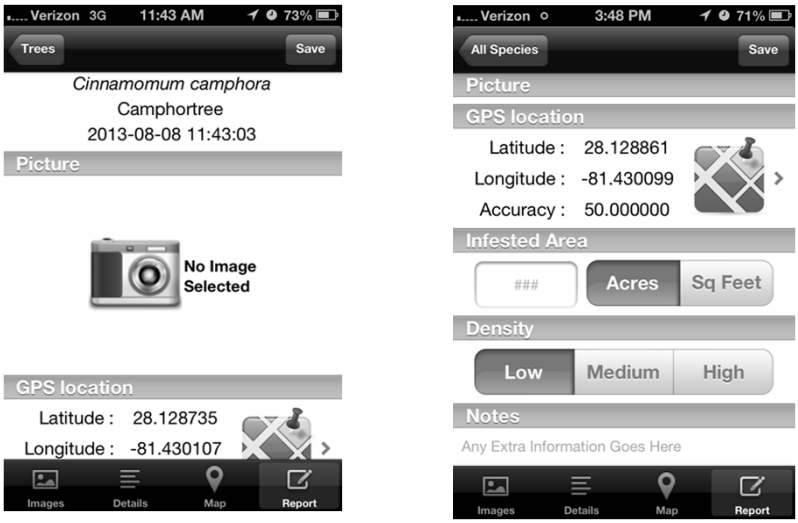
Data Entry



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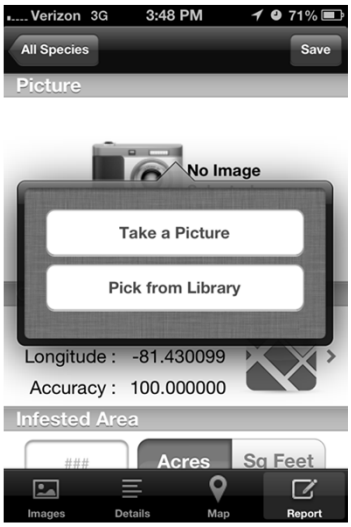
Picture and Location



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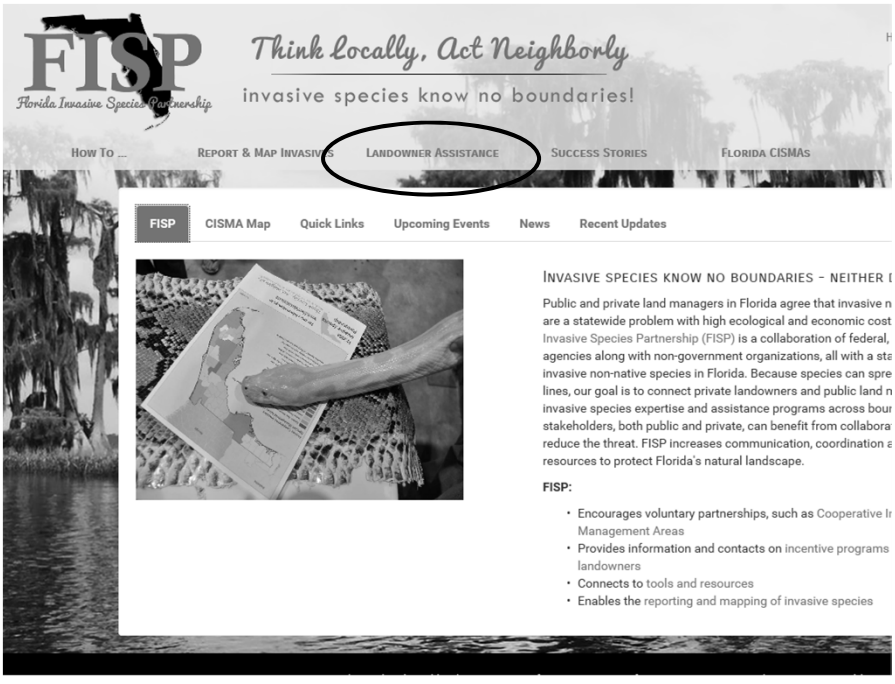
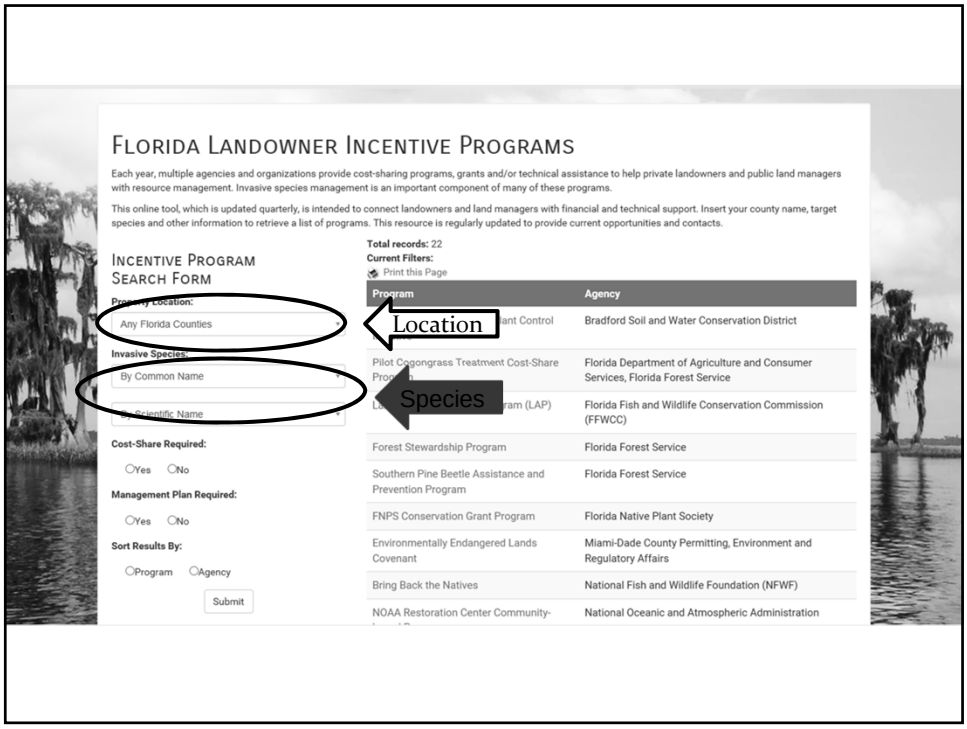
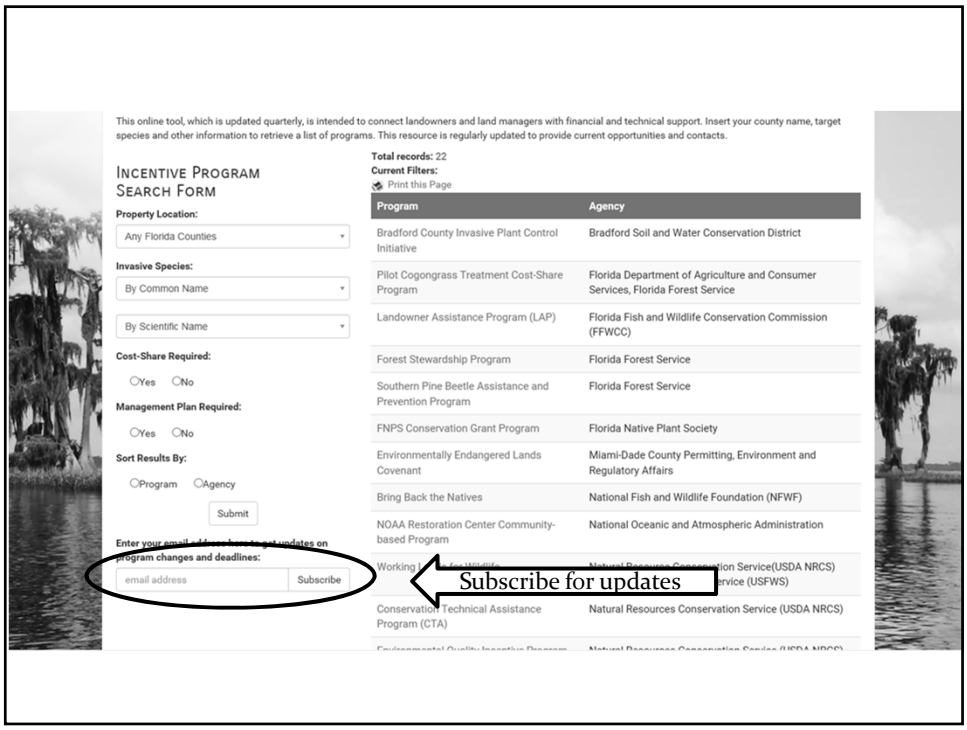



Florida Landowner Incentive Programs
Each year, multiple agencies and organizations provide cost-sharing programs, grants and/or technical assistance to help private landowners and public land managers with resource management. Invasive species management is an important component of many of these programs.
This online tool, which is updated quarterly, is intended to connect landowners and land managers with financial and technical support. Insert your county name, target species and other information to retrieve a list of programs. This resource is regularly updated to provide current opportunities and contacts.
Incentive Program Search Form
Property Location:
Any Florida Counties
Invasive Species:
By Common Name
By Scientific Name
Cost-Share Required:
Yes No
Management Plan Required:
Yes No
Sort Results By:
Program Agency
Submit
Location
Species
Total records: 22
Current Filters:
Print this Page
Program
Agency
Bradford Soil and Water Conservation District
Florida Department of Agriculture and Consumer Services, Florida Forest Service
Florida Fish and Wildlife Conservation Commission (FFWCC)
Forest Stewardship Program
Florida Forest Service
Southern Pine Beetle Assistance and Prevention Program
Florida Forest Service
FNPS Conservation Grant Program
Florida Native Plant Society
Environmentally Endangered Lands Covenant
Miami-Dade County Permitting, Environment and Regulatory Affairs
Bring Back the Natives
National Fish and Wildlife Foundation (NFWF)
NOAA Restoration Center Community-
National Oceanic and Atmospheric Administration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Incentive Program Search Form
Property Location:
Any Florida Counties
Invasive Species:
By Common Name
By Scientific Name
Cost-Share Required:
Yes No
Management Plan Required:
Yes No
Sort Results By:
Program Agency
Submit
Enter your email address here to get updates on program changes and deadlines:
email address
Subscribe
Subscribe for updates
Total records: 22
Current Filters:
Print this Page
Program
Agency
Bradford County Invasive Plant Control Initiative
Bradford Soil and Water Conservation District
Pilot Cogongrass Treatment Cost-Share Program
Florida Department of Agriculture and Consumer Services, Florida Forest Service
Landowner Assistance Program (LAP)
Florida Fish and Wildlife Conservation Commission (FFWCC)
Forest Stewardship Program
Florida Forest Service
Southern Pine Beetle Assistance and Prevention Program
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Miami-Dade County Permitting, Environment and Regulatory Affairs
Bring Back the Natives
National Fish and Wildlife Foundation (NFWF)
NOAA Restoration Center Community-based Program
National Oceanic and Atmospheric Administration
Conservation Technical Assistance Program (CTA)
Natural Resources Conservation Service (USDA NRCS)

Invasive Species know NO boundaries – Do we?

Ingredients for long-term success:

- Multiple agencies and organizations in partnership
- Involve private landowners and interests
- Recognize differences and commonalities in missions
- Conservation leverage

FISP Florida Invasive Species Partnership

Think Locally, Act Neighborly

invasive species know no boundaries!

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Questions?

Visit: FloridaInvasives.org
Contact us: coordinator@floridainvasives.org
Join us the 4th Wednesday of every month at 1:30pm EST for the CISMA Monthly Call
(Except November and December due to holiday conflicts. Call resumes in January)
Go to http://www.floridainvasives.org/cismas.cfm to join CISMA Listserv

SS-AGR-260

Herbicide Application Techniques for Woody Plant Control[1]

Jason Ferrell, Ken Langeland, and Brent Sellers[2]

The progression of trees and other woody plants into pastures, fencerows, ditch banks, rights-of-way and other areas is a common occurrence. These woody species can be particularly troublesome and require control since they will compromise fence intregrity, impede canal drainage, interfere with transmission of electricity, and some species (such as cherry trees) are highly poisonous to livestock. The aim of this publication is to detail the techniques for the removal of woody plants. For information on controlling similar species in natural areas or in forestry settings, consult UF/IFAS publications SP242 *Control of Non-native Plants in Natural Areas of Florida* (http://edis.ifas.ufl.edu/wg209) and Circular 1477 *Primer on Chemical Vegetation Management in Florida Pine Plantations* (http://edis.ifas.ufl.edu/fr160).

Control of woody perennials can be difficult, but several control techniques are available. Mowing is a commonly used control procedure for small brush because the equipment is readily available and the results are immediate. However, this method generally provides only short-term success because it leaves live stumps and root-stocks that re-sprout. Mowing some species, like Chinese tallow, worsens the situation by replacing a single stemmed plant with a stump with multiple re-sprout stems. Another strategy that can reduce some troublesome species is fire. However, fire can be tricky to manage and it is difficult to generate a fire with sufficient heat capacity to kill most hardwood species along fencerows, ditch banks and other sites with low plant density.

Herbicides are often the most effective and inexpensive means of controlling woody plants. There are several application techniques that can be used to control trees and brush of various sizes. Not all brush species are equally susceptible to herbicides. Therefore, results may vary for any of these application methods, relative to brush size and species. Each application technique is discussed below.

Foliar application

Foliar application directs a herbicide/water mixture directly onto the leaves of a plant (Figure 1). This technique can be highly effective on smaller species (6 to 8 feet in height). Auxin-type herbicides (such as triclopyr) are generally most effective early in the season while enzyme-inhibiting herbicides (imazapyr and others) are most effective in the late summer or fall. Glyphosate is most effective in late summer or fall--after blooming, but prior to change in leaf color.

Adequate control with foliar applications can be difficult to accomplish. This is because complete coverage of all foliage

1. This document is SS-AGR-260, one of a series of the Agronomy Department, Florida Cooperative Extension Service, Institute of Food and Agricultural Sciences, University of Florida. Original publication date January 2006. Reviewed November 2010. Visit the EDIS website at http://edis.ifas.ufl.edu.

2. Jason Ferrell, associate professor, Agronomy Department; Ken Langeland, professor, Agronomy Department; Brent Sellers, assistant professor, Agronomy Department, Range Cattle REC--Ona, FL. Florida Cooperative Extension Service, Institute of Food and Agricultural Sciences, University of Florida, Gainesville, FL 32611.

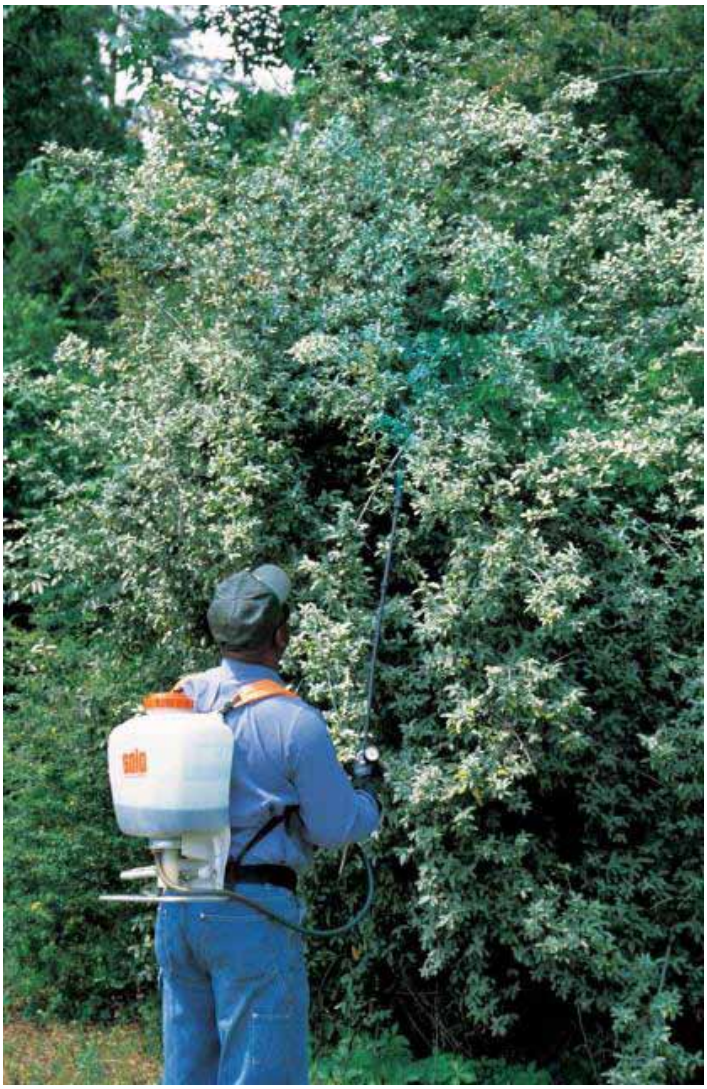

Figure 1. Foliar application with a backpack sprayer.

is essential for control, but over-application (that leads to spray run-off) will reduce effectiveness. Therefore, foliar applications commonly require multiple follow-up treatments before control is accomplished. It is important to control spray drift when making foliar applications. Certain desirable hardwood and crop species are highly sensitive to spray drift and can be inadvertently damaged. It is also advisable to include a tracer dye with the spray solution to ensure that some individuals are not sprayed twice while others are missed entirely.

What about mowing before treatment? Mowing decreases foliage while maintaining a large root mass, making control even more difficult. If plants have been mowed, it is important to allow them to regrow to a height of 3 or 4 feet before herbicide application.

Basal application

Basal application combines the herbicide with a penetrant oil and applies the mixture directly to the bark of a standing tree. For trees that are less than 6-inches in diameter and have smooth bark, this method is frequently successful. However, it is important that the lower 12 to 18 inches of the stem be treated on all sides with the herbicide/oil mixture (Figure 2). Adequate coverage is essential, since treating only one side of the stem will result in controlling only half of the tree. Basal applications can be made any time of the year, but are most effective during the dormant season when leaves are not present.

Basal applications will not provide rapid control. Herbicide injury is often not observed for several weeks after treatment and total control may require several months. Additionally, basal treatment is not effective on older trees with thick bark. For older trees, other application techniques should be employed.

Figure 2. Basal bark application with herbicide/oil mixture.

Hack and Squirt

The hack-and-squirt technique is ideal for control of large trees that cannot be managed with basal applications. This method requires that you use a small ax, machete, or hatchet to cut through the thick bark and into the sapwood.

When hacking, it should be done in a downward motion, leaving a "cup" to hold the herbicide solution. If the cut does not hold herbicide solution, it will leak out and become ineffective. After hacking the entire circumference of the tree, 1 squirt (approximately 1 ml) should be placed in each cut (Figure 3). The addition of a basal oil is not required for this procedure.

This method of application is advantageous because it is highly selective and injury to surrounding species is not common. It can also be done at any time during the year, but treatment of some species in the spring can be reduced due to heavy sap flow pushing the herbicide from the cut surfaces. Rainfall soon after application will also wash the herbicide away and limit uptake.

Figure 3. Hack-and-squirt application technique.

Cut stump

This technique is employed after cutting a tree to eliminate, or greatly reduce, resprouts from the cut surface. The herbicide should be applied to the cut surface as quickly as possible, after the sawdust has been removed. If applied immediately, a herbicide/water solution is sufficient. If herbicide treatment is delayed and the cut surface has begun to dry, a herbicide/basal oil mixture must be used and applied to the top and around the collar of the stump.

For stumps greater than 3 inches in diameter, thoroughly wet the outer edge while avoiding herbicide runoff (Figure 4). This is because the only living tissue in larger trees is around the outer edge. Covering the entire cut surface will require more herbicide, most of which will provide little effect. For smaller stems it is appropriate to cover the entire cut surface (Figure 5). For this procedure, herbicides can be applied using a backpack sprayer, squirt bottle, or paint brush. Regardless of how the herbicide is applied, a tracer dye should be included to ensure treatment of all individual stumps.

Figure 4. Application of herbicide to larger cut stumps only requires treatment of the outer edge.

Figure 5. Application of herbicide to smaller stumps requires complete coverage.

Soil Spots

This procedure is particularly useful when attempting to reclaim an area with a high density of small stems. This practice can also be used to remove individual specimens, but soil spotting is not as selective as other techniques and must be done with caution if desirables are in the vicinity of the application.

In areas with high stem density, herbicides should be applied as thin streams (not broadcast) on a grid pattern. The application rate and size of the grid depend on the soil texture and species composition. For fencerows, a single band may be applied, but larger stems should be treated individually to ensure control. See individual herbicide labels for instructions.

Soil spotting requires that the herbicide be taken up by the roots in order to be effective. Therefore, only soil active herbicides (imazapyr, hexazinone, tebithiuron) can be used for this type of application. In Florida, treatments should be made in mid-summer, when rainfall events are common, to ensure root uptake. Soil spotting is often a slow process

that may require multiple years to fully control some species. Highly susceptible species will be removed quickly, but those with higher tolerance can often endure several defoliation cycles before complete control is realized.

Table 1. Recommended herbicides for each application procedure.

Herbicide	Application Rate	Comments
Foliar Application		
Imazapyr (Arsenal)	1 – 3%	Excellent control of sweetgum and maples. Use higher rates for oaks and cherry. A non-ionic surfactant is required.
Glyphosate (Several)	5 - 8%	Cover as much of the foliage as possible and spray until wet. If the brush has been cut, delay application for approximately 1 year. Retreatment is commonly required control.
triclopyr + 2,4-D (Crossbow)	1 - 1.5%	For control of various herbacious and woody species. This product contains 2,4-D ester precautions to manage drift must be employed. Repeat applications are often required.
Triclopyr (Remedy or Garlon)	0.5-2%	Best when applied in late spring or early summer. If the brush has been cut, delay application for approximately 1 year. Thoroughly wet all leaves, but not to the point of runoff.
Triclopyr + fluroxypyr (Pasturegard)	3 - 8 pt/A	
Basal Bark		
Imazapyr (Stalker)	8-12 oz/gal	Best for trees less than 4 inches DBH*. Be aware that imazapyr is highly active in the soil. If desirables are near to a treated individual, it is possible for the herbicide to wash off into the soil and injure or kill the desirable.
Triclopyr (Pathfinder)	100%	Pathfinder is a "Ready to use" product that is formulated and dosed correctly for this type of application. Apply Pathfinder at 100% strength as directed.
Triclopyr (Remedy Ultra or Garlon Ultra)	25% + 75% basal oil	Best for trees less than 6 inches DBH. Generally most effective 6 weeks prior to leaf expansion, until 2 months after. Most effective on trees with smooth bark. Thick bark trees may require retreatment. These herbicides have little or no soil activity.
Triclopyr + fluroxypyr (Pasturegard)	50% + 50% basal oil	
Hack-and-Squirt		
Imazapyr (Arsenal AC)	6 oz/gal	One hack per 3 inches DBH.
Triclopyr (Garlon 3A)	50%	One hack per 3 or 4 inches DBH. Apply 0.5 ml undiluted herbicides or 1 ml of 50% solution in water.
Hexazinone (Velpar)	100%	One hack per 4 inches DBH. Use undiluted herbicide.
Glyphosate (several)	50%	1 ml per 2 or 3 inches DBH, applied below the branches. For larger trees, best results are observed from applying glyphosate in a continuous frill around the stem.
Cut Stump		
Imazapyr (Arsenal AC or Stalker)	6 oz/gal (for Arsenal AC) or 8-16 oz/gal (for Stalker)	Apply to the top and side of a freshly cut stump. Garlon 3A is excellent for this use. If surface of stump has began to dry prior to herbicide treatment, apply Chopper, Garlon 4, Remedy or Pasturegard in basal oil - or recut the stump and apply the freshly cut surface. Garlon 3A will not effectively mix with basal oils.
Triclopyr (Garlon 3A)	50 - 100% in water	
Triclopyr (Remedy Ultra or Garlon Ultra)	25% solution in water or basal oil	
Triclopyr + fluroxypyr (Pasturegard)	50% solution in water or basal oil	
Glyphosate (several)	50-100%	Apply to cut stumps immediately after cutting. Glyphosate is not effective on stumps that have started to dry after cutting. If immediate treatment is not possible, other herbicides should be selected since glyphosate will not mix with basal oils.
Soil Spot		
Hexazinone Velpar	100%	**Individual plants.** Use 2-4 ml of undiluted herbicide per 1 inch DBH. Apply within 3 ft of root collar. If more than 4 ml is required, apply as evenly spaced spots around the stem. **Grid**. See label for specifics on soil conditions.

Herbicide	Application Rate	Comments
Tebithiuron (Spike 20P)	2.5 to 20 lb/A (20P)	Control is rate- and species-specific. See label for control of specific species. Tebithiuron will move in water, so only apply in areas were runoff will not carry the herbicide to desirable species. Spike 20P is restricted to certain Florida counties, so consult product label before use.
* Diameter at breast height		

SS-AGR-44

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Efficacy of Herbicide Active Ingredients Against Aquatic Weeds[1]

K. Langeland, M. Netherland, and W. Haller[2]

Only those herbicide products that are registered for application directly to water by the U.S. Environmental Protection Agency (EPA) and the Florida Department of Agriculture and Consumer Services (FDACS) may be used in Florida to control weeds growing in water. Active ingredients that are contained in aquatic herbicide products may also be present in products that are not approved for aquatic uses. However, it is not legal to apply an herbicide directly to water unless the herbicide label has specific instructions for application to water. Label instructions for aquatic use may restrict the use of water for a given period of time for various purposes, including, for some examples, irrigation and mixing agricultural sprays, domestic use, recreational use, watering livestock, or consuming fish from treated water.

It is legal to use a herbicide for attempting to control a plant species that is not listed on the label as long as the product is labeled for the site. A permit from the Florida Department of Environmental Protection is required for control of weeds in public waters and waters with multiple ownership.

Table 1 is a quick reference to the effectiveness of herbicide active ingredients for controlling common aquatic weeds. Sensitivity of the target weed to the active ingredient is only one consideration in choosing the appropriate herbicide product. Other factors that may be important in such a decision include water uses, other plant species present, toxicity to fish and other organisms, and additives in individual products. These considerations, as well as other important aspects of aquatic weed control, are discussed more fully in other publications. *Aquatic Pest Control Applicator Training Manual* is available from the IFAS Extension Book Store (800/226-1764, http://IFASbooks.ufl.edu). Weed Control in Florida Ponds, EDIS Circular 707, is available at the following Web site: http://edis.ifas.ufl.edu/AA238.

Specific product information should be obtained by consulting the product labels; label instructions must be followed for any lawful herbicide application.

1. This document is SS-AGR-44, one of a series of the Agronomy Department, Florida Cooperative Extension Service, Institute of Food and Agricultural Sciences, University of Florida. Original publication date, September 2006. Original authors included T. Koschnick, formerly a research assistant professor, Agronomy Department. This publication was revised in June 2009. Visit the EDIS Web site -- http://edis.ifas.ufl.edu.

2. Ken Langeland, professor, Agronomy Department, Center for Aquatic and Invasive Plants; Michael Netherland, courtesy associate professor, Center for Aquatic and Invasive Plants, and William Haller, professor, Agronomy Department, and acting program director, Center for Aquatic and Invasive Plants, Florida Cooperative Extension Service, Institute of Food and Agricultural Sciences, University of Florida, Gainesville, FL.

Anyone who applies herbicides commercially or for a public agency should be licensed as a Restricted Use Pesticide (RUP) applicator. Information pertaining to RUP applicator training and licensing can be obtained from your County Cooperative Extension Service office. It is recommended that private pond owners employ a reputable aquatic-plant-management company to maintain their pond(s). Individuals who choose to apply herbicides to their own ponds should attain a basic understanding of herbicide application and ecology through RUP certification training. (For more on this topic, see EDIS publication PI26, *Licensing of Aquatic Herbicide Applicators in Florida*, http://edis.ifas.ufl.edu/PI011.)

Some herbicide active ingredients are available in only one or a limited number of products, which are registered for aquatic use. Other such active ingredients are available in many different products. Some of these products are identical while others may differ in additives that can affect the performance of the active ingredient. Representatives for herbicide manufacturers and distributors can provide information on different products. Additionally, FDACS, Division of Agricultural Environmental Services (850/847-2130) maintains a list with reference to the active ingredients of all pesticide products registered for use in Florida (http://flpesticide.us). Specimen product labels can be obtained from the Crop Data Management Systems, Inc (http://www.cdms.net/manuf/manuf.asp) or from manufacturer representatives or their Web sites.

Table 1. Effectiveness of Herbicide Active Ingredients for Aquatic Weed Control

	Endothall		Diquat	2,4-D		Copper[1]	Fluridone[2]	Glyphosate	Imazapyr	Triclopyr	Carfentrazone	Penoxsulam[2]	Imazamox	Hydrogen peroxide
	Aquathol	Hydrothol		Granular	Liquid									
FLOATING														
Duckweed	*[2]	*	G	*	F	*	E	*	*	*	*	E	*	*
Watermeal	*	*	*	*	*	*	F	*	*	*	F	G	*	*
Water fern	*	*	E	*	*	*	E	*	*	*	E	E	*	*
Mosquito fern	*	*	E	*	*	*	E	*	*	*	E	E	*	*
Water hyacinth	*	*	E	*	E	F	*	G	E	E	F	E	E	*
Water lettuce	*	*	E	*	*	F	*	F	E	*	E	E	G	*
Frog's bit	*	*	E	*	*	*	*	*	E	F	*	E	E	*
Alligatorweed	*	*	*	*	F	*	*	G	E	G	*	F	E	*
SUBMERSED														
Bladderwort	F	F	G	F	*	*	G	*	*	*	*	F	*	*
Brazilian elodea	*	*	E	*	*	E	G	*	*	*	*	G	*	*
Coontail	E	E	E	G	*	*	E	*	*	F	*	*	*	*
Hydrilla	E	E	E	*	*	G	E	*	*	*	*	E	G	*
Parrotsfeather	E	E	G	F	*	*	F	*	*	G	*	G	F	*
Pondweed	E	E	G	*	*	G	F[4]	*	*	*	*	E[4]	G	*
Slender naiad	E	E	E	*	*	G	E	*	*	*	*	F	*	*
Southern naiad	G	G	E	*	*	G	G	*	*	*	*	E	*	*
Proliferating spikerush	*	*	*	*	*	*	F	*	*	*	*	F	*	*
Variable leaf milfoil	G	G	G	E	*	*	G	*	*	E	*	G	G	*
EMERSED														
American lotus	*	*	*	G	*	*	*	G	G	E	*	*	E	*
Cattail	*	*	G	*	*	*	F	E	E	*	*	*	E	*
Fragrant waterlily	*	*	*	E	*	*	G	E	E	G	*	F	E	*
Soft rush	*	*	*	F	F	*	*	G	E	*	*	*	*	*
Spadderdock	*	*	*	E	F	*	G	E	E	F	*	F	E	*
Water pennywort	*	*	F	G	G	*	*	E	E	G	*	E	E	*
Torpedograss[4]	*	*	*	*	*	*	*	E	E	*	*	*	*	*
ALGAE														
Macrophytic	*	F	F	*	*	F	*	*	*	*	*	*	*	*
Filamentous	*	G	G	*	*	G	*	*	*	*	*	*	*	*
Planktonic	*	*	*	*	*	G	*	*	*	*	*	*	*	G

[1] Copper can be applied with diquat at a rate of 2 lb metallic copper and 4lb diquat cation for difficult-to-control species, such as hydrilla.

[2] Submersed plants absorb fluridone and penoxsulam very slowly, and their efficacy is highly dependent on concentraion and contact time.

[3] * = Not recommended; G = Good; F = Fair; E = Excellent

[4] Certain species, such as *Potamogeton illinoensis,* are relatively tolerant to fluridone while others, such as *P. nodosus,* are sensitive.

[5] Re-growth occurs from underground plant parts and repeat applications are necessary.

SS-AGR-108

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Single-nozzle Backpack or ATV Sprayer Calibration[1]

B.A. Sellers, J.A. Ferrell, and G. E. MacDonald[2]

Many growers have isolated patches of weeds that should be controlled to prevent their spread. In this case, spot spraying with a herbicide would be the most economically feasible approach. Some herbicide labels allow for spot-treatments. However, the recommended amount is often given in % volume of herbicide per volume of water, or a certain amount of herbicide per 1,000 square feet.

Before adding any herbicide to the spray tank, it is extremely important that the output of the sprayer is known. That is, it must be properly calibrated. This allows for reduced herbicide costs and optimum weed control. A simple calibration test for a single-nozzle backpack or ATV sprayer is shown in Table 1. No math is required for this calibration and the end result is a known output volume for your sprayer in gallons per acre (GPA).

Hints for calibration:

- Keep speed constant. This will ensure that you are walking the same speed at all times.
- Keep the nozzle at the same height at all times--a height that is comfortable.
- Modify the wand by adding a pressure gauge. Try to keep the pressure as constant as possible. Do not let the pressure fall below 10 psi.

Next the amount of herbicide to be added to the spray tank needs to be calculated. To do this multiply the amount of herbicide needed for 1 gallon by the number of gallons in the spray tank.

Example: A sprayer is calibrated with an output of 40 GPA and the tank holds 10 gallons. If the desired herbicide rate is 1 quart per acre, from Table 2, the amount of herbicide for 1 gallon of water is 4.75 tsp. Since the spray tank holds 10 gallons, 40.75 (41) tsp are needed, which is approximately equal to 7 fl oz.

Useful Conversions:

1 teaspoon = 0.17 fl oz

1 tablespoon = 0.5 fl oz

3 teaspoons = 1 tablespoon

1 pint = 16 fl oz = 32 tablespoons = 2 cups

1. This document is SS-AGR-108, one of a series of the Agronomy Department, Florida Cooperative Extension Service, Institute of Food and Agricultural Sciences, University of Florida. Original publication date January 2006. Reviewed: November 2006 and April 2010. Visit the EDIS Web Site at http://edis.ifas.ufl.edu.

2. B.A. Sellers, assistant professor, Range Cattle Research and Education Center--Ona, FL; J. A. Ferrell, assistant professor, Agronomy Department; and G. E. MacDonald, associate professor, Agronomy Department; Florida Cooperative Extension Service, Institute of Food and Agricultural Sciences, University of Florida, Gainesville, FL 32611.

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

Table 1. A no-math method for calibrating single-nozzle backpack or ATV wand sprayers for spot spraying herbicides.

Step 1	Measure a calibration plot that is exactly 18.5 feet by 18.5 feet.			
Step 2	Spray the calibration plot uniformly with water. Repeat 3 times and record the average number of seconds needed to spray the entire plot.	Time Required	____	seconds
Step 3	Spray into a clean bucket for the amount of time recorded in Step 2.			
Step 4	Measure the number of ounces of water in the bucket.	Volume Sprayed	____	Ounces
Step 5	The number of ounces collected from the bucket is equal to the number of gallons per acre the sprayer is delivering.	Output Volume	____	Gallons/Acre
Step 6	Determine the volume of the spray tank.	Tank Volume	____	gallons
Step 7	Determine the amount of herbicide to add to the tank from Table 2.	Herbicide/Acre	____	tsp, tbsp, mL, oz, cups

Table 2. Amount liquid herbicide to add to 1 gallon of water. Abbreviations: tsp=teaspoon, fl oz=fluid ounces.

Volume (GPA)	**Recommended Herbicide Rate per Acre**				
	1 pint	**1 quart**	**2 quarts**	**3 quarts**	**4 quarts**
20	5 tsp	10 tsp	3.25 fl oz	4.75 fl oz	6.33 fl oz
30	3 tsp	6 tsp	2 fl oz	3.25 fl oz	4.25 fl oz
40	2.33 tsp	4.75 tsp	1.66 fl oz	2.33 fl oz	3.25 fl oz
50	2 tsp	3.75 tsp	1.25 fl oz	2 fl oz	2.5 fl oz
60	1.66 tsp	3.25 tsp	6.33 tsp	1.66 fl oz	2 fl oz
70	1.33 tsp	2.75 tsp	5.5 tsp	1.33 fl oz	1.75 fl oz
80	1.25 tsp	2.33 tsp	4.75 tsp	7.25 tsp	9.5 tsp
90	1 tsp	2 tsp	2.25 tsp	6.33 tsp	8.5 tsp
100	1 tsp	2 tsp	3.75 tsp	5.75 tsp	7.66 tsp

UF UNIVERSITY of FLORIDA
IFAS Extension

EENY-547

Air Potato Leaf Beetle (Suggested Common Name), *Lilioceris cheni* Gressitt and Kimoto (Insecta: Coleoptera: Chrysomelidae: Criocerinae)[1]

Ted D. Center and William A. Overholt[2]

Introduction

Air potato (*Dioscorea bulbifera* L., Dioscoreaceae) is a herbaceous, perennial twining vine that attains lengths of 20 m or more, rendering it capable of climbing over and smothering native vegetation (Schmitz et al. 1997, Overholt et al. 2008, Figure 1).

The native range of air potato includes much of Asia and Africa, and recent molecular evidence suggests that air potato in Florida originated from China (Croxton et al. 2011). Air potato was introduced to Florida in 1905 when it was sent to the USDA by Henry Nehrling, who later noted its invasive potential (Morton 1976). It has since become extremely aggressive (Hammer 1998). By the 1980s, air potato vines were growing in thickets, waste areas, and hedges or fencerows in many parts of south and central Florida (Bell and Taylor 1982). By 1999, air potato was recognized as an invasive exotic that alters plant communities by displacing native species, changing community structure, and disrupting ecological functions (FLEPPC 2003). A leaf feeding beetle, *Lilioceris cheni,* was recently introduced into Florida from China for biological control of air potato.This article provides information on the distribution, appearance, life cycle, host range and importance of the beetle.

Figure 1. Air potato infestation at Snyder Park in Fort Lauderdale. Credits: Ted D. Center, USDA/ARS Invasive Plant Research Laboratory, Fort Lauderdale, FL.

Distribution

The air potato leaf beetle is native to Asia. Country records include China, India, Nepal, Laos, and Thailand (Kimoto and Gressitt 1979, Tishechkin et al. 2011). The beetle was first released in Florida in 2012 for biological control of air potato.

1. This document is EENY-547, one of a series of the Entomology and Nematology Department, Florida Cooperative Extension Service, Institute of Food and Agricultural Sciences, University of Florida. Original publication date January 2013. Visit the EDIS website at http://edis.ifas.ufl.edu.

2. Ted D. Center, research leader, USDA-ARS Invasive Plant Research Laboratory; William A. Overholt, professor, Indian River Research and Education Center, Fort Pierce, Florida.

Description

Adult

Lilioceris cheni adults are about 9 mm long and 4 mm wide. The color of the elytra ranges from brown to orange or red, and the abdomen, thorax, head, and legs are black. The beetle is elongate, with a rectangular-shaped abdomen, a thorax about half as wide as the abdomen, and a narrow head with bulging eyes. The shape somewhat resembles a square violin with a short neck (Figure 2).

Figure 2. Adult *Lilioceris cheni*. Credits: Ted D. Center, USDA/ARS Invasive Plant Research Laboratory, Fort Lauderdale, FL.

Egg

Pale white, oblong and about 1 mm in length. Eggs become yellowish as the embryo develops (Figure 3) and hatch after four days.

Figure 3. *Lilioceris cheni* eggs. Credits: Melissa C. Smith, USDA/ARS Invasive Plant Research Laboratory, Fort Lauderdale, FL.

Larva

There are four larval instars. First instars are yellowish to reddish (Figure 4), and later instars are grayish to reddish, with black legs, head capsule, and prothoracic shield (Figure 5). Larvae are often covered with a sticky secretion to which fecal material adheres.

Figure 4. *Lilioceris cheni* first instar. Credits: Gloria L. Witkus, USDA/ARS Invasive Plant Research Laboratory, Fort Lauderdale, FL

Figure 5. *Lilioceris cheni* late instar larva Credits: Melissa C. Smith, USDA/ARS Invasive Plant Research Laboratory, Fort Lauderdale, FL.

Pupa

Fully grown larvae enter the soil and produce a whitish oral secretion that hardens into a foam-like cocoon that is about 7 mm in length. Pupation occurs gregariously, often with several pupae clumped together within a matrix of the foam-like material that becomes covered with soil and other substances (Figures 6 and 7).

Figure 6. *Lilioceris cheni* pupal aggregation covered with soil particles. Credits: William A. Overholt, UF/IFAS Indian River Research and Education Center, Fort Pierce, FL.

Figure 7. *Lilioceris cheni* pupa within a partially removed cocoon. Credits: Gloria L. Witkus, USDA/ARS Invasive Plant Research Laboratory, Fort Lauderdale, FL

Life Cycle and Biology

Females deposit pale white, oblong eggs in loosely aggregated clusters on the undersides of young, expanding leaves of air potato. The process of oviposition apparently deforms the expanding leaf causing it to curl at the edges becoming cup-like around the eggs (Figure 8).

Figure 8. A deformed expanding air potato leaf. Credits: Ted D. Center, USDA/ARS Invasive Plant Research Laboratory, Fort Lauderdale, FL.

Females deposit more than 1200 eggs on average during their lifetime. The eggs become yellowish as the embryo develops, and dark reddish eye spots appear mid-way through the incubation period. Embryonic development requires about four days. Larvae feed gregariously and skeletonize the leaves from the underside (Figures 9).

Figure 9. An aggregation of late instar *Lilioceris cheni* larvae skeletonizing air potato leaves.

Young tender leaves are preferred but they also consume older, tougher leaves and are able to feed on the aerial bulbils. Complete development of the four instars requires about eight days, with each stage lasting about two days. When fully grown, larvae descend from the host plant and enter the soil where they produce a whitish oral secretion that hardens into a foam-like cocoon. Pupation occurs gregariously, often with several pupae clumped together within a matrix of this material. Adults emerge in 12 to 16

days, begin mating after about 10 days, and initiate oviposition five days later. The adults live for five months or longer. Both adults and larvae feed on the foliage.

Larvae can often be found in aggregations on the growing tips of air potato vines. The host plant senesces during the winter, forcing the adult beetles to go several months without food, presumably in diapause beneath leaf litter and other debris. The overwintered adults emerge in the spring, and females begin laying eggs.

Host

Extensive host range testing by scientists at the USDA/ARS Invasive Plant Research Laboratory in Fort Lauderdale demonstrated that the air potato leaf beetle is a specialist feeder on air potato. It will not complete development on any other plant found in Florida and is only known to feed on *Dioscorea bulbifera* in its native range (Pemberton and Witkus 2010).

Importance

Larvae and adults of the air potato leaf beetle consume leaf tissue and occasionally feed on bulbils, thereby negatively affecting plant growth and reproduction. Damage to growing tips inhibits vine elongation and may reduce the ability of air potato to climb vertical structures. At initial release sites, extensive damage to air potato was evident within three months after the first release.

Although it is too early to determine the long-term impacts of the beetle on air potato, initial results are very promising. If you think you have found this beetle in your area, please send a photograph for identification along with locality data (GPS coordinates preferred) to Paul.Pratt@ars.usda.gov and we will add this information to our locality map.

Selected References

Bell CR, Taylor BJ. 1982. Florida Wild Flowers and Roadside Plants. Laurel Hill Press, Chapel Hill, N.C.

Croxton MD, Andreu MA, Williams DA, Overholt WA, Smith JA. 2011. Geographic origins and genetic diversity of air-potato (*Dioscorea bulbifera*) in Florida. Invasive Plant Science and Management 4: 22-30.

FLEPPC Plant List Committee. 2003. Florida Exotic Pest Plant Council's 2003 list of invasive species. (27 August, 2012).

Hammer RL. 1998. Diognosis: *Dioscorea*. Wildland Weeds 2: 8-10.

Kimoto S, Gressitt JL. 1979. Chrysomelidae (Coleoptera) of Thailand, Cambodia, Laos and Vietman. I. Sagrinae, Donaciinae, Zeugophorinae, Melapodinae and Criocerinae. Pacific Insects 20: 191-256.

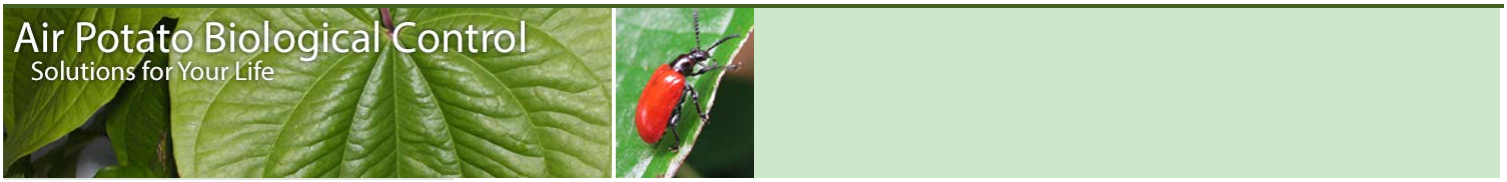
Morton JF. 1976. Pestiferous spread of many ornamental and fruit species in south Florida. Proceedings Florida State Horticultural Society 89: 348-353.

Overholt WA, Markle L, Meisenburg M, Raz L, Wheeler G, Pemberton R, Taylor J, King M, Schmitz D, Parks GR. 2008. Air Potato Management Plan. Florida Exotic Pest Plant Council. (27 August, 2012).

Pemberton RW, Witkus GL. 2010. Laboratory host range testing of *Lilioceris* sp. near *impressa* (Coleoptera: Chrysomelidae) - a potential biological control agent of air potato, *Dioscorea bulbifera* (Dioscoreaceae). Biocontrol Science and Technology 20: 567-587.

Schmitz DC, Simberloff D, Hofstetter RL, Haller WT, Sutton D. 1997. The ecological impact of nonindigenous plants, pp. 39-61. *In* Simberloff D, Schmitz DC, Brown TC (editors), Strangers in Paradise: Impact and Management of Nonindigenous Species in Florida. Island Press, Washington, D.C. 467 pp.

Tishechkin AK, Konstantinov AS, Bista S, Pemberton RW, Center TD. 2011. Review of the continental Oriental species of *Lilioceris* Reitter (Coleoptera, Chrysomelidae, Criocerinae) closely related to *Lilioceris impressa* (F.). ZooKeys 103: 63-83.



Air Potato - How Biological Control Works

Learn about the research and control methods being developed to fight this invasive plant. **More**...

Identifying Air Potato

Learn how to identify air potato. **More...**

Meet the Air Potato Leaf Beetle

Learn about the recognition, basic biology, host specificity and ecology of this biological control agent. **More...**

Air Potato Beetle Release Program

Land managers and home owners now are realizing the need to remove and stop the spread of air potato. **More**...

Air Potato Biological Control in the News

Find air potato biological control in the news. **More...**

How to Obtain Air Potato Leaf Beetles

Please complete the application for air potato leaf beetles for release on your property. **More**...

Solutions for Your Life

UF/IFAS Extension maintains an easy-to-use, comprehensive Web site, **Solutions for Your Life**.

Resources

St Lucie County Cooperative Extension Bitly for twitter: http://bit.ly/V1LBFc

Air Potato Vine (*Dioscorea bulbifera*) Infestation Site Record/ Air Potato Leaf Feeding Beetle (*Lilioceris cheni*) Request Form

Data Collector's Information

Date:

Name:

Organization:

Phone:

Email:

Infestation Site Information

Location

County:

City/Town:

Address or Park/Preserve Name (please include for all residential areas):

Property Owner/Land Manager:

Land Type (residential, park, conservation area, etc):

Habitat Type (pinewoods, hardwoods, swamp, etc):

GPS Coordinates (use Map Datum WGS 84; decimal degrees: hddd.ddddd) example: 29.03444, -81.62561

Latitude: Longitude:

Size/Density

Approximate total size of the air potato vine infestation:

Percent of the total area (above) covered by air potato vines (0-100%):

Directions to site / other remarks:

Please send data sheets to: **Dr. Eric Rohrig**
Email: Eric.Rohrig@freshfromflorida.com
Fax: 352-395-4624
Phone: 352-395-4744
Florida Department of Agriculture - Division of Plant Industry
1911 SW 34th Street
Gainesville, Florida 32608

Old World Climbing Fern (*Lygodium microphyllum*)

Old World climbing fern is a non-native vine that is rapidly invading flatwoods, and hardwood and cypress swamps of southern and central Florida, and it is moving north. Since 1993, the area infested in Florida has grown to nearly 210,000 acres. (A related species, Japanese climbing fern - *Lygodium japonicum*- is spreading south into central Florida, from the north.) Old World climbing fern smothers plants, including understory and canopy trees, and it creates thick mats of plant material on the ground. It is flammable and carries fire into the canopy and across wetlands. Land managers and property owners should be vigilant for these weeds. Early detection and elimination can significantly reduce control costs and efforts.

Lygodium microphyllum ***plant growing up the base of a small tree (the portion shown is about 2' high).***

Find it . . .

How to Identify Old World Climbing Fern: Ferns never have flowers; they reproduce by spores. Fern spores are nearly invisible and easily spread by wind. When the plant is fertile, the spores are on some of the leaflets, which means that at different times a plant can have two leaflet forms: "sterile" and fertile. When fertile (at left on the picture below), the edges of the leaflets are fringed with tiny lobes of in-rolled leaf tissue that cover the spore-containing structures. When sterile, the leaflets are oblong or lance-shaped, and slightly heart-shaped at the base where the stalk connects. Many leaflets make up a leaf, which is 2-5 inches long, and many leaves make up the "frond." A frond can grow and twine to 120 feet long. The above-ground stem is dark brown and wiry, and quickly forms thick horizontal and vertical mats.

Lygodium microphyllum ***leaflets—on the left are the fertile ones; the spores are along the edges.***

Where to Look: Old World climbing fern most commonly occurs in moist habitats, but also grows in shallow water and dry areas. Cypress wetlands, tree islands, floodplains, wet prairies, marshes, hammocks, edges of waterways, roadside ditches, and disturbed corridors are common habitats. Old World climbing fern has been found in Hillsborough, Polk, Lake, Seminole, and Volusia Counties, and south to the Keys. Because it produces millions of spores that spread by wind, water, and even animals, people and equipment, new infestations can arise great distances from existing populations.

. . . Report it . . .

If you think you have this plant on your property, please contact the Central Florida Lygodium Strategy (CFLS) or the University of Florida's Institute of Food and Agricultural Sciences (UF/IFAS). **For CFLS**, call Rosalind Rowe at 407.389.4803 or email rrowe@tnc.org, or go to www.nature.org/centralfloridainvasives. **For UF/IFAS**, call their Center for Aquatic & Invasive Plants at 352.392.1799, or go to plants.ifas.ufl.edu/education/whatisit.html.

Treating the lower portion of **L. microphyllum** *after performing a poodle cut.*

. . . Kill it.

The application of herbicide is the most common method of controlling Old World climbing fern. Cutting vines will result in death of the vines above the cut location, but will not kill the rooted portion of the plant. Regrowth will generally occur from roots, even after burning. Flooding does not kill established vines but seems to prevent germination of spores.

For small vines or low-growing patches: Pull out by the root, if possible, and dispose (see *Disposal* explained below), or spray the leaves until wet with a herbicide (see *Herbicides* instructions below).

For large patches climbing into trees: Cut the plant at waist height ("poodle cut"), using a stick to pull vines away from underlying vegetation that you do not want to damage. Cut enough of the plant so that you leave a gap of 10-12 inches between the upper and lower portions of the vine. The plant will die above the cut, although it may still release spores. Treat the remaining rooted portion of the plant with a herbicide as described below.

Herbicides: Spot treatments are usually made with a backpack sprayer or other hand-held sprayer. For best results, apply herbicides when plants are actively growing and not stressed by environmental conditions such as drought, flood or frost. Treat as much of the green parts of the plant as you can, spraying the leaves until wet. Use a herbicide that contains the active ingredient glyphosate (3-4 lb active ingredient per gallon) or metsulfuron methyl. Glyphosate products are usually applied at a concentration of 2.0% (volume of herbicide/volume of diluent). Metsulfuron methyl is applied at an equivalent of 2 oz of product (60% active ingredient) per 100 gal (0.6 g/gal). The two herbicides are also often applied together. Plants treated with glyphosate alone will begin dying within three weeks, while plants treated with metsulfuron methyl may take several months. If the ferns are in water or near water—where herbicide may end up directly in the water—you must use a product that is registered for use in aquatic sites.

In all cases, several treatments probably will be necessary. Whether you pull out the weed or treat it with herbicide, you will need to monitor for re-sprouts or new growth.

Remember: Federal law requires that anyone who applies a herbicide reads the entire label first and follows the label instructions. Also, most herbicides are not selective, so be careful to keep herbicide only on target plants!

Herbicides available at retail garden supply or agricultural supply stores

Products*	Active Ingredient	Dry Areas Only	Water Areas OK
Roundup Pro, GlyPro Plus, Glyphos	Glyphosate, 3lb/gal	X	
Touchdown Pro	Glyphosate, 3lb/gal		X
Rodeo, Accord, AquaMaster, GlyPro	Glyphosate, 4lb/gal		X
Excort XP	Metsulfuron methyl, 60% flowable powder	X	

*This is a sample, incomplete list of products available and reflects no preferences, guarantees or warranties for the items named.

Disposal: Remove fern material from your equipment and your shoes, and then bag clothing until it can be washed. Bag all pulled fern material prior to transport and seal tightly. Never use fen material for mulching or composting because spores may remain viable. Never discard Old World climbing fern in natural areas.

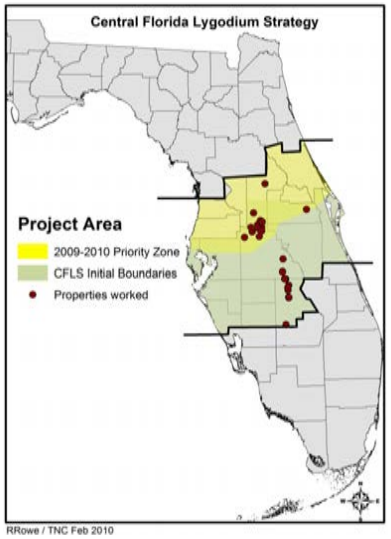
This flyer was paid for by a grant from the Florida Exotic Pest Plant Council (FLEPPC) Kathy Craddock Burks Education and Outreach Fund.

Other resources for photos and plant information include: 1) **www.fleppc.org** (and click *Plant Lists)*.; 2) **www.plantatlas.usf.edu** (and type *Lygodium* in the Search box); and 3) **http://edis.ifas.ufl.edu/AG122** for the publication "Natural Area Weeds: Old World Climbing Fern (*Lygodium microphyllum*)" by Kenneth A. Langeland

The Central Florida Lygodium Strategy

"Working Across the Fence Line"

What is the Central Florida Lygodium Strategy (CFLS)?



This is a project to detect and remove *Lygodium* species (invasive climbing ferns) on private lands, to stop its spread and prevent new infestations in central Florida. There are two species of climbing ferns now found in central Florida, Japanese climbing fern (*Lygodium japonicum*) and Old World climbing fern (*Lygodium microphyllum*). **In 2010, CFLS will focus on controlling Old World climbing fern in Lake, Orange, Seminole, Volusia, Pasco, and north Hillsborough and Polk Counties.**

Why should I care?

Old World climbing fern is advancing north from its infestations in south Florida. It threatens conservation habitat and private lands. This fern grows over and smothers *all* other plants, destroys wildlife habitat and working lands, and increases fire hazard intensity by carrying fire into tree canopies and into wetlands. Where this fern is left untreated, it continues to produce spores, spreads to new areas and re-infests treated areas.

Who is working on this problem?

The Nature Conservancy, in cooperation with twelve other public and private agencies, is working to implement the Central Florida Lygodium Strategy. Neighbors across public and private property fence lines are working together to prevent the continued northward spread of this climbing fern.

How can I help to rid my land of *Lygodium*?

Early and repeated treatment is necessary to control this weed. Learn how to identify it and how to kill it. Visit the CFLS website for more information on this (www.nature.org/centralfloridainvasives), or use the information below to contact staff at CFLS. Feel free to ask questions!

What type of assistance is available?

CFLS, through staff provided by The Nature Conservancy, will help you identify whether you have Old World climbing fern, and if you do, CFLS has funds to provide a professional contractor to treat infestations on your property with herbicide. In addition, CFLS can provide you with recommendations for follow-up treatments and for incentive programs that may be able to provide additional assistance. For more information, visit www.nature.org/centralfloridainvasives

How can I sign up?

Call or email Rosalind Rowe, (941) 320.4363 or (rrowe@tnc.org).

UF UNIVERSITY of FLORIDA
IFAS Extension

SS-AGR-52

Cogongrass (*Imperata cylindrica*) Biology, Ecology, and Management in Florida Grazing Lands[1]

B. A. Sellers, J. A. Ferrell, G. E. MacDonald, K. A. Langeland, and S. L. Flory[2]

Cogongrass is found on every continent and is considered a weedy pest in 73 countries. In the U.S., cogongrass is found primarily in the Southeast. It was accidentally introduced into Alabama in the early 1900s, and purposely introduced as a potential forage and soil stabilizer in Florida (and other states) in the 1930s and early 1940s. However, soon after investigations began it was realized that cogongrass could be a weedy pest. Since its introduction, cogongrass has spread to nearly every county in Florida. In some cases, it has completely taken over pastures so that it is the only species present. This is a common thread where cogongrass invades; it quickly displaces desirable species and requires intensive management.

There are many reasons why cogongrass is such a prolific invader. It is a warm-season, perennial grass species with an extensive rhizome root system. In fact, at least 60% of the total plant biomass is often found below the soil surface. In addition to the rhizome root system, cogongrass adapts to poor soil conditions, and its fires burn so hot that they eliminate nearly all native species. Cogongrass is drought tolerant and has prolific wind-dispersed seed production. Additionally, it can grow in both full sunlight and highly shaded areas, although it is less tolerant to shade.

Cogongrass spreads through its creeping rhizome system and seed production. The rhizomes can penetrate to a depth of 4 feet, but most of the root system is within the top 6 inches of the soil surface. The rhizomes are responsible for long-term survival and short-distance spread of cogongrass. Long-distance spread is accomplished through seed production. Seeds can travel by wind, animals, and equipment. Seed viability is significant in north Florida and other states of the Southeast; however, there are no confirmed cases of viable seed production in central and south Florida.

An established cogongrass stand invests heavily in its perennial root system. These infestations are capable of producing over 3 tons of root biomass per acre. This extensive network of rhizomes is capable of conserving water while the top growth dies back during prolonged drought. This is essentially a survival mechanism to keep the rhizome system alive. Another key to cogongrass invasion is that the root system may produce allelopathic chemicals that reduce the competitive ability of neighboring plants.

Identification

Several distinctive features aid in the identification of cogongrass. First, cogongrass infestations usually occur in circular patches. The grass blades tend to be yellow to

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2. B. A. Sellers, associate professor, Agronomy Department, Range Cattle Research and Education Center, Ona, FL; J. A. Ferrell, associate professor, Agronomy Department; G.E. MacDonald, professor, Agronomy Department; K. A. Langeland, professor, Agronomy Department; and S. L. Flory, assistant professor, Agronomy Department; Florida Cooperative Extension Service, Institute of Food and Agricultural Sciences, University of Florida, Gainesville, FL 32611.

Figure 1. Cogongrass plants are yellow to green in color. Note that the edges of the leaf tend to have more yellow than green.
Credits: G. Keith Douce, University of Georgia, www.forestryimages.org.

green in color (Figure 1). Individual leaf blades are flat and serrated, with an off-center prominent white midrib (Figure 2). The leaves reach 2–6 feet in height. The seed head (Figure 3) is fluffy, white, and plume-like. Flowering typically occurs in spring or after disturbance of the sward (mowing, etc.). Seed heads range from 2 to 8 inches in length and can contain up to 3,000 seeds. Each seed contains silky-white hairs that aid in wind dispersal. When dug, the rhizomes (Figure 4) are white, segmented (have nodes), and are highly branched. The ends of the rhizome are sharp pointed and can pierce the roots of other plants.

Forage Value

Cogongrass has been used in Southeast Asia as forage because it is the dominant vegetation on over 300 million acres. In these areas it was found that only very young shoots should be grazed or cut for hay. At this stage, the leaves lack sharp points and razor-like leaf margins. For about four weeks following a prescribed burn, crude protein of regrowth is comparable to bahiagrass. Crude protein of mature stands rarely attains the minimal 7% level needed to sustain cattle, making supplementation essential for livestock production. Cogongrass yields are relatively low, even under heavy fertilization, and usually do not exceed 5 tons per acre.

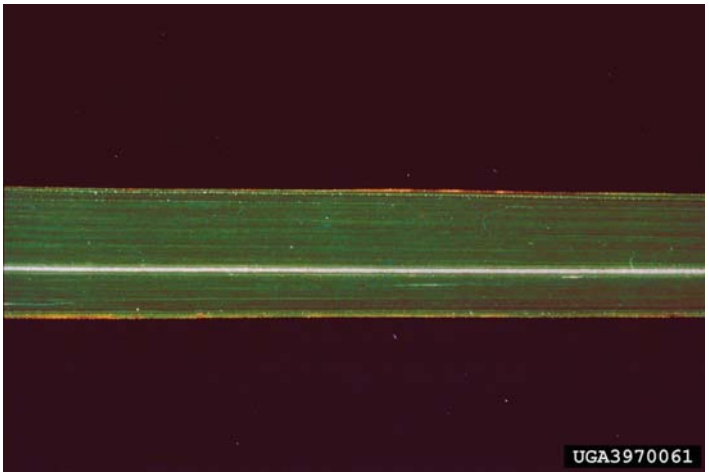

Figure 2. Cogongrass leaves have serrated edges and a prominent, white, off-center midrib.
Credits: L. M. Marsh, Florida Department of Agriculture and Consumer Services, www.forestryimages.org.

Figure 3. Cogongrass seed heads are fluffy and white. Each plant produces nearly 3,000 seeds.
Credits: John D. Byrd, Mississippi State University, www.forestryimages.org.

Management

For many years researchers all over the world have studied cogongrass control. During this time nearly all available herbicides have been tested, but few effective products have been found. For example, all of the commonly used pasture herbicides such as metsulfuron, 2,4-D, triclopyr, Velpar, and other combinations have little to no activity on cogongrass. Only glyphosate (Roundup, etc.) and imazapyr (Arsenal, Stalker, etc.) herbicides have been found to be effective, but long-term control is rarely achieved.

Imazapyr is an extremely effective herbicide that controls a variety of weeds, from herbaceous to woody species. One or two applications of imazapyr (0.75 lb/acre) will often effectively control cogongrass for 18–24 months. However, there are several disadvantages to using this herbicide. First, imazapyr will severely injure or kill forage grasses such as bermudagrass and bahiagrass. It also has a long soil half-life and will remain in the soil for several months after application. This often leads to "bare ground" for up to 6 months in the application area because of the non-selective nature of this herbicide. Imazapyr also has the potential to move down slopes during periods of rainfall, killing or injuring other species in the runoff area (oaks and other hardwood trees are especially sensitive). Second, imazapyr can only be used as a "spot-treatment" with no more than 10% of the pasture area treated per year.

Similarly, glyphosate is also a non-selective herbicide that effectively controls a variety of weeds. Unlike imazapyr, glyphosate possesses very little to no soil activity. Non-target effects caused by runoff during high rainfall events are not likely. Since glyphosate has no soil activity, it does not take very long for weeds or desirable grasses to reinfest the treated areas. Cogongrass will likely reinfest the area if only one application of glyphosate is applied during the same year. Research in Alabama has revealed that it takes approximately three years of two applications per year to reduce cogongrass rhizome biomass by 90%.

Small Infestations

Early detection of cogongrass in any setting is extremely important. A young infestation will be much easier to treat and eradicate than established infestations. In this case, we would define a small patch as 20–30 feet or less in diameter. Even for a small patch, monitoring is required after the initial application to ensure that any re-sprouting is quickly treated. See Table 1 for specific timelines and suggested herbicide rates.

Large Infestations

Large infestations are 30 feet or larger in diameter. These types of infestations can be considered as established and likely have a large, intact root system. This will require more herbicide treatments to completely eradicate cogongrass. See Table 2 for specific timelines and suggested herbicide rates.

Integrated Management

Herbicide inputs alone are rarely successful in eradicating perennial species like cogongrass. In these cases, we need to use all of the tools we have to remove an unwanted species to reestablish a desirable species. This type of strategy is best employed in an area where cogongrass has long been established and is the predominant species present. See Table 3 for specific timelines and suggested herbicide rates.

Figure 4. Cogongrass rhizomes are segmented (have nodes) where new shoots are able to grow.
Credits: Chris Evans, River to River CWMA, www.forestryimages.org.

In general, burn the area infested with cogongrass in August to September. One to four months later, treat the burned area with a mixture of imazapyr and/or glyphosate. Take soil samples prior to spring tillage the next growing season to ensure that the soil pH is adequate for your desirable forage species. Till the treated area the following spring to a depth of at least 6 inches and prepare a seedbed.

Consult with your local county Extension agent to consider your options for forage cultivars and fertility recommendations. Getting a good start on the desirable forage will help limit cogongrass reinfestations in your pasture. Continue to monitor this area in six-month intervals until the fourth year. Spot treat with glyphosate when necessary to remove any new cogongrass growth.

Table 1. Herbicide suggestions for small infestations of cogongrass in grazing areas. This includes both improved and native rangeland. These concentrations are good for mixing in small (3–30 gallon) sprayers. Please read the entire label of the suggested products prior to treating existing cogongrass stands.

	Timing	Herbicide Rate	Application Notes
1st year	Fall (August-November)	1% Arsenal/Stalker + 0.25% non-ionic surfactant	Treat only 10% of the area to be grazed. No grazing restrictions, but do not cut for hay for 7 days. Read the herbicide label for mixing instructions.
		3% glyphosate	No grazing or haying restrictions. Read the herbicide label for mixing instructions.
		0.5% Arsenal/Stalker + 2% glyphosate+ 0.25% non-ionic surfactant	Treat only 10% of the area to be grazed. No grazing restrictions, but do not cut for hay for 7 days. Read the herbicide label for mixing instructions.
2nd year	Spring (monitor regrowth)	2–3% glyphosate	See above.
	Fall (monitor regrowth)	2–3% glyphosate	See above.
3rd year – until eradicated	Spring – Fall (monitor regrowth)	Spot treat at the above rates for the 2nd year.	

Table 2. Herbicide suggestions for large cogongrass infestations in grazing areas, including both improved and native rangeland. These suggestions are intended for large (>1000 gallon) sprayers. Please read the entire label of the suggested products prior to treating existing cogongrass.

	Timing	Herbicide Rate	Application Notes
1st year	Fall (August-November)	48 oz/acre Arsenal/Stalker + 0.25% non-ionic surfactant	Treat only 10% of the area to be grazed. No grazing restrictions, but do not cut for hay for 7 days. Read the herbicide label for mixing instructions.
		3 to 4 qt/acre glyphosate	Do not graze for 8 weeks. Read the herbicide label for mixing instructions.
		24 oz/acre Arsenal/Stalker + 2 qt/acre glyphosate + 0.25% non-ionic surfactant	Treat only 10% of the area to be grazed. No grazing restrictions, but do not cut for hay for 7 days. Read the herbicide label for mixing instructions.
2nd year	Spring (monitor regrowth)	2–3% glyphosate	No grazing or haying restrictions.
	Fall (monitor regrowth)	2–3% glyphosate	No grazing or haying restrictions.
3rd year – until eradicated	Spring – Fall (monitor regrowth)	Spot treat at above rates for the 2nd year.	See above.

Table 3. Control of cogongrass using an integrated approach. Adjust your timelines based on your location in Florida. For example, burning should be performed earlier in north Florida than in south Florida because of the first onset of a potential killing frost. Please read all herbicide labels prior to treating cogongrass for restrictions and mixing instructions.

	Timing	Herbicide Rate	Application Notes
1st year	Summer – Fall (August-November)	1. Burn	Cogongrass fires burn extremely hot. Be sure to have firebreaks in place before attempting to burn cogongrass.
		2. Apply herbicide: 24 oz/acre Arsenal/Stalker + 2 qt/acre glyphosate + 0.25% non-ionic surfactant	Treat only 10% of the area to be grazed. No grazing restrictions, but do not cut for hay for 7 days. Read the herbicide label for mixing instructions.
		3. Take soil samples.	Have the soil pH tested at a reputable laboratory. Amend the soil as needed to grow desirable forage.
2nd year	Spring	1. Tillage	Prepare a seedbed for desirable forage species. Repeated tillage will help to desiccate any remaining cogongrass rhizomes.
		2. Plant desirable forage.	Please consult your local Extension agent for up-to-date recommendations on forage cultivars and fertility recommendations.
3rd year	Spring (monitor regrowth)	2–3% glyphosate	No grazing or haying restrictions.
	Fall (monitor regrowth)	2–3% glyphosate	No grazing or haying restrictions.
4th year – until eradicated	Spring-Fall (monitor regrowth)	Spot treat at the above rates for the 3rd year.	See above.

UF UNIVERSITY of FLORIDA
IFAS Extension

SS-AGR-17

Brazilian Pepper-tree Control [1]

Ken Gioeli and Ken Langeland[2]

Common Name: **Brazilian Pepper-tree**

Scientific Name: *Schinus terebinthifolius*

Family Name: Anacardiaceae, Sumac Family

Florida's natural ecosystems are being degraded by an invasion of non-native plants. This invasion is partially responsible for the declining numbers and quality of native biotic communities throughout Florida.

Brazilian pepper-tree is one of the most aggressive of these non-native invaders. Where once there were ecologically productive mangrove communities, now there are pure stands of Brazilian pepper-trees. Scrub and pine flatwood communities are also being affected by this invasion. Nearly all terrestrial ecosystems in central and southern Florida are being encroached upon by the Brazilian pepper-tree.

Land managers and home owners now are realizing the need to remove and stop the spread of Brazilian pepper-trees.

Figure 1. The Brazillian pepper-tree is an aggressive non-native invader that needs to be controlled throughout Florida.

HISTORY

Brazilian pepper-tree is a native of Argentina, Paraguay, and Brazil. It is thought to have been introduced into Florida around 1842-1849 as a cultivated ornamental plant. *Schinus* is the Greek word for mastic-tree, a plant with resinous sap, which this genus resembles. The species name *terebinthifolius* is a combination of the genus name *Terebinthus* and the Latin word *folia*, leaf. It refers to the leaves of Brazilian pepper-tree that resemble the leaves of species in the genus *Terebinthus*.

HABITAT

Brazilian pepper-tree is sensitive to cold temperatures, so it is more abundant in southern Florida and protected areas of central and north Florida. Brazilian pepper-tree

1. This document is SS-AGR-17, one of a series of the Agronomy Department, Florida Cooperative Extension Service, Institute of Food and Agricultural Sciences, University of Florida. Original publication date April 1997. Revised February 2009, May 2012. Visit the EDIS website at http://edis.ifas.ufl.edu.

2. Ken Gioeli, courtesy Extension agent I, St. Lucie County and Ken Langeland, professor, Agronomy Department, Florida Cooperative Extension Service, Institute of Food and Agricultural Sciences, University of Florida, Gainesville, FL 32611.

successfully colonizes native tree hammocks, pine flatlands, and mangrove forest communities.

IDENTIFICATION

Seedlings

The cotyledons are simple with both the apex and the base having an obtuse outline. The margin is generally curved inward on one side. The first true leaves are simple with a toothed margin (Figure 2). The later leaves are compound (Figure 3).

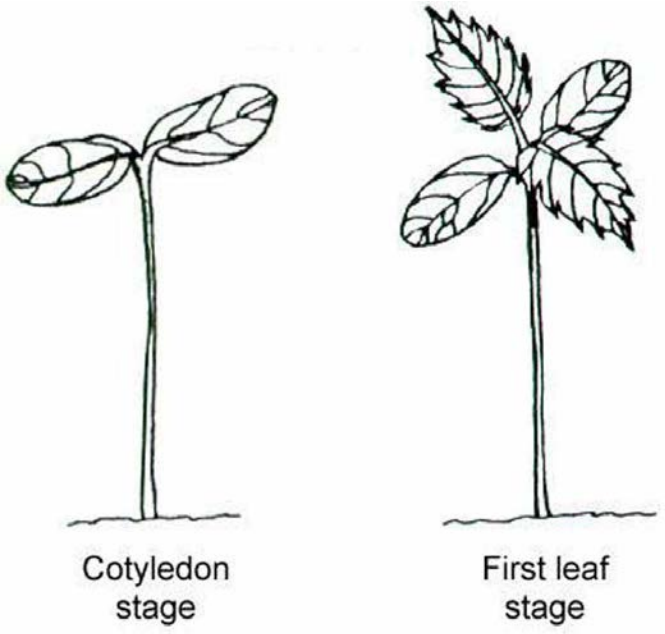

Figure 2. Brazilian pepper seedlings.

Mature Plant

Brazilian pepper-tree is a shrub or small tree to 10 m (33 ft) tall with a short trunk usually hidden in a dense head of contorted, intertwining branches. The leaves have a reddish, sometimes winged midrib, and have 3 to 13 sessile, oblong or elliptic, finely toothed leaflets, 2.5 to 5 cm (1 to 2 in) long (Figure 3). Leaves smell of turpentine when crushed. The plants have separate male or female flowers and each sex occurs in clusters on separate plants. The male and female flowers are both white and are made up of five parts with male flowers having 10 stamens in 2 rows of 5 (Figure 4). Petals are 1.5 mm (0.6 in) long. The male flowers also have a lobed disc within the stamens. The fruits are in clusters, glossy, green and juicy at first, becoming bright red on ripening, and 6 mm (2.4 in) wide. The red skin dries to become a papery shell surrounding the seed. The seed is dark brown and 0.3 mm (0.1 in) in diameter.

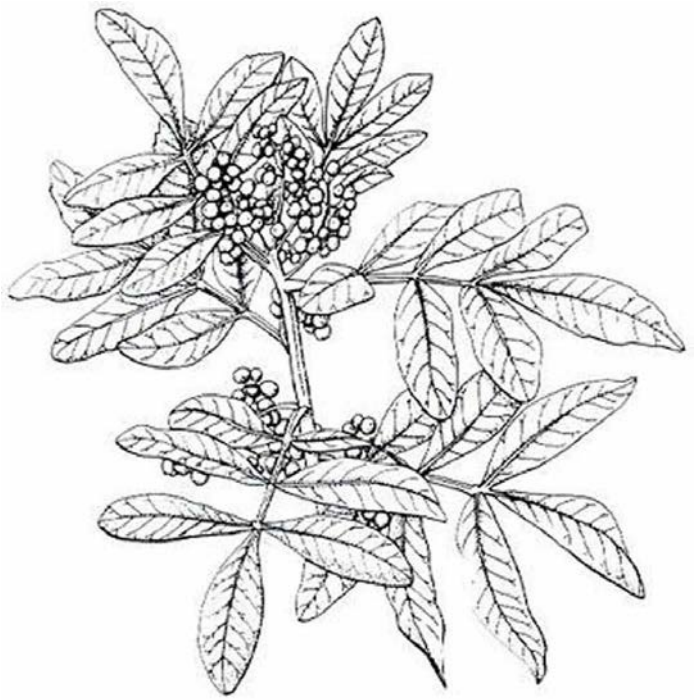

Figure 3. Leaves and fruits of mature Brazilian pepper-tree.

Figure 4. Male and female flowers of mature Brazilian pepper-tree.

Biology

Seedlings are flood-tolerant, but rapid change of water level up or down causes some mortality. About 20 percent of seedlings exposed to fire re-sprout. Flowering occurs predominantly from September through November. Male flowers last only 1 day. Female flowers last up to 6 days and are pollinated by insects. Fruits usually are mature by December. Birds and mammals are the chief means of seed dispersal. Seed viability is 30 to 60 percent and can last up to 2 months, but declines to 0.05 percent at 5 months. Many native species have a lower percentage of germination than *Schinus*. The high seed viability combined with animal dispersing agents may explain colonization by Brazilian pepper-tree in our native plant communities.

Seedlings have a high rate of survival and some can be found all year. Any break in the tree canopy can be

exploited by seedlings. Reproduction can occur 3 years after germination. Some trees can live for about 35 years.

CONTROL

Using Herbicides

Herbicides are available that aid in the control of Brazilian pepper-trees (Table 1). Only those herbicides that are recommended for Brazilian pepper-tree control should be used. They are safe and effective when used correctly. **It is illegal to use an herbicide in a manner inconsistent with the label's instructions; therefore, read the label carefully and follow the instructions.**

Herbicide Application to Cut-Stump

Brazilian pepper-trees can be controlled by cutting them down and treating the stumps with herbicide. A saw should be used to cut the trunk as close to the ground as possible. Within 5 minutes, an herbicide that contains the active ingredient 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 (Figure 5).

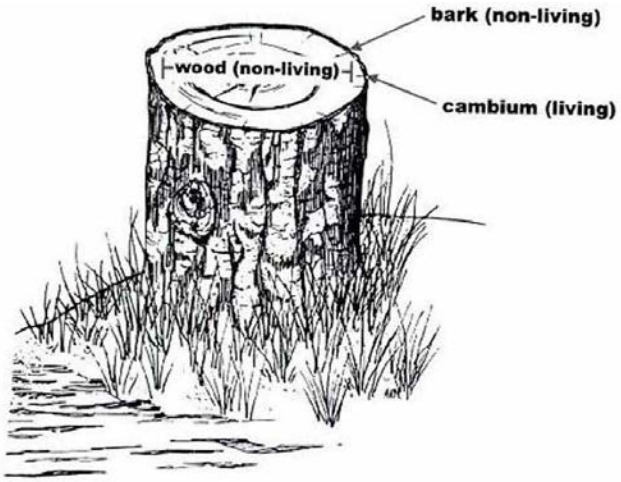

Figure 5. Brazilian pepper-tree stump showing location of the cambium layer.

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. If Brazilian pepper-trees that have fruits attached are cut, care should be taken not to spread the fruits to locations where they can cause future problems. Fruiting Brazilian pepper-trees can be controlled using a basal bark herbicide application. Information about basal bark herbicide applications is described in the next section.

Caution: Avoid touching the tree's cambium. A rash can result. Some individuals are very sensitive to touching only the leaves. Use proper protective gear when sawing the tree and applying the herbicides.

Basal Bark Herbicide Application

Brazilian pepper-trees can be controlled using basal bark herbicide application. An application of an herbicide product that contains triclopyr ester is applied to the Brazilian pepper-tree's bark between one half and one foot from the ground. Garlon 4® is diluted with a penetrating oil. Pathfinder II® is pre-mixed with a penetrating oil. The herbicide will pass through the bark. Therefore, girdling the tree's trunk is not necessary and, in fact, may reduce the effectiveness. Once the basal bark treatment has been completed, it may take several weeks before there is evidence that the tree has been controlled. Defoliation and the presence of termites are indicators that the treatment has been successful.

Basal bark treatments are most effective in the fall when the Brazilian pepper-trees are flowering. This is due to the high level of translocation occurring within the tree. Fruiting occurs during winter, and Brazilian pepper-trees that have been controlled using a basal bark treatment may retain their fruit. This situation will require that the area be checked for seedlings on a regular basis.

Foliar Herbicide Application

Foliar herbicide application can be used on Brazilian pepper-tree seedlings. An herbicide containing triclopyr or glyphosate is applied directly to the tree's foliage. Results of a foliar application will be wilting of leaves. The herbicide will be translocated to other parts of the tree, thus effectively controlling the Brazilian pepper-tree.

Caution: Foliar applications require considerably more herbicide to control Brazilian pepper-tree. Also, damage to nearby plants resulting from wind drift of the herbicide should be avoided.

Biological Control

Currently, there are no biological controls that have been released in the United States for Brazilian pepper-tree. Over 200 insects have been identified that feed on Brazilian pepper-trees in the tree's native land. However, in order for them to be considered as possible biological control agents, scientists must prove that they are specific to Brazilian pepper-trees. Effective biological control agents must be able to reproduce after introduction into the United States.

University of Florida scientists have identified two insect species that may prove to be effective biological control agents, a sawfly and a thrips. The sawfly causes defoliation and the thrips feeds on new shoots. UF scientists expect authorization to release these insects in the future. However, their effectiveness for controlling Brazilian pepper-trees in Florida is as yet unknown.

For more information, see UF/IFAS EDIS publication ENY-820 Classical Biological Control of Brazilian Peppertree (*Schinus terebinthifolius*) in Florida at http://edis.ifas.ufl.edu/IN114 and EENY-270 Brazilian Peppertree Seed Wasp, *Megastigmus transvaalensis* (Hymenoptera: Torymidae) at http://edis.ifas.ufl.edu/IN453.

Table 1. Herbicides and application methods for Brazilian pepper-tree control.

Active ingredient[1]	**Application Methods**	**Comments**
Glyphosate	Cut stump Foliar	Some products available in small containers from retail garden suppliers. Some products may be applied directly to water
Imazapyr (2 lb/gallon)	Cut stump Foliar (low volume)	Should only be applied by licensed herbicide applicators.
Triclopyr amine	Cut stump Foliar	Some products available in small containers from retail garden suppliers. Some products may be applied directly to water
Triclopyr ester	Cut stump FoliarBasal bark	Available from agricultural suppliers. May **not** be applied directly to water.

[1] Based on the acid.

Weed alert

Chinese tallow

(Sapium sebiferum)

Chinese Tallow

Chinese tallow, a small to medium-sized tree native to China, was introduced into the United States as an ornamental in the 18th century. In North and Central Florida, the tree has escaped cultivation and has invaded closed-canopy forests, bottomland hardwood forests, lakeshores and wetlands. Insect herbivory on Chinese tallow is low in the U.S., and it offers little food value for native species. Chinese tallow can rapidly displace native vegetation in Florida wetlands by forming dense monospecific stands. The trees may also increase nutrient loading of aquatic systems through leaf drop and fast decay, which may lead to much higher concentrations of phosphorus, potassium, nitrates, zinc, manganese and iron in infested waterways. It is a fast growing tree, and its foliage becomes yellow to red during the fall. New growth on Chinese tallow begins as early as February and flowering lasts from March through May. Fruit ripens from August to November. The tree is deciduous, losing leaves during the autumn. Young trees establish a taproot system and are able to withstand extended periods of drought. Its primary seed vectors are birds (pileated woodpeckers have been observed eating the seed) and moving waters (tests show seed viability even after several weeks of floating in water).

Why Chinese tallow must be managed:

Chinese tallow is adaptable to growing in most soils from moderately wet to dry, saline to fresh. It is now widespread in Florida along roadside ditches, coastal areas and streams, often forming dense thickets. It readily colonizes low-lying areas, and also thrives in upland, better-drained areas in and near towns. It can colonize open sites or invade closed-canopy forests. The rapid growth and spread of this species represents a significant threat to Florida's aquatic and upland environments.

Flower spikes

Fall foilage and "popcorn" fruit

Because of its aggressive growth rate, never plant Chinese tallow trees. There are native trees that provide shade and do not harm the environment. Possession of Chinese tallow with the intent to sell, transport or plant is illegal in Florida.

Florida Fish and Wildlife Conservation Commission
MyFWC.com

Synonymy: Croton sebiferus L., Stillingia sebifera, Triadica sebifera

Chinese Tallow *(Sapium sebiferum)*

Chinese tallow, a deciduous tree to 16 mm (52 ft), has a fast rate of growth maturing in 3-5 years. The tree flowers in spring, sets fruit in late-summer and early fall with an average of 100,000 per tree. Seeds are bird-dispersed. Untreated stumps and roots can sprout.

Leaves: simple, alternate and broadly ovate, 3-6 cm (1-2.5 in) wide. Leaf blades pinnately veined and broadly ovate, with broadly rounded bases. Petioles slender, mostly about 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) and 2-3 stamens or 3 styles. Female flowers on lower spike, male flowers above.

Fruits: a three-lobed capsule, 1 cm (0.5 in) wide with one seed in each lobe. Dull white seeds are covered with vegetable tallow, a white waxy coating.

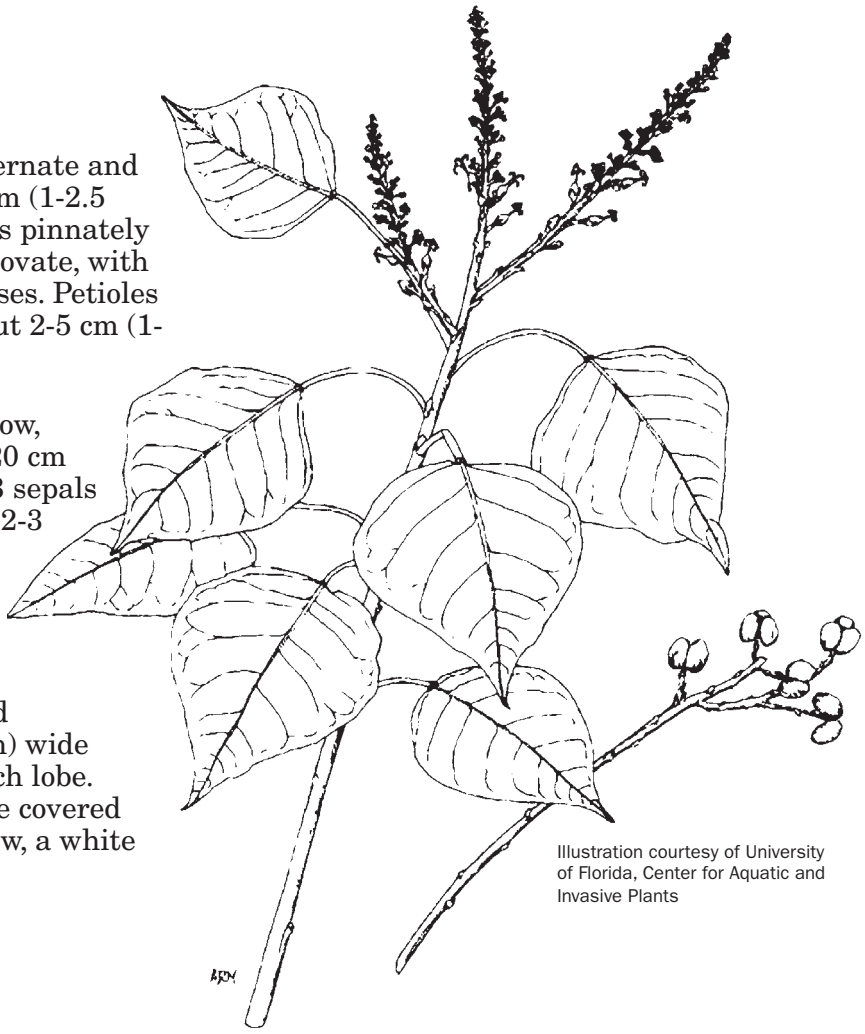

Illustration courtesy of University of Florida, Center for Aquatic and Invasive Plants

Look at first:

- open fruit capsules that look like popcorn
- seeds with a white waxy coating
- oval, aspen-like leaves

Distribution

Established in the outer coastal plain of South Carolina and adjacent North Carolina, south to Florida, and west to eastern Texas. Native to Eastern Asia.

MyFWC.com

Florida Fish and Wildlife Conservation Commission

Division of Habitat and Species Conservation
Invasive Plant Management Section
620 South Meridian St.
Tallahassee, FL 32399-1600
850-487-3796

UF UNIVERSITY of FLORIDA
IFAS Extension

Introduced and Invasive Vertebrates in Florida—Online Resources for Managers

Supplement to NCFL CISMA Workshop—October 23, 2014

Prepared by: Dr. Steve A. Johnson, Associate Professor, Dept. of Wildlife Ecology, University of Florida

Invasive Species Websites of General Interest

Florida Invasive Species Partnership—FISP: This website is an invaluable resource for land managers in Florida. An excellent resource provided by FISP is its "Florida Landowners Incentives Program", which lists more than 25 potential sources of funds available to managers of private and public lands for control of invasive species. Other features of this site include an up-to-date calendar of events and news on invasive species, details for Florida's Cooperative Invasive Species Management Areas, and information on reporting and mapping observations of invasive plants and animals. This is a MUST VISIT site for anyone responsible for managing Florida's natural areas!

http://www.floridainvasives.org/index.html

The National Invasive Species Council—NISC: NISC is consortium of US federal agencies working together to address a myriad of invasive species nationally. NISC provides high-level interdepartmental coordination of federal invasive species actions and works with other federal and non-federal groups to address invasive species issues at the national level. Be sure to check out the 2008-2012 National Invasive Species Management Plan, which can be downloaded from NISC.

http://www.invasivespecies.gov/index.html

INVASIVES.ORG Center for Invasive Species and Ecosystem Health: The University of Georgia, in partnership with the USDA, hosts this great website and it's worth a visit. There you will find links to species profiles and a diversity of reports and publications, a library of digital images, and much more. This site provides information on invasive plants, invertebrates, vertebrates, and diseases. Click the "Maps" button at the top of the home page to go to the EDDMapS where you can report observations of introduced animals and plants. You will want to bookmark this web page for sure.

http://www.invasive.org/

USDA National Invasive Species Information Center: This site is a "gateway to invasive species information; covering Federal, State, local, and international sources." Although the information provided here for invasive vertebrates is relatively sparse, it is a great source of information for invasive insects, plants, and aquatic species. It also includes links to recent news and events on invasive species from a national perspective.

http://www.invasivespeciesinfo.gov/index.shtml

eXtension: "eXtension is an interactive learning environment delivering the best, most researched knowledge from the smartest land-grant university minds across America." This site provides resources for a variety of species of North American wildlife, including invasive vertebrates such as feral hogs and armadillos. There is also a great deal of additional information potentially valuable to natural resource managers.

http://www.extension.org/

Florida Fish and Wildlife Conservation Commission—Nonnative Species: This site provides a general background on invasive species and the problems they cause, numerous links to invasive species resources, and rules and regulations governing non-native animals in Florida. This FWC site is especially valuable because it is the clearinghouse for information on the status of introduced animals in Florida. Here you will also find brief profiles for virtually all of the state's introduced animals.

http://www.myfwc.com/nonnatives

Species Profiles and Management Resources

eXtension

- Feral Hogs: http://www.extension.org/feral_hogs
- Armadillos: http://www.extension.org/pages/8781/armadillo-damage-management#.Uo6eGulyga8

Berryman Institute

- Feral Hogs: http://www.berrymaninstitute.org/pdf/Managing%20Wild%20Pigs%205-2010.pdf
- Coyotes**: http://www.berrymaninstitute.org/pdf/Mastro-coyote-addendum.pdf**

Internet Center for Wildlife Damage Management

- Armadillos: http://icwdm.org/handbook/mammals/armadillos.asp
- European Starlings: http://icwdm.org/handbook/birds/EuropeanStarlings.asp

Florida Fish & Wildlife Conservation Commission

- Armadillos: http://myfwc.com/wildlifehabitats/profiles/mammals/land/armadillo/
- Coyotes: http://myfwc.com/wildlifehabitats/profiles/mammals/land/coyote/faqs/
- Outdoor Cats: http://myfwc.com/wildlifehabitats/nonnatives/mammals/feral-cats/
- Feral Hogs: http://myfwc.com/media/2102702/6staffreport-wildhog_presentation.pdf
- Feral Hogs: http://myfwc.com/wildlifehabitats/profiles/mammals/land/wild-hog/
- Mallard/Mottled Ducks: http://myfwc.com/wildlifehabitats/profiles/birds/waterfowl/mottled-ducks/
- Mallard Ducks: http://myfwc.com/license/wildlife/nuisance-wildlife/mallard-control/

University of Florida Institute of Food and Agricultural Sciences

- Armadillos: http://edis.ifas.ufl.edu/uw362
- Coyotes: http://edis.ifas.ufl.edu/uw127
- Feral Hogs: http://edis.ifas.ufl.edu/uw322
- Iguanas: http://edis.ifas.ufl.edu/in528
- Sacred Ibis: http://edis.ifas.ufl.edu/pdffiles/UW/UW31200.pdf
- Purple Swamphen: http://edis.ifas.ufl.edu/uw317 & http://edis.ifas.ufl.edu/uw315
- European Starling: http://edis.ifas.ufl.edu/uw300
- Cuban Treefrog: http://ufwildlife.ifas.ufl.edu/cuban_treefrog_inFL.shtml & http://edis.ifas.ufl.edu/uw259
- Cane (Bufo) Toad: http://edis.ifas.ufl.edu/uw345
- Burmese Python: http://edis.ifas.ufl.edu/uw333 & http://edis.ifas.ufl.edu/uw286

Florida Museum of Natural History

- Iguanas: http://www.flmnh.ufl.edu/herpetology/kk/pdf/2007_Krysko_et_%20al-Iguana_iguana.pdf

University of Nebraska

- Outdoor Cats: http://ianrpubs.unl.edu/live/ec1781/build/ec1781.pdf

American Bird Conservancy

- Outdoor Cats: http://www.abcbirds.org/abcprograms/policy/cats/index.html

US Department of Agriculture

- Feral Hogs: http://www.aphis.usda.gov/wildlife_damage/feral_swine/
- Feral Hogs (Immunocontraception) : http://digitalcommons.unl.edu/cgi/viewcontent.cgi?article=1102&context=icwdm_usdanwrc
- European Starlings: http://www.aphis.usda.gov/wildlife_damage/blackbirds_and_starlings/index.shtml

Cornell Lab of Ornithology

- European Starlings: http://nestwatch.org/learn/nest-box-resource-center/managing-house-sparrows-and-european-starlings/

Education and Training Resources

University of Florida Institute of Food and Agricultural Sciences

- UF Wildlife**:** This is a website with information about invasive vertebrates, their natural history, and management. Online guides to Florida's Snakes and Florida's Frogs & Toad can be found here too, as well as resources for educators. Be sure to check out the page for the *Invader Updater* (click the "Invasive Vertebrates" link), a quarterly newsletter focused primarily on providing information on invasive vertebrate animals in Florida and the southeastern US. http://ufwildlife.ifas.ufl.edu/
- Reptile Early Detection and Documentation (REDDy): This is a free, online training module focused on identification and reporting of observations on large constrictors and carnivorous lizards in Florida. Numerous supplemental resources are provided. http://ufwildlife.ifas.ufl.edu/reddy.shtml
- Buyers Guide to Pet Reptiles: This brochure offers advice on the purchase of pet reptiles. It is available as a tri-fold brochure at the second link below. http://edis.ifas.ufl.edu/uw357 http://ufwildlife.ifas.ufl.edu/pdfs/PARC%20pet%20buyers%20guide.pdf
- Options for Unwanted Pets: This brochure offers advice on suitable options for unwanted exotic pets. A similar version is available as a tri-fold brochure at the second and third links below. http://edis.ifas.ufl.edu/uw353 http://edis.ifas.ufl.edu/pdffiles/UW/UW35300.pdf http://ufwildlife.ifas.ufl.edu/pdfs/PARC%20Pet%20Brochure.pdf

The Nature Conservancy

- Python Patrol: The Nature Conservancy conducts workshops that provide participants with hands-on training for safe and effective methods to capture large constrictors. http://www.nature.org/ourinitiatives/regions/northamerica/unitedstates/florida/howwework/stopping-a-burmese-python-invasion.xml

Florida Fish and Wildlife Conservation Commission

- FWC Pet Amnesty Program: The FWC conducts several "Pet Amnesty" events each year throughout the state. Anyone is allowed to surrender unwanted, exotic pets (no dogs, cats, etc.) with no questions asked. After a veterinarian examines each animal, those deemed healthy are sent home with pre-approved, adoptive parents. FWC can also help place needy animals with adopters upon request.
  http://myfwc.com/wildlifehabitats/nonnatives/amnesty-day-events/

National Park Service

- "Don't Let It Loose": This educational campaign provides numerous resources for educators on the issue of invasive species. The curriculum consists of numerous classroom activities targeted at middle school-aged students. "Interactive games and classroom activities instill students with the importance of responsible pet selection and ownership."
  http://www.nps.gov/ever/forteachers/dlil.htm

Aquatic Nuisance Species Task Force

- Habitattitude: This program is a partnership among several federal agencies—the USFWS is the lead—and the pet industry to educate the public about not releasing nonindigenous fish and aquatic plants.
  http://www.habitattitude.net/

Center for Invasive Species and Ecosystem Health

- Early Detection & Distribution Mapping System—EDDMapS: Developed by the University of Georgia with support from several federal agencies, EDDMapS is the portal for reporting and mapping observations of nonindigenous animals and plants in Florida. Here you can report observations and check current distribution maps for introduced plants and animals. You can also download smartphone apps for reporting your observations.
  http://www.eddmaps.org/

I hope you find these resources useful. If you have any suggestion, such as websites to add, please don't hesitate to email me at tadpole.ufl.edu.

Nonnative Reptiles in South Florida Identification Guide

- The nonnative reptiles shown here are native to Central and South America, Asia, and Africa. They were introduced to south Florida by human activity.
- **Invasive species** harm native species through direct predation, competition for resources, spread of disease, and disruption of natural ecosystems. Many of the nonnative reptiles on this guide are, or have the potential to become, invasive.
- Use this guide to identify invasive species and immediately **report sightings of the black and white tegu, Nile monitor, and all invasive snakes to 1-888-IVE-GOT1**. Take a photo and note the location relative to street intersections or with a GPS if possible.
- More photos can be found at www.flmnh.ufl.edu/herpetology/herpetology.htm.
- **Be certain** that an animal is a nonnative species before removing it. **Warning—most reptiles will bite or scratch if provoked.**

Nonnative species are sometimes confused with the Florida natives shown because their colorations and patterns are very similar. Pay attention to the distinct characteristics and typical adult sizes listed on this guide to avoid confusion when you encounter these animals.

Nonnative Lizards

Green Iguana 4 to 6 ft.
Vibrant shades of green become dull with age. Males have larger spikes along back.

Black Spinytail Iguana
2 to 4 ft.
Gray to tan body with well-defined black bands

Black and White Tegu
2 to 3 ft.
Dark bands with plentiful white dots between them

Brown Anole
5 to 9 in.
Color changes from yellowish tan to brown.

Cuban Knight Anole
13 to 19.5 in.
Changes from bright green to brown, yellow facial band

Northern Curly-Tailed Lizard 7 to 10.5 in.
Gray to tan with curled tail

Nile Monitor 4 to 6 ft. Brown/yellow body bands, forked black/blue tongue, long sharp claws

NATIVE Look-a-Likes

Green Anole 5 to 8 in.

Eastern Fence Lizard
3.5 to 7.5 in.

Florida Scrub Lizard
3.5 to 5.5 in.

American Alligator 6 to 9 ft.
(juvenile pictured)

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Nonnative Snakes

Burmese Python
10 to 12 ft.
Tan body with dark blotches that do not touch, dark and light wedges beneath the eye

African Python
10 to 12 ft.
Tan to grey body with irregular dark spots, dark and light wedges beneath the eye

Reticulated Python
14 to 18 ft.
Distinct reddish eyes, tan body with dark brown net-like markings with yellow and white accents

Ball Python
2 to 4 ft.
Large brownish spots outlined in light cream color against a dark brown or black body

Boa Constrictor
6 to 9 ft.
Tan oval spots, reddish-brown tail

Green Anaconda
13 to 15 ft.
Green body, large round dark spots, eye stripes

Yellow Anaconda
6 to 9 ft.
Yellow body, large dark spots, five dark stripes on top of head

Report sightings of the nonnative snakes shown above to **www.IveGot1.org** or **1-888-IVE-GOT1** (1-888-483-4681)

Sometimes confused with these NATIVE snakes:

Eastern Indigo Snake 5 to 6 ft.

Brown Watersnake
3.5 to 4.5 ft.

Eastern Diamond-back Rattlesnake
3 to 5 ft.

Corn Snake
1.5 to 3.5 ft.

Cottonmouth
2.5 to 3 ft.

Note that invasive snakes are much heavier-bodied than most natives and always have smooth, shiny scales. Cottonmouths and rattlesnakes have a more distinctly triangular head than the invasive snakes.

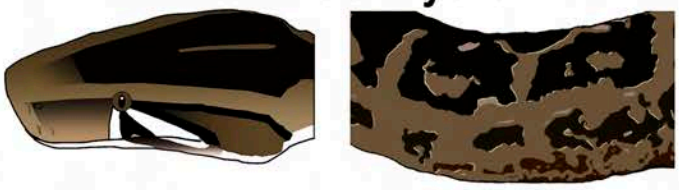
REPORT IMMEDIATELY!

Nile Monitor

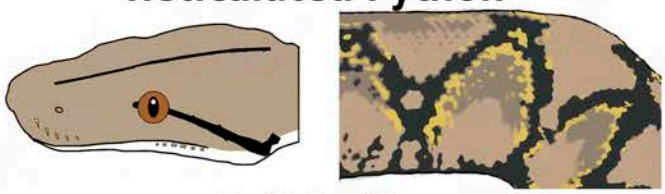
Tegus

Burmese Python

African Rock Python

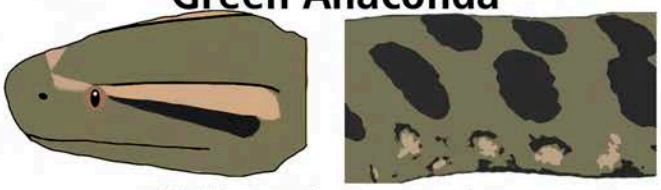


Reticulated Python



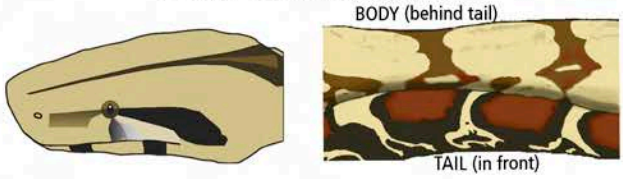
Ball Python

Green Anaconda



Yellow Anaconda

Boa Constrictor



Make Observations

Become a reptile observer:
Get certified - http://eces.ifas.ufl.edu

Look for:
Lizards -
> 12", smooth scales, spots or bands
Snakes -
Large, shiny scales, bold markings

Collect Data

Who - your name and contact info

What - lizard/snake, live/dead, body color, head & body markings, color of markings, body position, behavior, size

When - date, time, weather conditions

Where - GPS coordinates or measured distance to known address or road intersection

Call it In

Standing over the animal, live or dead?

Call it in immediately!

1-888-IVE-GOT1

Report Online

All sightings should be reported online the same day - even if reported by phone!

www.IveGot1.org

WEC295

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IFAS Extension

Florida Invader: Tegu Lizard[1]

Steve Johnson and Monica McGarrity[2]

Figure 1. Black-and-white Tegu (*Tupinambis merianae*), also known as the Giant Argentine Tegu Credits: Mauro Teixeiro, Jr., Universidade de São Paolo, Brazil

Report tegu lizard sightings immediately:

1-888-IveGot1 (1-888-483-4681; live animals only)

www.IveGot1.org (provide photos if possible)

The Black-and-white or Giant Argentine Tegu (*Tupinambis merianae*), native to South America, has become established in the Balm-Wimauma (southeast of Tampa) and Homestead (south of Miami) areas due to releases or escapes of pets. Individual lizards belonging to several tegu species have also been captured in other areas in Florida. These large lizards grow to 4–5 feet long. Like Nile Monitor lizards, tegus are likely to eat the eggs and young of ground-nesting birds and turtles and could impact threatened and endangered species, including Gopher Tortoises. They are opportunistic predators and consume a variety of small prey as well as plant matter and carrion (dead animals). Black-and-white Tegus inhabit dry, upland areas with sandy soils, including natural, urbanized, and agricultural areas. Tegus could potentially become an agricultural pest or a source of bacterial contamination of food crops. These lizards may dig burrows, but also frequently invade the burrows of native Gopher Tortoises. They remain underground during late fall and winter months. Females lay approximately 5 eggs per clutch up to twice per year. Lifespan is 15–20 years.

Acknowledgments

This project was made possible in part by a grant from the South Florida National Parks Trust and the Ferris Greeney Family Foundation, and by the USDA-RREA. This document was created as additional reference material for the Introduced Reptile Early Detection and Documentation training

1. This document is WEC295, one of a series of the Wildlife Ecology and Conservation Department, Florida Cooperative Extension Service, Institute of Food and Agricultural Sciences, University of Florida. Original publication date August 2010. Visit the EDIS website at http://edis.ifas.ufl.edu.

2. Steve A. Johnson, associate professor and Extension specialist, Department of Wildlife Ecology and Conservation and Gulf Coast Research and Education Center, University of Florida/ IFAS–Plant City Center, 1200 North Park Road, Plant City, FL 33563; Monica McGarrity, biological scientist, Gulf Coast Research and Education Center, University of Florida/ IFAS–Plant City Center, 1200 North Park Road, Plant City, FL 33563

Figure 2. The head and neck of a tegu are much thicker than those of a Nile Monitor. The fleshy, forked tongue is red. In young animals, the head is greenish (as shown here). Credits: Mario Sacramento, Universidade de Alfenas, Brazil

Figure 3. The body of Black-and-white Tegus is grayish and marked with dark bands with abundant light spots in between. Other tegu species are similarly marked, but base coloration may vary (as shown in Fig. 4). Credits: Mario Sacramento, Universidade de Alfenas, Brazil

Figure 4. Several tegu species have been found in Florida, including the Red Tegu (shown here) and the Gold Tegu, which has a yellow-tan base color. Credits: Patrick Lynch, South Florida Water Management District, 2009

program, also known as REDDy. For more information, visit http://ufwildlife.ifas.ufl.edu/reddy.shtml.

Some Resources for Identifying and Controlling Invasive Exotic Plants[1]

Burks, K.C. 2003. **Plant Identification Tips: Upland and Wetland Invasive Exotics**. Florida Department of Environmental Protection, Bureau of Invasive Plant Management. http://floridainvasives.org/toolbox/IDtipsUpland03.pdf

Miller,James H. 2003. **Nonnative Invasive Plants of Southern Forests: A Field Guide for Identification and Control.** U.S. Department of Agriculture, Forest Service, Southern Research Station, Asheville, N.C., Gen. Tech. Rep. SRS-62. 93pp. http://www.srs.fs.usda.gov/pubs/gtr/gtr_srs062/ To request a printed copy, call 828-257-4830, or email pubrequest@fs.fed.us and ask for GTR-SRS-62.

Miller, James H., Erwin B. Chambliss and Nancy J. Loewenstein. 2010. **A Field Guide for the Identification of Invasive Plants in Southern Forests**, United States Department of Agriculture, Forest Service, Southern Research Station General Technical Report SRS–119. 126 pp. http://www.srs.fs.usda.gov/pubs/35292 Hardcopies available without charge from the Southern Research Station, 200 W.T. Weaver Blvd., Asheville, NC 28804.

Florida Department of Agriculture and Consumer Services, Florida Forest Service, Invasive Non-native Plants, http://www.freshfromflorida.com/Divisions-Offices/Florida-Forest-Service/Our-Forests/Forest-Health/Invasive-Non-native-Plants

Florida Exotic Pest Plant Council Invasive Plant Lists, http://www.fleppc.org/list/list.htm

Florida Fish and Wildlife Conservation Commission, Invasive Plant Management Section, http://myfwc.com/wildlifehabitats/invasive-plants/

Florida Natural Areas Inventory, Invasive Species, http://www.fnai.org/invasivespecies.cfm

United States Department of Agriculture, National Agricultural Library, National Invasive Species Information Center, Florida, http://www.invasivespeciesinfo.gov/unitedstates/fl.shtml

University of Florida/IFAS Center for Aquatic and Invasive Plants, http://plants.ifas.ufl.edu/

University of Florida/IFAS Extension Publications, http://edis.ifas.ufl.edu/

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[1] Prepared by Dr. Bob Stamps (rstamps@ufl.edu), Professor of Environmental Horticulture and Cut Foliage Extension Specialist, University of Florida, Institute of Food and Agricultural Sciences, Department of Environmental Horticulture, Mid-Florida Research and Education Center, 2725 S. Binion Road, Apopka, FL 32703

UF/IFAS Forest Stewardship Extension Publications on EDIS:

http://edis.ifas.ufl.edu/TOPIC_Forest_Management_and_Stewardship

- Assessing the Economic Feasibility of Short-Rotation Woody Crops in Florida
- Assessment and Management of Hurricane Damaged Timberland
- Beyond the Trees: A Systems Approach to Understanding Forest Health in the Southeastern United States
- Conservation Easements: Options for Preserving Current Land Uses
- Cooperation and Communication: Benefits for Non-Industrial Private Forest Landowners
- Dead Wood: Key to Enhancing Wildlife Diversity in Forests
- Forest Management in the Interface: Forest Health
- Forest Management in the Interface: Practicing Visible Stewardship
- Forest Resource Information on the Internet: Connecting to Today's On-line Resources
- Improving, Restoring, and Managing Natural Resources on Rural Properties in Florida: Sources of Financial Assistance
- Improving, Restoring, and Managing Wildlife Habitat in Florida: Sources of Technical Assistance for Rural Landowners
- Longleaf Pine Regeneration
- Making the Most of Your Mast
- Management Practices to Support Increased Biodiversity in Managed Loblolly Pine Plantations
- Opportunities for Uneven-Aged Management in Second Growth Longleaf Pine Stands in Florida
- Ownership Succession: Plan Now for the Future of Your Land
- Pre-Commercial Thinning Loblolly Pines – Does It Pay?
- Selecting a Consulting Forester
- Steps to Marketing Timber
- Stewardship Ecosystem Services Study Series: Assessing Forest Water Yield and Purification Ecosystem Services in the Lower Suwannee River Watershed, Florida
- Stewardship Ecosystem Services Study: Carbon Stores on Florida Forest Stewardship Program Lands
- Ten Tips for Encouraging the Use of Your Pine Plantations By Game Species
- Ten Tips for Increasing Wildlife Biodiversity in Your Pine Plantations
- The Green Value of Your Woods: A Summary of Ecosystem Services Provided by Forest Stewardship Lands in Florida
- Thinning Southern Pines - A Key to Greater Returns
- Tips for Integrating Land and Wildlife Management: Deer in Forests
- Tips for Integrating Land and Wildlife Management: Quail and Timber
- Using Soils to Guide Fertilizer Recommendations for Southern Pines
- What is in a Natural Resource Management Plan?
- What to Expect in a Forest Inventory

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