Biology and Control of Japanese Climbing Fern (*Lygodium japonicum*)

Alabama Invasive Plant Council

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Auburn, AL

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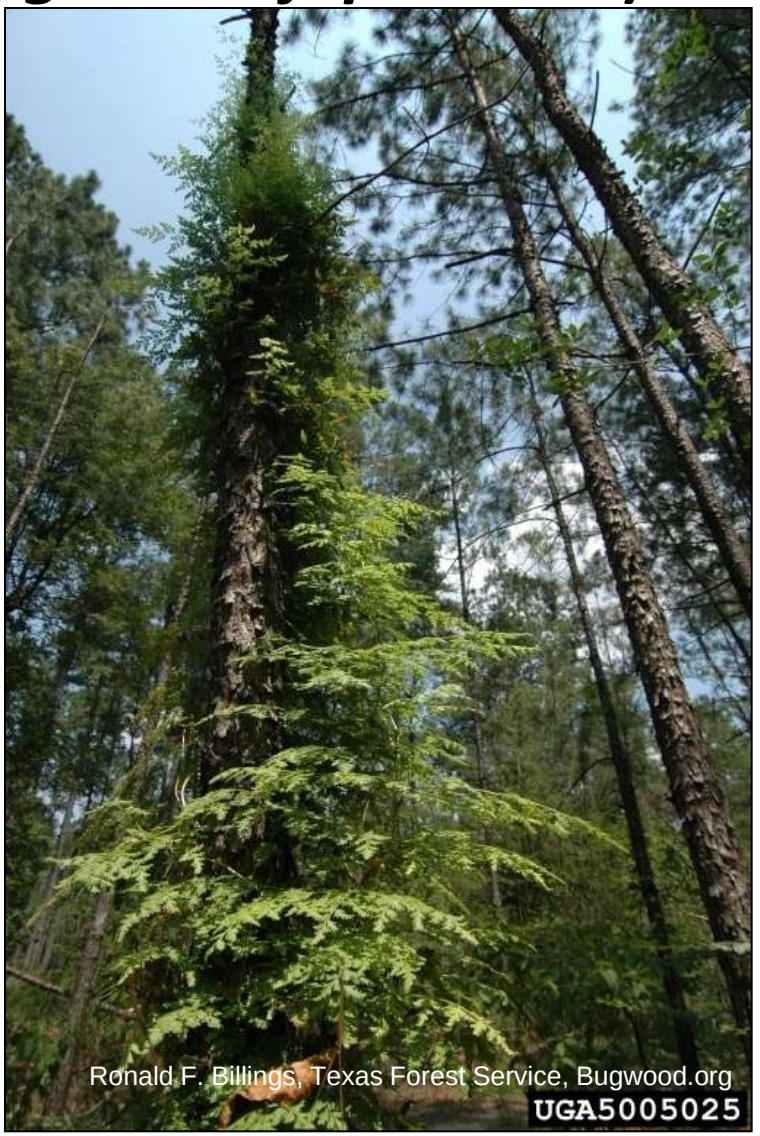
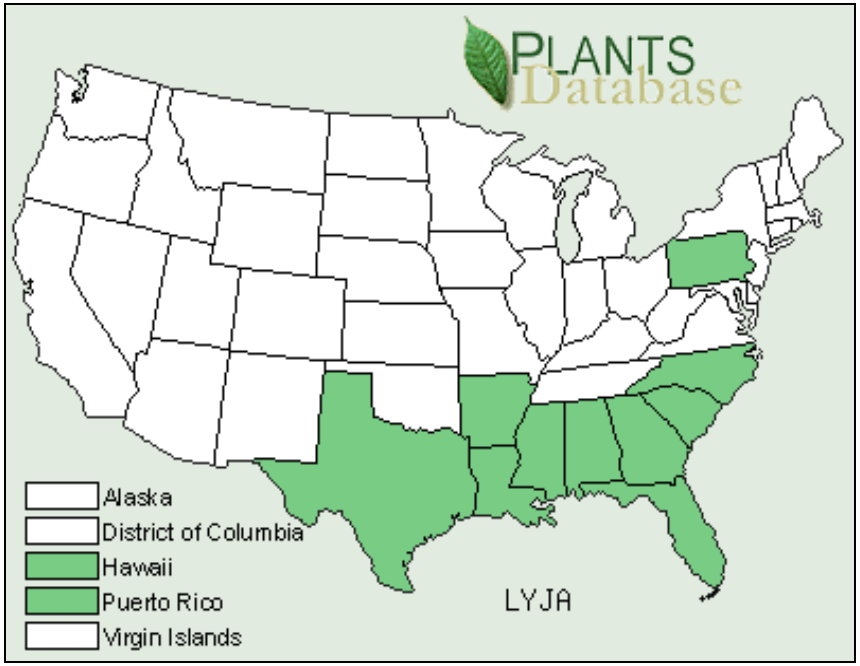


Japanese climbing fern

- Introduced ca. 1900 as an ornamental plant
- Native to East Asia, from Japan and west to the Himalayas
- Present in nine states in the Southeastern U.S. as well as Hawaii and Puerto Rico



PLANTS database, http://plants.usda.gov/java/profile?symbol=LYJA

- ***Characterized by climbing, twining fronds of indeterminate growth to 90 feet***

Climbing ferns in the United States

Japanese climbing fern, *Lygodium japonicum:*

Richard Old, XID Services, Inc., Bugwood.org

Patrick Minogue, UF

Old world climbing fern, *Lygodium microphyllum*:

Peggy Greb, USDA Agricultural Research Service, Bugwood.org

Tony Pernas, National Park Service, Bugwood.org

American climbing fern, *Lygodium palmatum*:

Troy Evans, Bugwood.org

Recognize Japanese Climbing Fern!

Rhizomes are large, mostly black in color

- **Spores produced in late summer**
- **Spores are viable for many years**
- **38,000 spores per square inch!**

Recognize Japanese Climbing Fern
Leaf shapes vary!

Japanese Climbing Fern
Life History

- Reproduces by spores and re-vegetates by rhizomes.
- Spores may be dispersed by water, wind, animals and vehicles.
- Grows in mesic to hydric sites (moist to upland soils).
- Thought to prefer soils near neutral pH (Nauman 1993).
- North of the frost line, leaves die in winter but rachis remain intact, providing a ladder for subsequent re-growth from rhizomes in spring.

Preferred Sites

- Prefers damp areas such as surface runoff courses, edges of swamps and other water bodies.
- Common in upland pine sites where forest litter is abundant (older stands).
- May grow in shady or sunny sites.


Pat Minogue


Kimberly Bohn

Ecological Threats

- Japanese climbing fern occurs on 182,000 acres in forests of the Southeast (Miller 2009) and appears to be spreading exponentially.
- JCF will overtop tree saplings and shrubs causing loss of vigor or mortality by shading and girdling; a significant threat to regeneration of bottomland hardwoods.
- May have up to 100% ground cover, displacing other plants in the understory.
- The rachis (vines) appear to climb most effectively on small diameter stems or on the bark of pines.

Japanese Climbing Fern Economic Threats

- ***JCF may be introduced to ornamental landscaping in pine straw***

FL Category I Invasive Exotic Plant; MAY NOT BE TRANSPORTED


Pat Minogue, UF

- Significant threat to the **pine straw industry**, a $89 million market in Florida alone

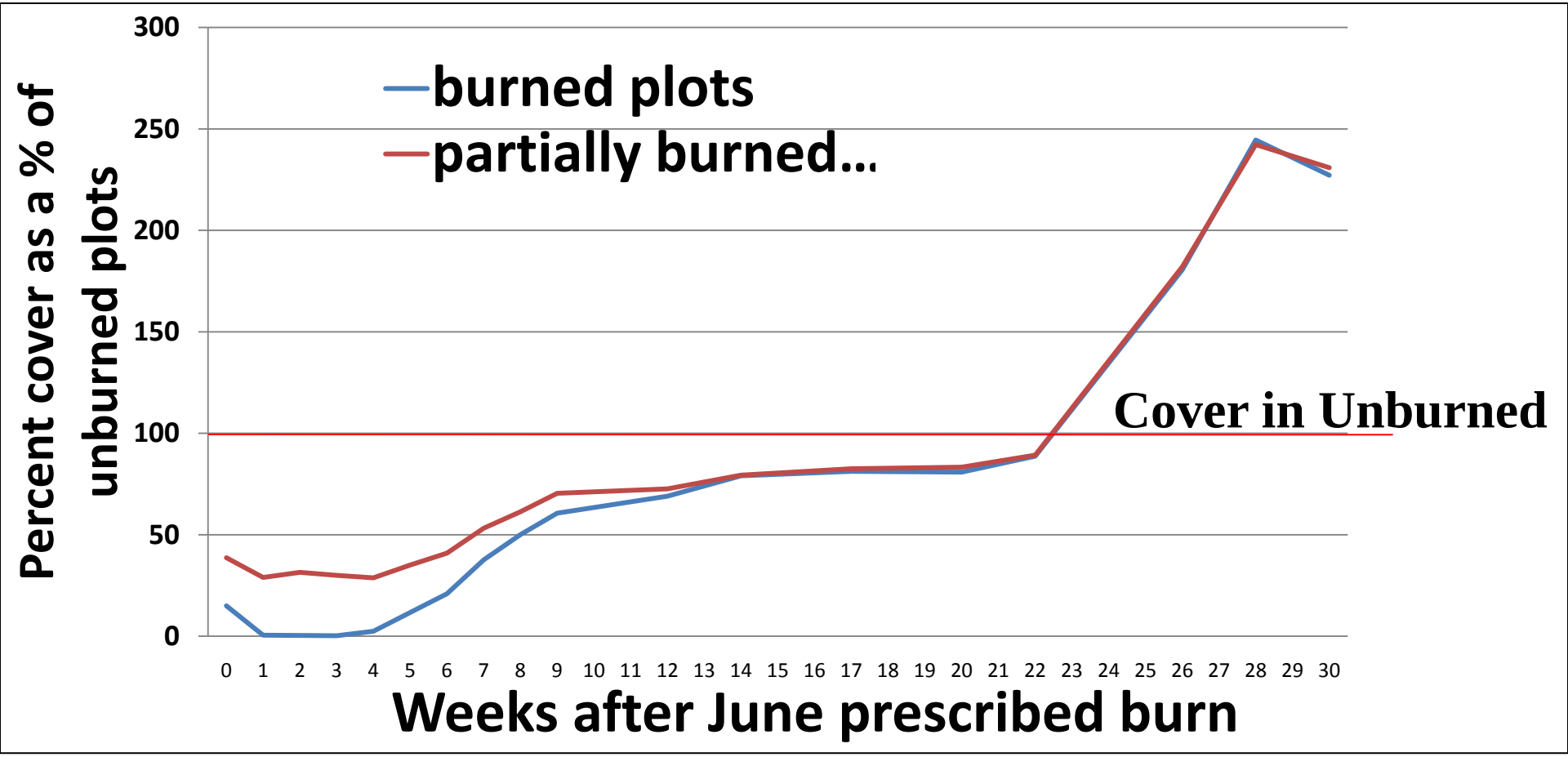
Current Regulatory Status (*Lygodium japonicum)*

- Category I invasive exotic plant (***a species that alters native communities***) in Florida, Georgia, Alabama, South Carolina

- Noxious weed listing in Florida, Alabama

- No Federal noxious weed listing

Burning Increases JCF Cover



From: E. Corrie Peterson, MS Thesis, University of Florida, In Progress

Previous Studies – Herbicide Trials

- **Valenta et al. (2001)**
  - Glyphosate (Rodeo); 3 triclopyr products (Pathfinder II; Garlon 4; Garlon 3A)
  - single herbicides tested at single concentrations
- **Zeller & Leslie (2004)**
  - Glyphosate (Accord); triclopyr (Garlon 4); 2,4-D amine/dicamba (Veteran 720); metsulfuron methyl (Escort); hexazinone (Velpar L)
  - single herbicides tested at low and high rates
  - Glyphosate was effective; Escort least injurious to associated vegetation

Herbicide Control of *Lygodium japaonicum*

- 15 herbicide treatments

(9 active ingredients) were tested in a heavily infested pine stand in North Florida.

- Glyphosate, imazapyr, and metsulfuron methyl showed the greatest level of control 10 MAT.
- **Only glyphosate and imazapyr sustained >70% control 12 MAT.**

Van Loan, Andria. 2006. Aspects of the invasion and management of Japanese climbing fern in Southeastern forests. MS Thesis. Univ. FL.

Use of Backpack Directed Sprays of Glyphosate, Metsulfuron, and Imazapyr Herbicides for Selective Control of Japanese Climbing Fern (Lygodium japonicum) in Florida's Natural Areas

OBJECTIVES:

- **Determine herbicide rate response**
- **Examine additive effects for herbicide combinations**
- **Evaluate impacts to associated vegetation**
- **Assess site conditions influencing occurrence of JCF**

Apalachicola River terrace site at Torreya State Park

2007-05 Japanese Climbing Fern Control Site Location Map

1: Joe Budd WMA

2: Torreya State Park

3: The Nature Conservancy (TNC)

4: Blackwater River State Forest

5: WFREC, Jay

6: Perdido Water Management Area

● Study Site

Herbicide Treatments Tested

16 treatments, CR or RCB design, 3-4 reps, 6 studies

Glyphosate (Accord® Concentrate)

1, 2, 4%

(1.5 – 6.3 lb ai/Ac)

Imazapyr (Arsenal® AC)

0.25, 0.5, 1.0%

(0.23 – 1.0 lb ae/Ac)

Metsulfuron (Escort® XP)

0.05, 1.0, 2.0 oz/gal

(0.04 – 0.21 lb ai/Ac)

2-way Combinations

2% Gly + 0.25% Ima

2% Gly + 0.5% Ima

2% Gly + 0.05 oz/gal Met

2% Gly + 0.10 oz/gal Met

3-way Combinations

2% Gly + 0.25% Ima + 0.05 Met

2% Gly + 0.5% Ima + 0.1 oz Met

Herbicide Impacts to Associated Vegetation

- **Glyphosate**:
  - Broad-spectrum
  - No soil residual
- **Imazapyr**:
  - Broad-spectrum
  - Soil residual
  - Pine selectivity
  - Kills hardwoods and shrubs
- **Metsulfuron**:
  - Narrow-spectrum
  - Least threat to native vegetation
  - Perennial grasses are tolerant

Sweetgum killed by imazapyr

Measurements

Pre, 60 DAT, 8 MAT, 1, 2 YAT

Individual JCF Rootstocks:

- Rachi length
- Number of rachi /rootstock
- % Crown reduction

Area Plots, aggregates:

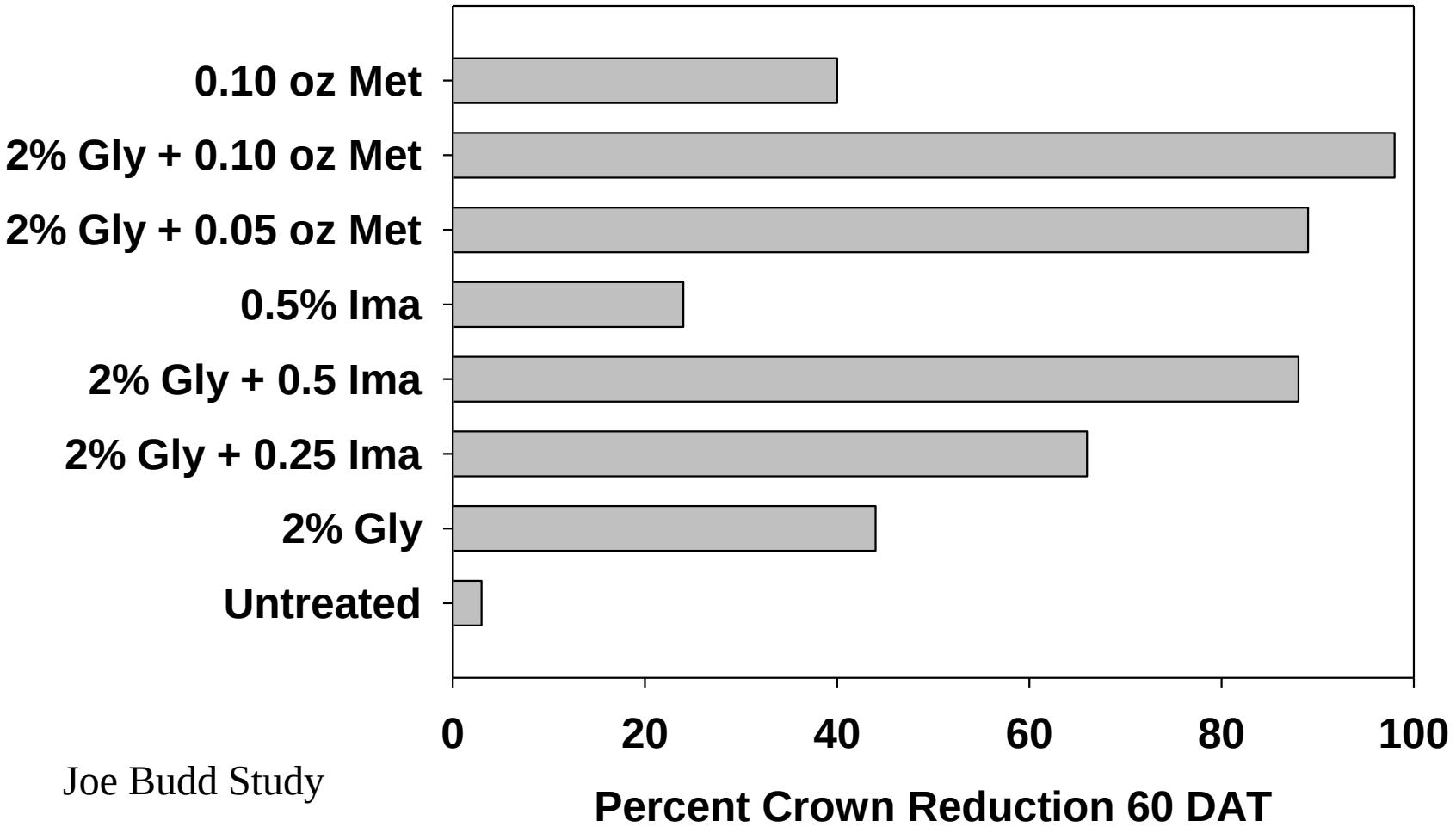
-Percent cover for JCF, plant groups, dominant species

-Woody perennial phytotoxicity code

-Species Richness

Kimberly Bohn, UF

JCF Percent Crown Reduction with Herbicide Combinations, Individual Fern Rootstocks, 60 days



Joe Budd Study

Percent Reduction of Japanese Climbing Fern Cover at 2 YAT: Means across 3 herbicide rates

Herbicide	TNC Bluffs P=0.0002	Torreya P=0.0001
Glyphosate	90 A	90 A
Imazapyr	72 A	-11 B
Metsulfuron	31 B	7 B
Untreated	-39 C	-75 C

Within a column, means followed by the same letter are not significantly different using LSD tests at alpha = 0.05

Percent Reduction of Japanese Climbing Fern Cover at 2 YAT: Glyphosate Treatments

Accord Conc %	TNC Bluffs	Torreya
1%	85 A	84 A
2%	91 A	91 A
4%	95 A	95 A
Untreated	-39 B	-75 B

Within a column, means followed by the same letter are not significantly different using LSD Tests at alpha = 0.05.

Percent Reduction of Japanese Climbing Fern Cover at 2 YAT: Imazapyr Treatments

Arsenal AC %	TNC Bluffs	Torreya
0.25%	46 A	-10 A
0.5%	83 A	-25 A
1%	86 A	3 A
Untreated	-39 B	-75 A

Within a column, means followed by the same letter are not significantly different using LSD Tests at alpha = 0.05.

Percent Reduction of Japanese Climbing Fern Cover at 2 YAT: Metsulfuron methyl

Escort XP (g/l)	TNC Bluffs	Torreya
0.375	29 AB	-5 A
0.75	53 A	-1 A
1.5	13 AB	28 A
Untreated	-39 B	-75 A

Within a column, means followed by the same letter are not significantly different using LSD Tests at alpha = 0.05.

Percent Reduction of Japanese Climbing Fern Cover at 2 YAT: Combination Treatments

	TNC Bluffs	Torreya
2% Glyphosate	91 A	91 A
2% Glyphosate + Imazapyr	94 A	91 A
2% Glyphosate + Metsulfuron	88 A	86 A
2% Gly. + Ima. + Metsulfuron	87 A	90 A
Untreated Control	-39 B	-75 B

Within a column, means followed by the same letter are not significantly different using LSD Tests at alpha = 0.05.

Perennial grasses are tolerant to Escort

Indian woodoats (Chasmanthium latifolium)

Findings at Two-Years (Apalachicola sites)

- Re-treatment is necessary.
- Glyphosate alone or imazapyr alone resulted in significantly less JCF cover than metsulfuron.
- No significant improvement in JCF control for combining 2% glyphosate with either imazapyr or metsulfuron, and no significant effect of the tank-mix rates (high versus low imazapyr or metsulfuron) in combination with 2% glyphosate.
- At two years after treatment, percent cover of graminea increased at one location; species richness remained the same at both locations.

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Biological Control Agents?

Cataclysta camptozonale released in south Florida for control of Old World Climbing Fern

Research Needs

- Determine the extent of re-growth from spores versus rhizomes following various herbicide treatment timings
- Determine Japanese climbing fern distribution and preferred habitat
- Examine interactions of herbicides and fire in direct control methods
- Determine environmental factors affecting spore germination and vine establishment
- Explore biological controls

Sources of Additional Information

- **Biology and control of Japanese climbing fern**
  http://edis.ifas.ufl.edu/FR280
- **The University of Florida Weed Science Website**
  http://weedext.ifas.ufl.edu/
- **FWCC Bureau of Invasive Plant Management**
  http://www.myfwc.com/WILDLIFEHABITATS/InvasivePlants_index.htm

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Questions?