Laurel Wilt: A Devastating Disease of Lauraceous Trees

Bud Mayfield, Forest Entomologist

Florida DACS Division of Forestry

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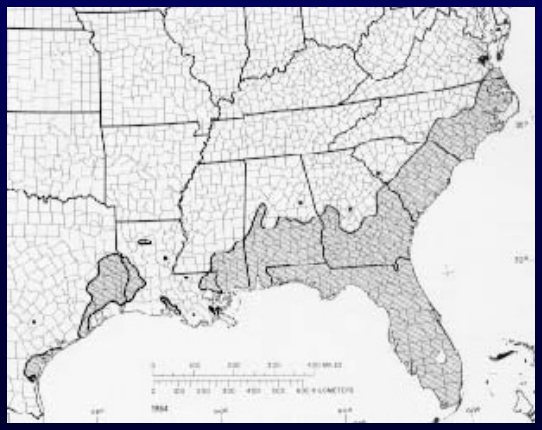
- Others I have probably overlooked

Laurel Wilt: Introduction

- Laurel wilt:
  - Vascular wilt disease of trees in the Lauraceae in the southeastern U.S.
- The pathogen:
  - *Raffaelea lauricola,* a newly-described ambrosia beetle symbiont
- The vector:
  - *Xyleborus glabratus,* the redbay ambrosia beetle (RAB), a non-native invasive species

Redbay (*Persea borbonia*)

- Aromatic, broadleaved, evergreen of SE coastal plain
- Other closely-related species or varieties (swamp bay, silk bay)
- Wide habitat variety: hammocks, swamp edges, dunes, residential
- Cultural value: culinary, cabinetry, woodturning
- Fruits utilized by variety of wildlife
- Important larval host of Palamedes swallowtail butterfly (*Papilio palamedes*)

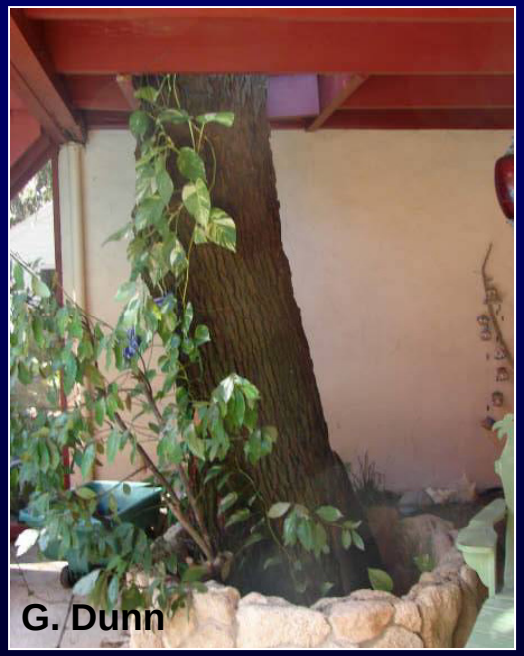


Redbay (*Persea borbonia*)

A.E. Mayfield

Redbay (*Persea borbonia*)

Redbay (*Persea borbonia*)



Redbay at the Horton House on Jekyll Island, GA (November, 2006)

Horton House on Jekyll Island, GA (December, 2007)
Photo credit: William Kauffman (USDA APHIS)

Redbays on coastal dunes

Coastal areas near St. Augustine

Laurel wilt: no site discrimination

Pine flatwoods

swamps

Residential neighborhoods

Sand dunes

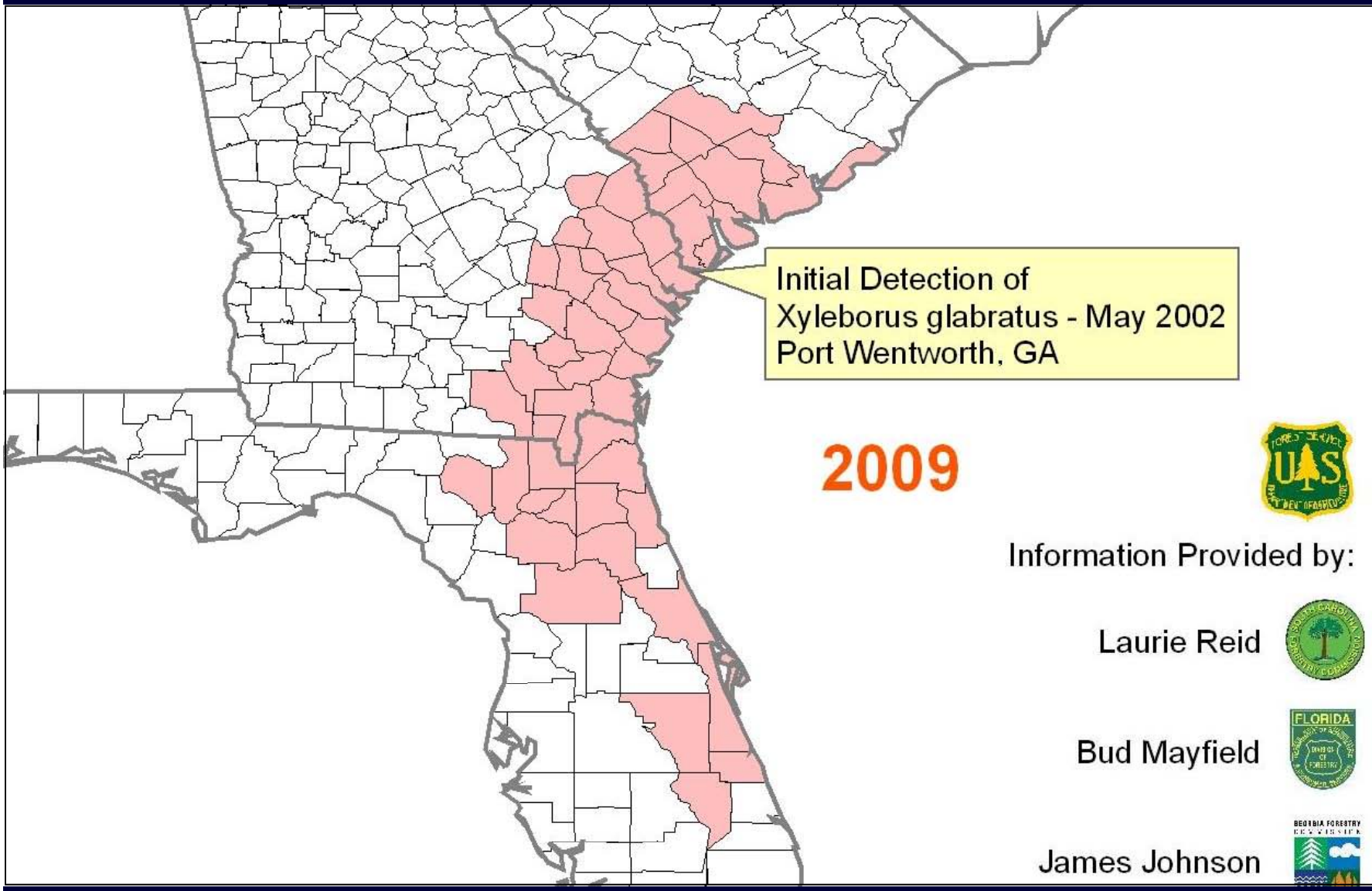
Mixed hardwood hammocks

History

- 2002: *Xyleborus glabratus* first detected in EDRR survey trap near Port Wentworth, GA
- 2003: Unusual, unexplained mortality of redbay trees around Hilton Head, SC and Savannah, GA.
- Late 2004 – early 2005:
  - *X. glabratus* found in association with dying redbay trees
  - Unknown fungus consistently isolated from discolored sapwood, tentatively identified as an *Ophiostoma* sp.
  - Beetle and fungus determined to be cause of disease.

S.W. Fraedrich et al. 2008. Plant Disease 92: 215-224

Historical Spread of Laurel Wilt Disease

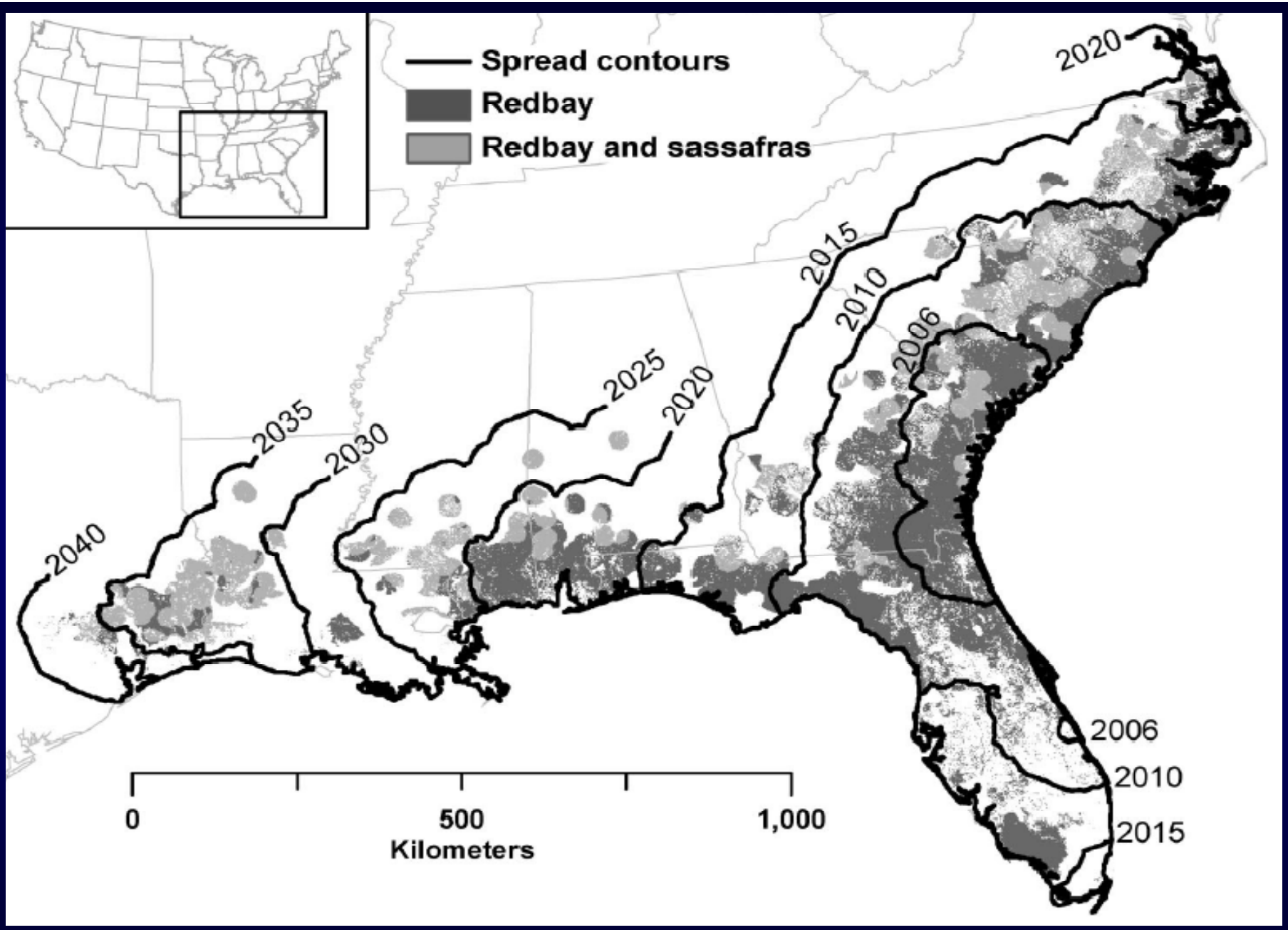


Information Provided by:

Laurie Reid

Bud Mayfield

James Johnson



F. H. Koch and W. D. Smith 2008. Environ. Entomol. 37(2): 442-452

The redbay ambrosia beetle (*Xyleborus glabratus*)

Redbay Ambrosia Beetle (*Xyleborus glabratus*)

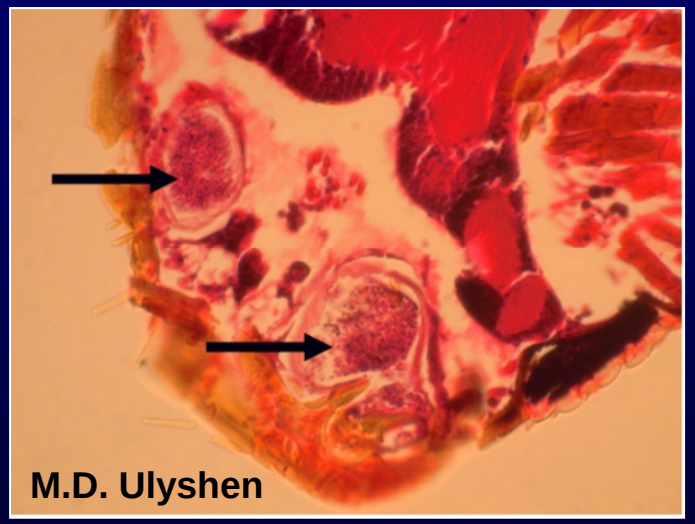
- Scolytinae: Scolytini: Xyleborina
  - Ambrosia fungus feeder
  - Partial parthenogenesis, sib mating
  - Sex ratio: strongly skewed to female
  - Introduced in solid wood PM
- Native to Asia (India, Bangladesh, Japan, Myanmar, Taiwan)
- Reported Asian hosts
  - Lauraceae (*Lindera, Litsea, Phoebe*)
  - Dipterocarpaceae (*Shorea*)
  - Fagaceae (*Lithocarpus*)
  - Fabaceae (*Leucaena*)

Photos: M.C. Thomas

R.J. Rabaglia et al. 2006. Ann. Entomol. Soc. Am. 99(6):1034-1056.

Laurel wilt pathogen (*Raffaelea lauricola*)

- Previously undescribed species presumed to have arrived with vector
- Isolated from heads of female *Xyleborus glabratus*
  - paired mandibular mycangia packed with spores
- Transmitted to host sapwood via *X. glabratus* and moves systemically in the xylem



S.W. Fraedrich et al. 2008. Plant Disease 92: 215-224

Laurel Wilt: Disease Cycle & Symptoms

- Initial beetle attacks:
  - Stems, branches of healthy trees
  - Difficult to locate
  - Female inoculates host but thought to abandon tunnel without egg laying
- Drooping and discoloration of leaves

Laurel Wilt: Disease Cycle & Symptoms

September 2005 → May 2006

Mature trees completely wilt and die 5-12 weeks after initial inoculation. Dead leaves tend to remain a year or more.

Laurel Wilt: Disease Cycle & Symptoms

Dark sapwood discoloration

Laurel Wilt: Disease Cycle & Symptoms

- Trees become suitable for beetle brood production in advanced stages of disease
  - *X. glabratus*
  - other ambrosia beetles
- Female *X. glabratus* emerge to attack and infect new hosts

RAB Biology and Host Attraction

Hanula, J.L. et al. 2008. J. Econ. Entomol. 101:1276

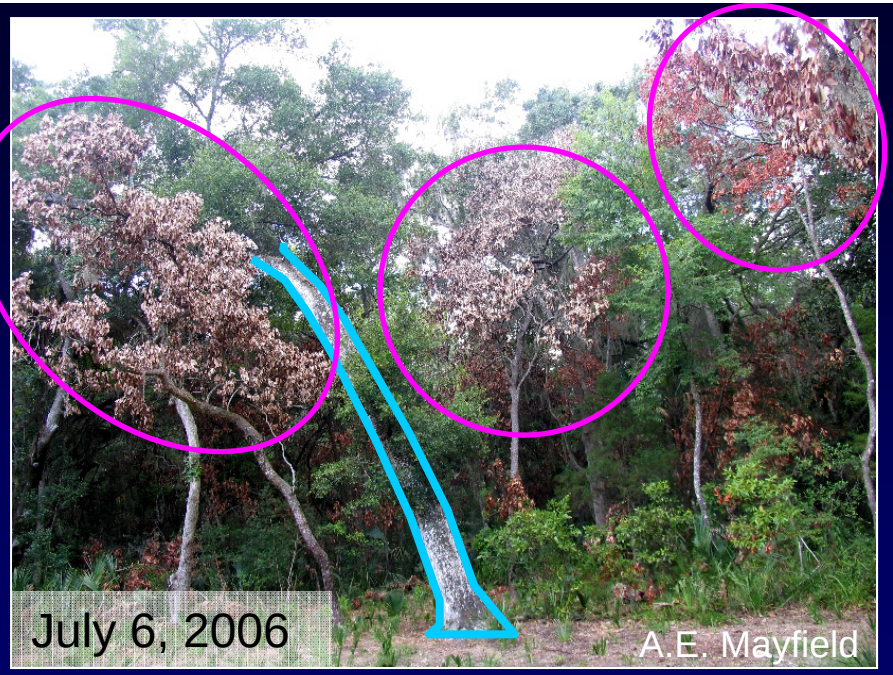
Hanula, J.L and Sullivan, B. 2008. Environ. Entomol. 37:1403

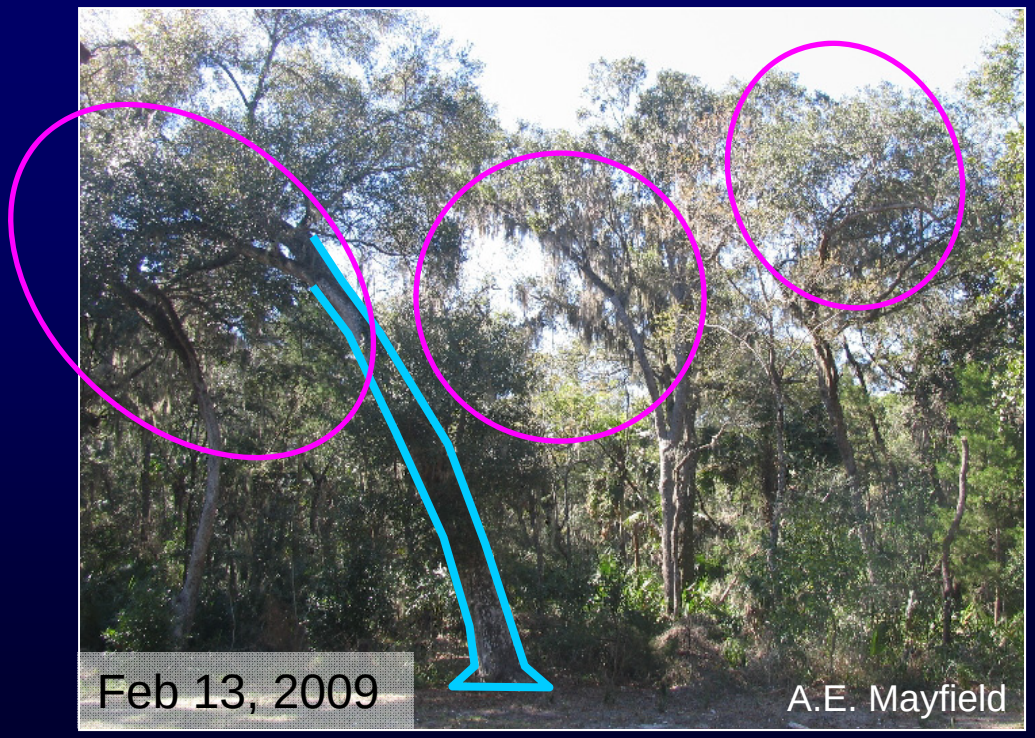
- Adults active year round, peak in September (GA and SC)
- Brood development takes 50-60 days; multiple gen/year
- Diseased + beetle-infested redbay wood is not more attractive than uninfested wood
- Redbay wood remains attractive up to 70 days
- Trap catch correlated with number of dead redbay trees with leaves attached
  - Beetle populations drop dramatically after mature redbays gone
- Manuka oil and phoebe oil are attractive lures

Impact on Redbay

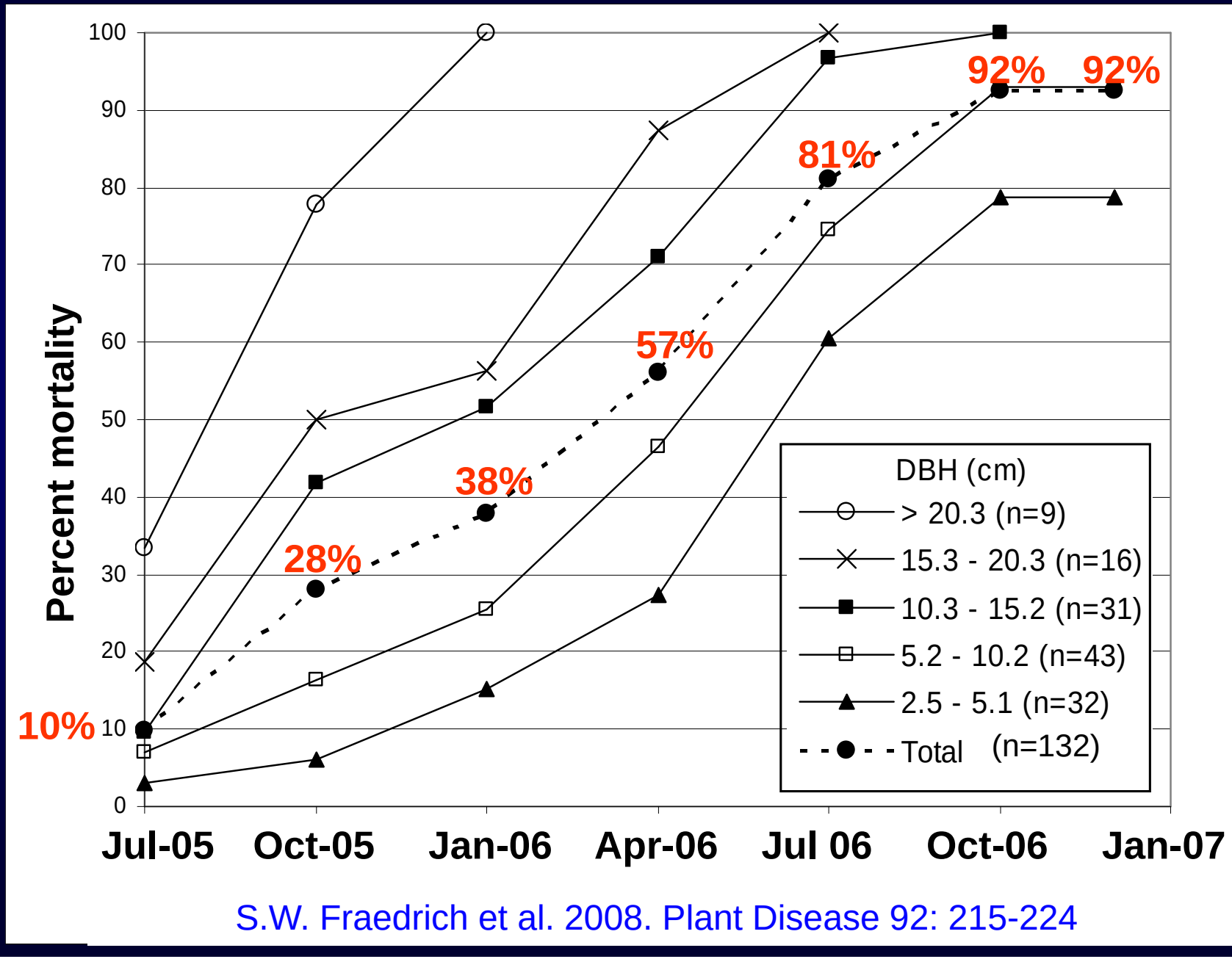
- Nearly all mature redbays dead in areas affected for 2-5 years
- Regeneration <1” diameter seems much less affected

Fort George Island, Florida





Redbay mortality curve at Ft. George Island, FL



S.W. Fraedrich et al. 2008. Plant Disease 92: 215-224

Redbay regen at Ft. George Island

after 4 years of laurel wilt

3” diameter redbay survivor at Florida’s “ground zero”

Northern Ft. George Island after 4 years of laurel wilt

Confirmed Hosts Plants in US

Confirmed in the field:

- Redbay (*Persea borbonia)*[1]
- Swamp bay (*Persea palustris)*[1]
- Sassafras (*Sassafras albidum)*[1]
- Pondspice (*Litsea aestivalis)*[1] - endangered
- Pondberry (*Lindera melissifolia*)[1] - endangered
- Camphor (*Cinnamomum camphora*)[3]
- Avocado (*Persea americana)*[2]

Susceptible in inoculation trials:

- Spicebush (*Lindera benzoin*)[1]
- California laurel (*Umbellularia californica*)[4]

1 Fraedrich, S.W. et al. 2008. Plant Dis. 92:215

2 Mayfield A.E., III et al. 2008. Plant Dis. 92:976

3 Smith, J.A. et al. 2009. Plant Dis. 93:198

4 Fraedrich, S.W. 2008. Plant Dis. 92:1419

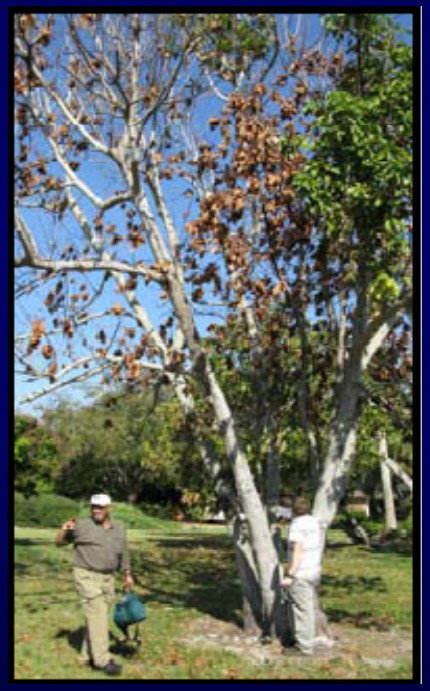
Laurel Wilt and Avocado

- Commercial avocado production
  - FL: $30 million/yr
  - CA: $375 million/yr
- Laurel wilt distribution currently only 160 km north of FL production

Laurel Wilt and Avocado

Jacksonville, summer ’07

Merritt Island ‘09

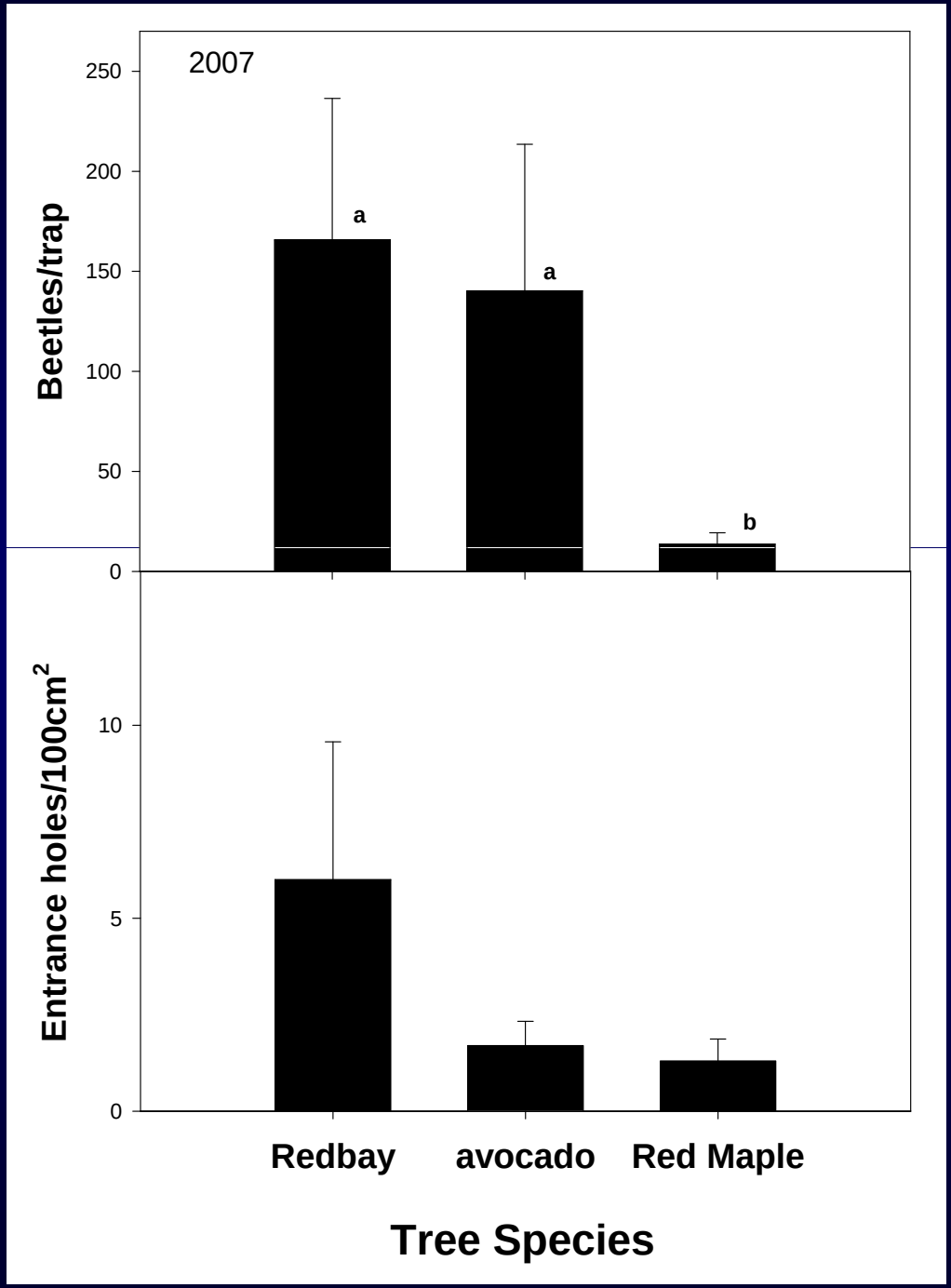


R. Ploetz

Mayfield, A.E. III et al. 2008. Plant Disease 92: 976

Avocado attractive to RAB

Avocado bolts as attractive as redbay, but few beetle entrance holes



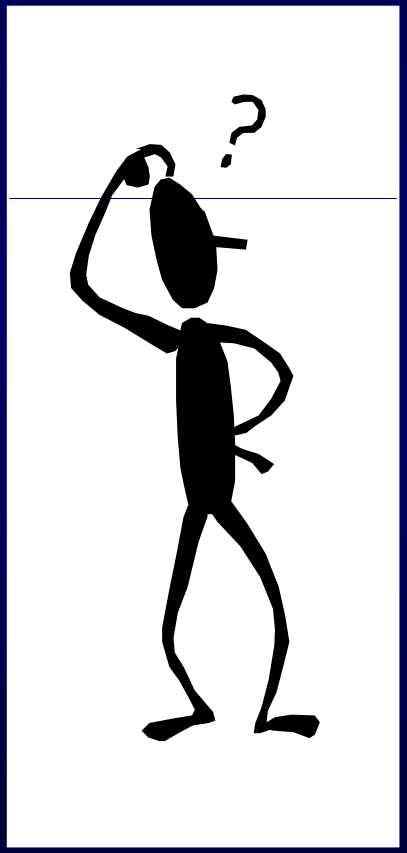
Hanula, J.L. et al. 2008.
J. Econ. Entomol. 101:1276

RAB Release Experiments on Avocado

Mayfield, A.E. III et al. 2008. Florida Entomologist 91:485

- Released 4-5 female RAB into mesh sleeves enclosing stems of plants in 1 gal pots
- Beetles bored into all 5 avocado cultivars and redbay, not live oak
- Pathogen transferred to all cultivars except ‘Hass’, only ‘Simmonds’ died
- Subsequent trials indicate disease development differs with plant size, cultivar, and fungal isolate used in inoculations (Randy Ploetz, U.F.)

Yeah, but what can you do about it?



Laurel Wilt Management Possibilities

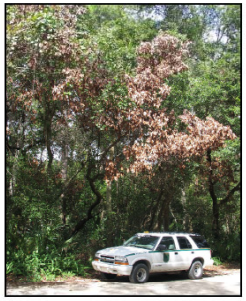
- Restrict / discourage movement of infested wood

PEST ALERT

DON'T TRANSPORT REDBAY FIREWOOD

Non-native insects, diseases and invasive plants are major threats to our nation's forests. Of current concern in Florida is the accidental introduction of the **Redbay Ambrosia Beetle and its associated fungus from Asia**. This beetle is killing redbay trees at an alarming rate, and related trees like sassafras are also at risk. This exotic tree-killing pest can spread to new areas through the movement of infested wood.

- **Please do not bring redbay firewood from places outside the local area.**
- **If you have already brought redbay firewood from somewhere else, burn all of it thoroughly.**



Dying redbays

Ambrosia beetle sawdust

Tree killed by redbay ambrosia beetle and lethal fungus

Florida Department of Agriculture and Consumer Services, Division of Forestry
CHARLES H. BRONSON, Commissioner · MICHAEL C. LONG, Director · www.fl-dof.com

Laurel Wilt Management Possibilities

- Restrict / discourage movement of infested wood
- Sanitation? (failed attempt at Jekyll Island, GA)
  - 2006: over 400 symptomatic trees cut & burned
  - 2007: Laurel wilt spread through entire island

Laurel Wilt Management Possibilities

- Restrict / discourage movement of infested wood
- Sanitation? (failed attempt at Jekyll Island, GA)
- Pesticides on high value trees
  - Alamo® fungicide (propiconzaole)
  - >1½ year preventive efficacy

Mayfield, A.E. III et al. 2008.
Arboriculture and Urban Forestry 34: 317-324

Laurel Wilt Management Possibilities

- Restrict / discourage movement of infested wood
- Sanitation? (failed attempt at Jekyll Island, GA)
- Pesticides on high value trees
- Collection and conservation of redbay seed

Laurel Wilt Management Possibilities

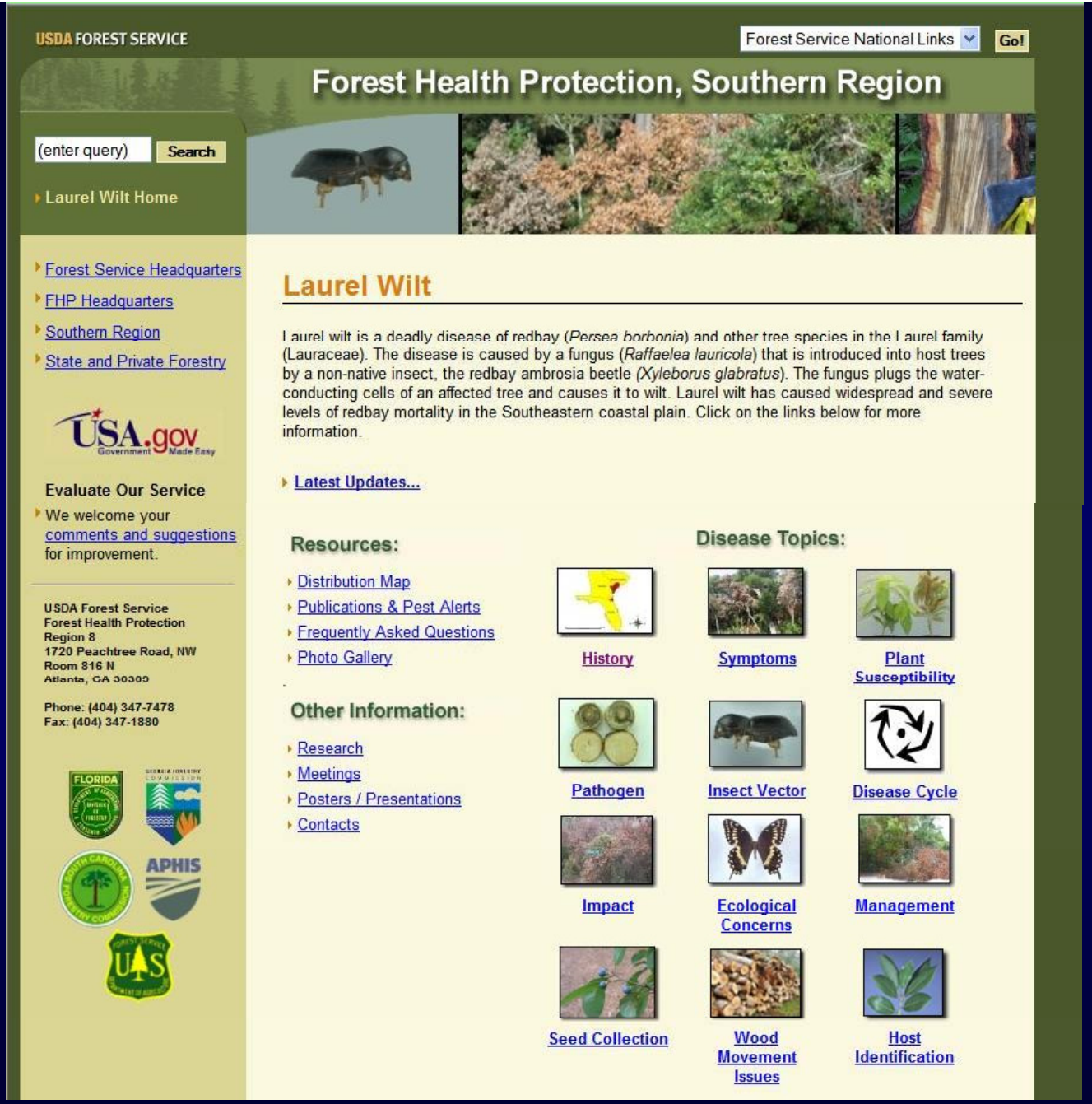
- Restrict / discourage movement of infested wood
- Sanitation (failed attempt at Jekyll Island, GA)
- Pesticides on high value trees
- Collection and conservation of redbay seed
- Discovery and use of resistant genotypes
  - Jason Smith (Univ. Fla.) identify and propagate from "putatively resistant" redbay trees
    - Also working on PCR diagnostics, pathogen genetic diversity

Laurel Wilt Management Possibilities

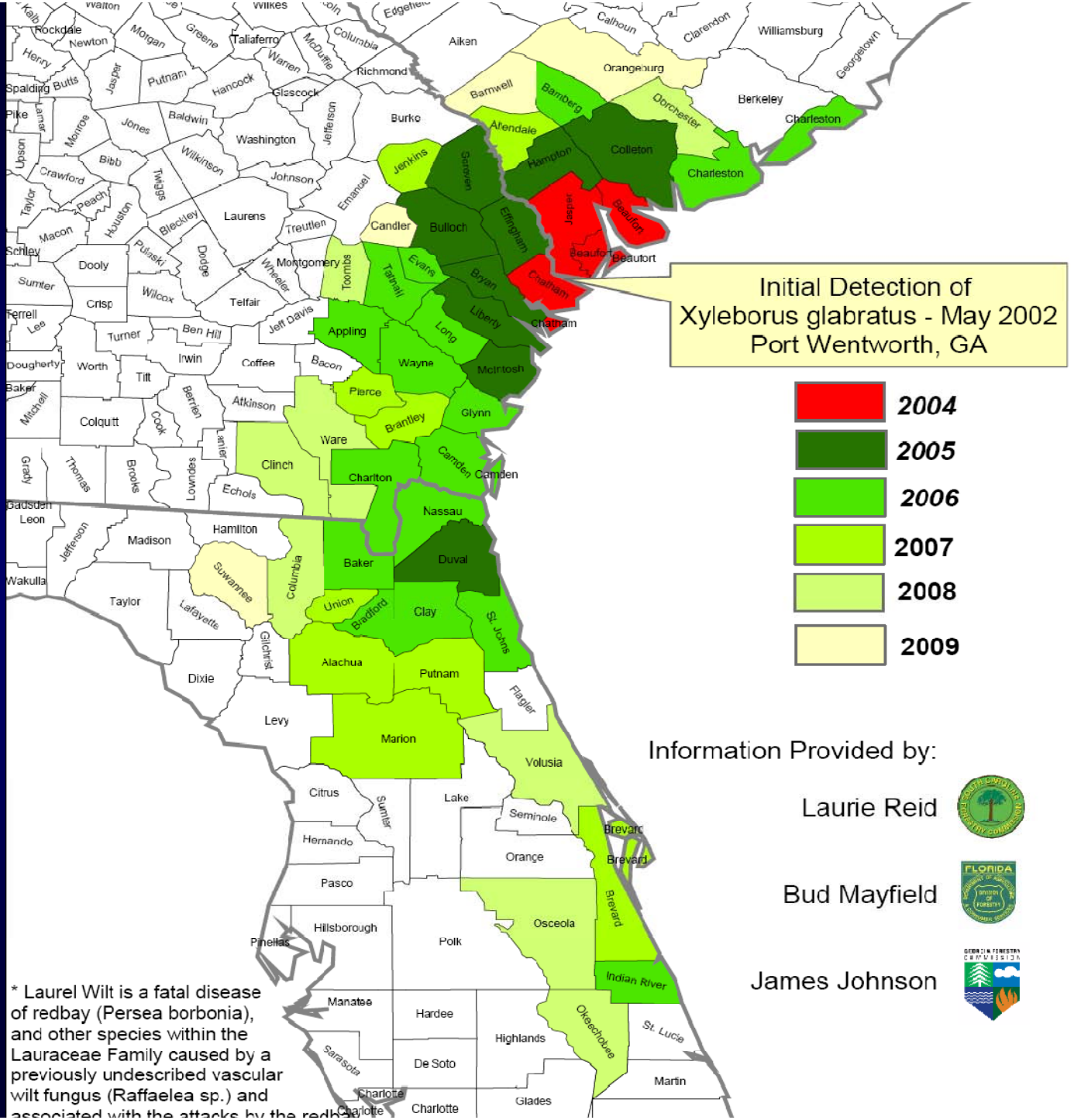
- Restrict / discourage movement of infested wood
- Sanitation (failed attempt at Jekyll Island, GA)
- Pesticides on high value trees
- Collection and conservation of redbay seed
- Discovery and use of resistant genotypes
- “Trap out” of low beetle populations in aftermath of Laurel Wilt, possibly re-establish laurel hosts

Collaboration

- Jekyll Island Conference, Jan 2007:
  - Scientists, FH professionals, managers met to share info and discuss approaches to dealing with LW
  - Laurel Wilt Working Group
    - Website on FHP Southern Region site
    - “Management Opportunities” document



www.fs.fed.us/r8/foresthealth/laurelwilt


Initial Detection of
Xyleborus glabratus - May 2002
Port Wentworth, GA
2004
2005
2006
2007
2008
2009
Information Provided by:
Laurie Reid
Bud Mayfield
James Johnson
* Laurel Wilt is a fatal disease of redbay (Persea borbonia), and other species within the Lauraceae Family caused by a previously undescribed vascular wilt fungus (Raffaelea sp.) and associated with the attacks by the redbay
Chatham
Beaufort
Jasper
Effingham
Bulloch
Screven
Jenkins
Candler
Evans
Tattnall
Bryan
Liberty
Long
McIntosh
Wayne
Appling
Toombs
Montgomery
Wheeler
Telfair
Jeff Davis
Ben Hill
Irwin
Coffee
Bacon
Pierce
Brantley
Glynn
Atkinson
Ware
Clinch
Charlton
Camden
Nassau
Duval
Baker
Columbia
Suwannee
Hamilton
Madison
Jefferson
Leon
Gadsden
Wakulla
Taylor
Lafayette
Dixie
Gilchrist
Levy
Union
Bradford
Clay
St. Johns
Alachua
Putnam
Flagler
Marion
Volusia
Citrus
Sumter
Lake
Seminole
Brevard
Hernando
Orange
Pasco
Osceola
Hillsborough
Pinellas
Polk
Indian River
Manatee
Hardee
Highlands
Okeechobee
St. Lucie
Sarasota
De Soto
Martin
Charlotte
Glades
Hampton
Colleton
Charleston
Berkeley
Dorchester
Barnwell
Bamberg
Orangeburg
Calhoun
Clarendon
Williamsburg
Georgetown
Aiken
Allendale
Burke
Richmond
Columbia
McDuffie
Warren
Glascock
Jefferson
Washington
Johnson
Emanuel
Laurens
Treutlen
Wilkinson
Bleckley
Dodge
Twiggs
Jones
Baldwin
Hancock
Putnam
Jasper
Morgan
Greene
Taliaferro
Wilkes
Lincoln
Edgefield
Rockdale
Newton
Walton
Spalding
Butts
Henry
Pike
Lamar
Upson
Crawford
Peach
Houston
Macon
Taylor
Schley
Dooly
Sumter
Crisp
Wilcox
Pulaski
Ferrell
Lee
Turner
Worth
Tift
Dougherty
Baker
Mitchell
Colquitt
Berrien
Cook
Lanier
Lowndes
Echols
Grady
Thomas
Brooks

Collaboration

- Jekyll Island Conference, Jan 2007:
  - Scientists, FH professionals, managers met to share info and discuss approaches to dealing with LW
  - Laurel Wilt Working Group
    - Website on FHP Southern Region site
    - “Management Opportunities” document

- USDA-ARS organizes LW Focus Group, Jan 2009
  - National Plant Disease Recovery System (NPDRS)
  - Recovery Plans for avocado and redbay

In Closing

- Laurel Wilt is a devastating trees disease comparable to Dutch Elm Disease or Chestnut Blight
- Despite “early detection” of the vector, no opportunity for “rapid response” until too late
- “Presiding over the demise” of yet another group of native forest species
- We should expect much more of the same without revolutionary changes in the way we import goods

Laurel Wilt Website

www.fs.fed.us/r8/foresthealth/laurelwilt