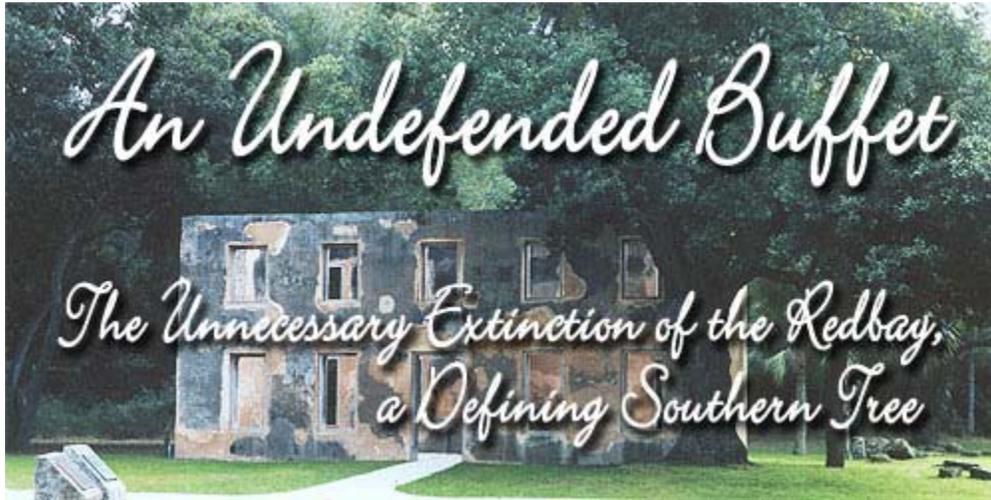


Article



by Susan Cerulean

“Something’s dead wrong in these woods,” said Georgia forester Chip Bates, as he led a group of 30 scientists into Jekyll Island’s interior forests on a hot afternoon last July.

“You may be seeing extinction in progress.”



Redbay partial canopy wilt due to a vascular infection by an *Ophiostoma sp.* fungus introduced by the redbay ambrosia beetle, an invasive species.

Photo by Albert (Bud) Mayfield, Florida Department of Agriculture and Consumer Services (Bugwood.org).

Bates paused near a small evergreen tree and snapped off a wilting twig.

“This tree is fixing to go out,” said Bates. Foresters and entomologists from Louisiana to Canada gathered in close, noting the unnaturally bronze growth at the tips of the tree’s drooping branches.

“I want you to be able to identify the symptoms of this disease, and the beetle that carries it,” Bates continued. “Because it’s coming your way next. Take your knife and roll back the bark.”

The scientists quickly produced pocketknives and hand lenses. Bates dug a squirming black beetle from the twig.

This beetle was no bigger than the head of

a finishing nail, but along with an army of her kind imported from Asia on wood packaging material, she had unleashed a tree-killing disease previously unknown to science.

It wasn't just the one tree. You could turn a full circle in the midst of this forest where every deer, every bird, every plant is protected and see a brown tide of devastation in all directions. The dying tree is called redbay; it is an aromatic, broad-leaved relative of the avocado. Until now, redbay was considered common, certainly not endangered or rare.

“Mississippi, Texas, Alabama—y’all better brace up,” said Bates. “This disease is coming your way, and man, it moves fast. Twenty miles per year. Every island on the coast of Georgia has been either infested or overrun.”

“I just hope it doesn’t stick to the soles of my boots when I go back home,” said a forester from Louisiana, shuffling his feet in the leaf litter.

A Silent Invasion

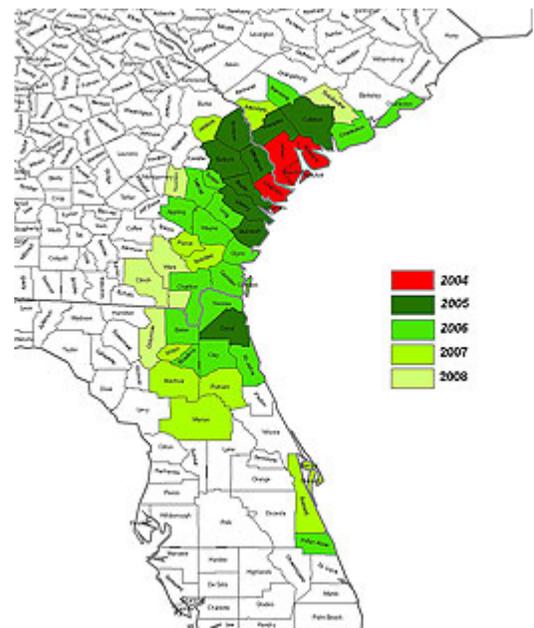
Redbay ambrosia beetles were first detected in a survey trap at Port Wentworth, Georgia near Savannah in 2002. Apparently the insects hitchhiked a ride on a container ship all the way from their native landscape in India, Japan, or Taiwan. U.S. scientists didn’t realize the severity of the beetles’ impact until two years later, when thousands of redbay trees were reported dying in South Carolina, on Hilton Head Island. Since then, laurel wilt, a fungal disease carried by the beetle, has been identified as the killer of uncountable numbers of redbay in more than 33 counties in South Carolina, Georgia, and Florida. At least three related species, including sassafras and possibly avocado, are also at risk.

In 2004, park managers on Ft. George Island in northeast Florida called in urban forester Larry Figart to look at what they believed were hurricane-damaged trees at their preserve. Right away, Figart deduced that every dying tree was a redbay.

“I knew this was bigger than me,” said Figart.

Soon after, Jacksonville area residents began to call the extension office, as many as ten each day, and report that their oak trees seemed to be dying.

“Are you certain they are oak trees?” Figart would ask.



Distribution of counties with laurel wilt disease symptoms, by year of initial distribution.

Graphic by Laurie Reid, Bud Mayfield, and James Johnson, courtesy Georgia Forestry Commission.

“Sure,” they’d reply.

“Do the trees have acorns?” Figart would say. He knew most people had simply never identified a redbay. He’d have the homeowners go outside, crush a leaf from the wilting tree, breathe in its pungent bay fragrance, confirm the absence of acorns. Then Figart broke the bad news: he could offer no solution to stop the native trees from dying.



Healthy redbays among pine and other native Southeastern U.S. trees and forest undergrowth.

Photo by David Moynahan.

“You could hear people deflate over the phone,” Figart said. “We’re so used to being able to fix things. When people have powdery mildew or aphids on their plants, we tell them what to spray, and it generally works. But we don’t have an answer for this disease.”

Ironically, it’s Duval County’s oldest, shadiest neighborhoods that appear most devastated by the laurel wilt’s lethal epidemic. Residential communities such as Atlantic Beach were built to preserve maximum tree cover in the early to mid-1900s. As the trees succumb, it looks like a dappled brown shroud has settled over

the prettiest, most natural neighborhoods near the northeast Florida coast.

“Now that people know about the disease in the Jacksonville area, I don’t get nearly as many calls as I did two years ago. We’re no longer the front line,” said Larry Figart. “But I keep hoping that somewhere out there is a naturally resistant tree. I tell people to keep looking for that tree.”

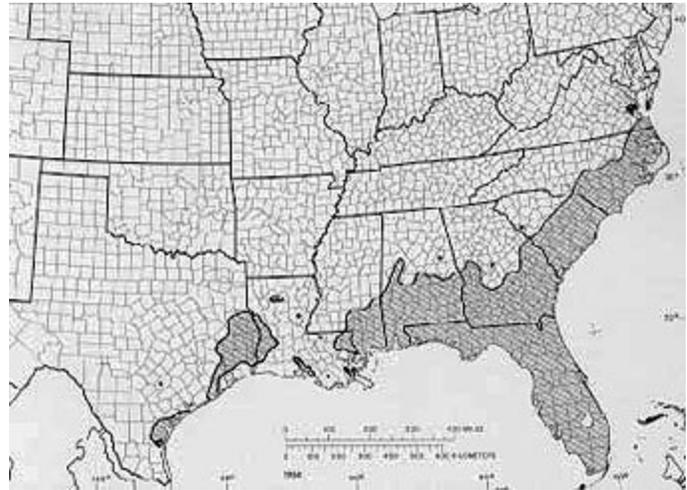
A Green Darker Than All Others

Redbay is a low-profile tree. Commercial timber companies don’t harvest it for profit. A few fine woodworkers employ redbay wood for cabinetry and boat building. Some Southern cooks use the leaves for flavoring gumbos or stews. Most people don’t know it at all.

“Until I saw them dying, I never knew there were so many redbays out there, nor how they were organized in space,” said Florida botanist Dr. Dennis Hardin.

But redbays are the quiet infrastructure of forests from Virginia south into the Everglades, and west all the way to Texas. If you walk into a Southern river forest, or a coastal hammock, redbay will brush against your knees, your chest, and your head. High in the canopy, there it is too, filling up the space between the level ground and the branching of live oaks, palms, and pines. You can count dozens to hundreds of trees per acre.

A crisp menthol fragrance impregnates the air of forests where redbay live. In the late spring, the tree extends thick bouquets of lemon-yellow new leaves, brilliant against last year's khaki. But most of the year, "its green [is] darker than all others, its leaves edged with little waves (like the smile of a wind)," as the poet Rainier Maria Rilke wrote of the family of trees—the laurels—to which redbays belong. In the fall, the redbay's jet-blue fruits draw tanagers, warblers, and wild turkeys. Deer also browse on the evergreen foliage of the tree.



Historical range of the redbay tree in the Southeastern U.S.

Graphic courtesy U.S. Forest Service.

Redbay is so prolific and shady it affects the microclimate of the forests it lives in.

"It's literally degrees cooler under the canopy of a redbay forest," said the Nature Conservancy's Kris Serbesoff-King, invasive species program manager for the organization's Florida chapter.

"The first thing that came to my mind when I heard about redbay mortality was butterflies," said Laurie Reid, a forest entomologist who works for the state of South Carolina. "My God, I thought, what will the swallowtails lay their eggs on if the redbay is gone?"

Butterflies can sip nectar from lots of kinds of plants, but in the caterpillar stage, many chew their way to maturity on just one or two species. Redbays play host to three related butterflies: palamedes, Schaus, and spicebush swallowtails. The range of the palamedes overlays that of its sole host plant, the redbay, from Virginia to Louisiana. You'd mostly see it in swampy woods, or coastal hammocks, same as the tree. The palamedes is broad as an outstretched human palm, with tail-like projections on its hind wings. A pale yellow calligraphy marks the insect's dusky chocolate wing margins.



The palamedes swallowtail butterfly is highly dependent, in its caterpillar form, on the redbay.

Photo by Jack Scheper (c) 2008 Floridata.com

This kind of butterfly is as tightly dependent on redbays as polar bears are to ice. The best case scenario for the palamedes may be periodic major reductions, depending on how far north the laurel wilt travels. The worst case scenario? The butterfly's extinction in the next decade or two.

“We will undoubtedly see a shift across the Southern landscape with wholesale loss of redbay,” said Dr. Doria Gordon, senior ecologist and associate director of conservation science at the Nature Conservancy’s Florida chapter. “We are simplifying our natural systems with consequences we don’t yet understand.”

An Undefended Buffet

Although we know that at least 55 alien bark and ambrosia beetles have been introduced onto our continent in the past 27 years, most aren’t considered aggressive. In other words, they only attack dead or dying trees, not mature trees in the prime of their leafy lives. Not so with the redbay ambrosia beetle. It goes after healthy individuals, from sapling to full-grown. The redbay ambrosia beetle does not actually feed on the wood of the redbay, but on a fungus she has carried and inoculated into the



Redbay leaves afflicted with laurel wilt.

Photo by Albert (Bud) Mayfield, Florida Department of Agriculture and Consumer Services (Bugwood.org).

tree’s sapwood. The beetles bore tunnels into redbays, where they lay their eggs, deposit the laurel wilt spores, and then farm the fungus—at the expense of the tree’s life. Within weeks or months at most, the fungus clogs the circulatory system of the tree, and the redbay will die.

Many trees have developed chemical defenses to thwart attacks by insects and disease, but the redbay has no such protection against the laurel wilt fungus. Since the redbay and this disease evolved in separate places all the way around the world from one another, the tree has had no opportunity to develop any resistance to the wilt. Our redbay forests offer these alien invaders an undefended buffet half a continent wide.

Moving Like the Wind

Laurel wilt moves very rapidly once it reaches a stand of woods. At Hunting Island State Park in South Carolina, the first collapsing redbays were noted in spring 2005. Just over a year later, 80 percent of the island’s redbay were dead. Scientists believe laurel wilt is likely to spread throughout the range of this tree. The disease also kills other members of the laurel family, including sassafras, pondspice, and the endangered pondberry. Commercial growers are beginning to worry about the impact of laurel wilt on another redbay relative—the luscious avocado. Laurel wilt has been observed in residential and experimental avocado trees, and if the disease reaches the major production areas of south Florida, a crop worth \$14.5 million (in 2004-2005) will be at risk.

The prospects of halting the rampage of laurel wilt and the beetles that spread it are bleak. In some places, such as Jekyll Island, teams of foresters and scientists have tried to contain or limit spread of what they call an ecological catastrophe. Forester Chip Bates and his colleagues put together a chainsaw strike team in 2006.



Healthy redbay leaves.
Photo by David Moynahan.

“We cut down and skidded out almost five hundred infested trees,” said Bates. But within three months, the foresters saw fresh beetle attacks and six months later, widespread redbay mortality.

“We might have slowed the beetle down a little,” said Bates.

“There are things people can do to slow the spread of this disease. We’re emphasizing not moving the beetle vector, not moving firewood or dead trees,” said Florida entomologist Dr. Bud Mayfield. Although the redbay ambrosia beetle is undoubtedly invading new territory through its own flight, it can move much farther and faster with human help. Firewood, logs, or nursery stock of wilted or dead trees should not be transported, except to be destroyed locally, by burning or in a landfill.

“It makes your heart stop to come across people advertising free redbay wood in places like church bulletins,” said forest entomologist Laurie Reid. It’s easy to picture: someone has a redbay die on his property.

Unaware he is spreading a deadly beetle-borne disease, he cuts down the tree and offers the wood to neighbors. The beetle accepts the free ride and hopscoches ever more quickly through the South. Campers and boaters inadvertently worsen the problem, loading up and transporting downed redbay wood as they travel from affected counties to areas yet unscathed.

No pesticides have been demonstrated effective against laurel wilt disease. And even if such a remedy was found, says Dr. Bud Mayfield, “We’re certainly not going to save our forests with fungicide injections, tree by tree. This would be limited to park and landscape situations.”

Changing the Face of Home

In northeast Florida, at the confluence of three rivers—the St. Marys, St. Johns, and Nassau—24,000 acres of gorgeous wetlands and woodlands have been protected for the public’s enjoyment. Little and Big Talbot Island State Parks, and the Timucuan and Machaba Balu Preserves, fall within this remarkable



Dead redbay in the dense undergrowth of McIntosh County, Georgia.

Photo by James Johnson, Georgia Forestry Commission (Bugwood.org).

mosaic of public and private ownerships.

Trish Gramajo-St. John, northeast Florida community relations manager with the Nature Conservancy, works with area land managers, and has organized a five-county working group to address the issue of invasive pests.

“We’ve tried to do everything right,” said St. John. “We’ve acquired these lands, we manage them carefully, we study wildlife and water quality issues using the best science available, and still, we find ourselves at the mercy of this threat. We want to know what we can do to preserve our trees. But basically we’re just documenting new outbreaks.”

Gramajo-St. John was married to her husband Caleb at Little Talbot Island State Park on the 29th of April in 2006. “It’s one of my favorite places in north Florida. I have a very deep connection to that place, with its gorgeous view of the salt marsh and its huge coastal forest.”

“But when we got married here, only one or two trees were infected with the laurel wilt. We’ve returned to picnic and celebrate our past two wedding anniversaries. It’s heartbreaking to see big chunks of the forest covered in dead trees.”

Gramajo tries to analyze this problem as a scientist, but she finds that everyone familiar with this landscape—anglers, hunters, kayakers, birders, hikers—have an emotional reaction to the visual impact of the laurel wilt.

“It’s as if someone has changed the color of our forests,” said Gramajo-St. John.

“We need reassurance that actions will be taken at the national level to see that this doesn’t happen again.”

Most scientists agree that the only way to stop the laurel wilt redbay tragedy from repeating itself is to prevent introducing new pests. But invasive plants, animals, and pathogens now top the list of threats to the planet’s biodiversity. An abridged list of forest trees hard hit by non-native pests includes American chestnut (ravaged by chestnut blight) and American elm (Dutch elm disease), as well as American beech, flowering dogwood, and white pine.

What you can do to help redbay and slow the spread of laurel wilt disease (and other forest-killing pests)

1. Don’t move firewood. Buy firewood where you plan to burn it. Do not transport firewood to or from vacation homes, campsites, picnic grounds, or other places. Spread the word; tell your family and friends not to transport firewood, as well.



2. Until [stronger federal regulations](#) are in place for plant imports, consider buying seeds or locally grown plants from nurseries.

3. Clean your boots carefully after hiking in a forest to [avoid spreading diseases](#).

4. Understand the origins of your wood and paper products. Choose wood, furniture, paper, and other products certified by the [Forest Stewardship Council](#) (FSC), which promotes responsible stewardship of the world’s forests. If these products are not available at your favorite stores, ask stores to begin carrying FSC-certified wood and paper products.

Photo: Georgia Forestry Commission forester Chip Bates, pictured here with a dead redbay from Liberty County, Georgia, was among the first to detect laurel wilt damage to redbays. Photo by James Johnson, Georgia Forestry Commission (Bugwood.org).



Cross-section of redbay branch with ambrosia beetles and larvae.

Photo by James Johnson, Georgia Forestry Commission (Bugwood.org).

These bioinvasions are reaching epidemic proportions as international global commerce and transport increase. Billions of creatures are on the move, hitching free rides in cargo or on the superstructure of the more than 6.5 billion containers shipped over the oceans in the global economy.

Like other invasive pests, bark and ambrosia beetles are frequently moved from continent to continent in shipments of wood products, or in solid wood packing material. They are tiny, easily missed, and very efficient at finding appropriate hosts.

“It’s usually an accident when we find an invasive pest. And once it’s here, we don’t have a plan,” said Doria Gordon. “We argued for a quarantine from the moment we learned about this disease. But pests of native systems without a commercial component don’t get nearly the attention as those that affect agriculture or the timber industry. A lot of good research was done quickly once the wilt was discovered. But no regulatory approach has been developed to slow the spread.”

Ultimately, scientists agree, the tragedy of the redbay isn’t a firewood transport issue, nor a question of developing an effective pesticide or biocontrol measure. It’s an international relations issue, fueled by consumer choices. As long as the bulk of what we buy is made overseas and imported in a massive pattern of international commerce—without adequate investment in making sure that trade is safe as well as cheap—ecological disruptions from the introduction of foreign pests will likely continue.

Across the Southeast, we will have to keep vigil as the loss of a glossy green scaffold of our forests—*Persea borbonia*, the redbay tree—leaves us with a drabber, more impoverished landscape.

If you want to help strengthen policies that will protect our forests from non-native insects and diseases, here’s what to do:

1. Urge states which do not yet have laurel wilt, but do have redbay or sassafras trees, to adopt regulations prohibiting importation of redbay or sassafras firewood, logs, chips, mulch, or nursery stock from Florida, Georgia, and South Carolina. Restrictions on nursery stock should include other plants in the laurel family as a precaution, since the full host range of the pathogen is not known.
2. Urge Florida, Georgia, and South Carolina to adopt regulations to restrict movement of redbay or sassafras firewood, logs, chips, mulch, or nursery stock—so as to slow the human-assisted spread of the disease complex to uninfected areas. Restrictions on nursery stock should include other plants in the laurel family as a precaution, since the full host range of the pathogen is not known.

3. Urge all states vulnerable to laurel wilt (those with redbay and possibly sassafras) to enact broad rules governing movement of firewood. ([See New York's model here.](#))
4. Urge the [U.S. Department of Agriculture Animal and Plant Health Inspection Service](#) to enact broad rules governing movement of all firewood.

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*Editor's Note:* Susan Cerulean was commissioned to write this article for [The Nature Conservancy](#). It is copyright © The Nature Conservancy 2008. All rights reserved.

Title photo: Once considered one of the largest redbays in the U.S., adjacent to the Horton House ruins in Jekyll Island, Georgia, this majestic redbay was afflicted with laurel wilt in late 2006 and cut down in November 2007. Photo by Faith Campbell.

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Writer and naturalist **Susan Cerulean** lives in Tallahassee, Florida, where she keeps watch over the still-healthy redbays along the Wakulla and St. Marks Rivers. In 2005, her nature memoir, [Tracking Desire: A Journey After Swallow-tailed Kites](#), was named Editors' Choice by *Audubon* magazine.

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