American Butterflies

Volume 29: Number 1

Spring 2021

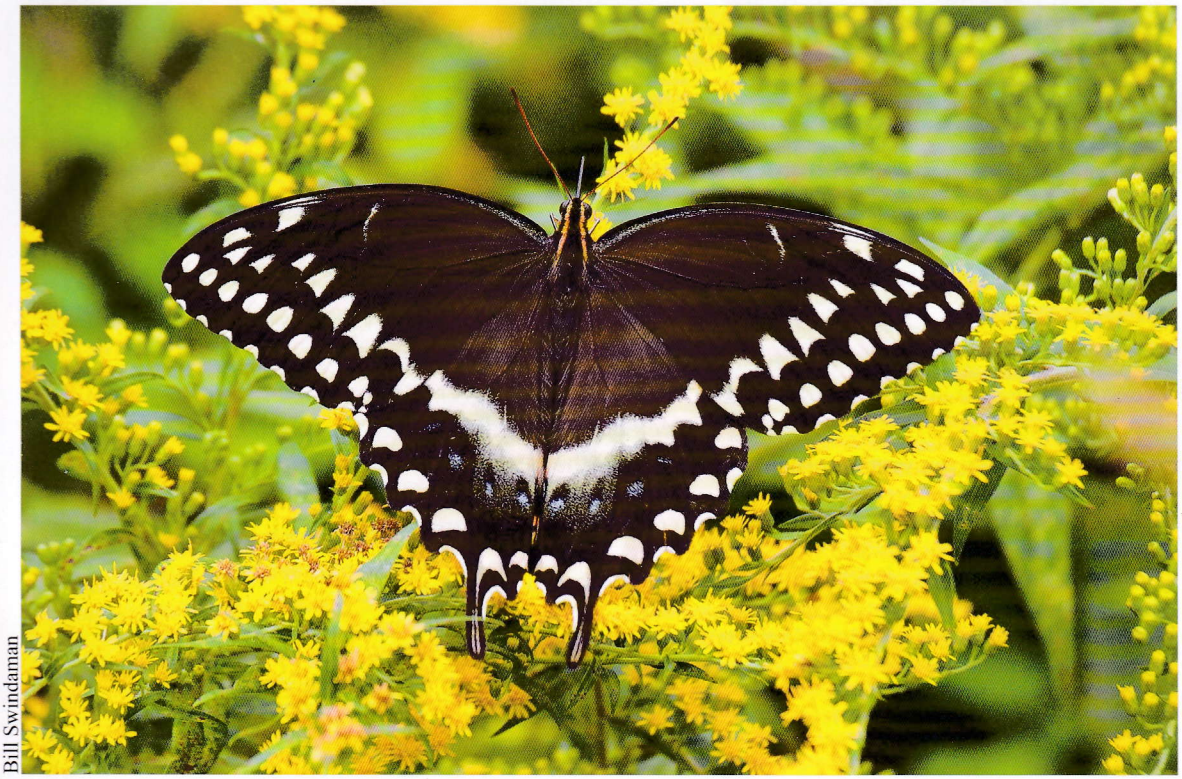
Laurel Wilt Disease

We Are NABA: Delia Smith

Hot Seens

Taxonomists: The Fabulous Fabricius

Sleepy Orange Food



Bill Swindaman

Laurel Wilt Disease and Palamedes Swallowtails

by Jennifer Reed

Palamedes Swallowtails are named for a figure in Greek mythology, and true to genre, they have an enemy that leads to a tragic downfall. Not a pair of powerful men, as killed their namesake, but a beetle, the size of a rice grain. About twenty years ago, a Redbay ambrosia beetle (*Xyleborus glabratus*) hitched a ride on a shipping container from Asia, landed in Georgia, and looked to make itself at home. It bored into a Redbay, a common tree species in the southeastern United States, and set off a reaction that has resulted in the death

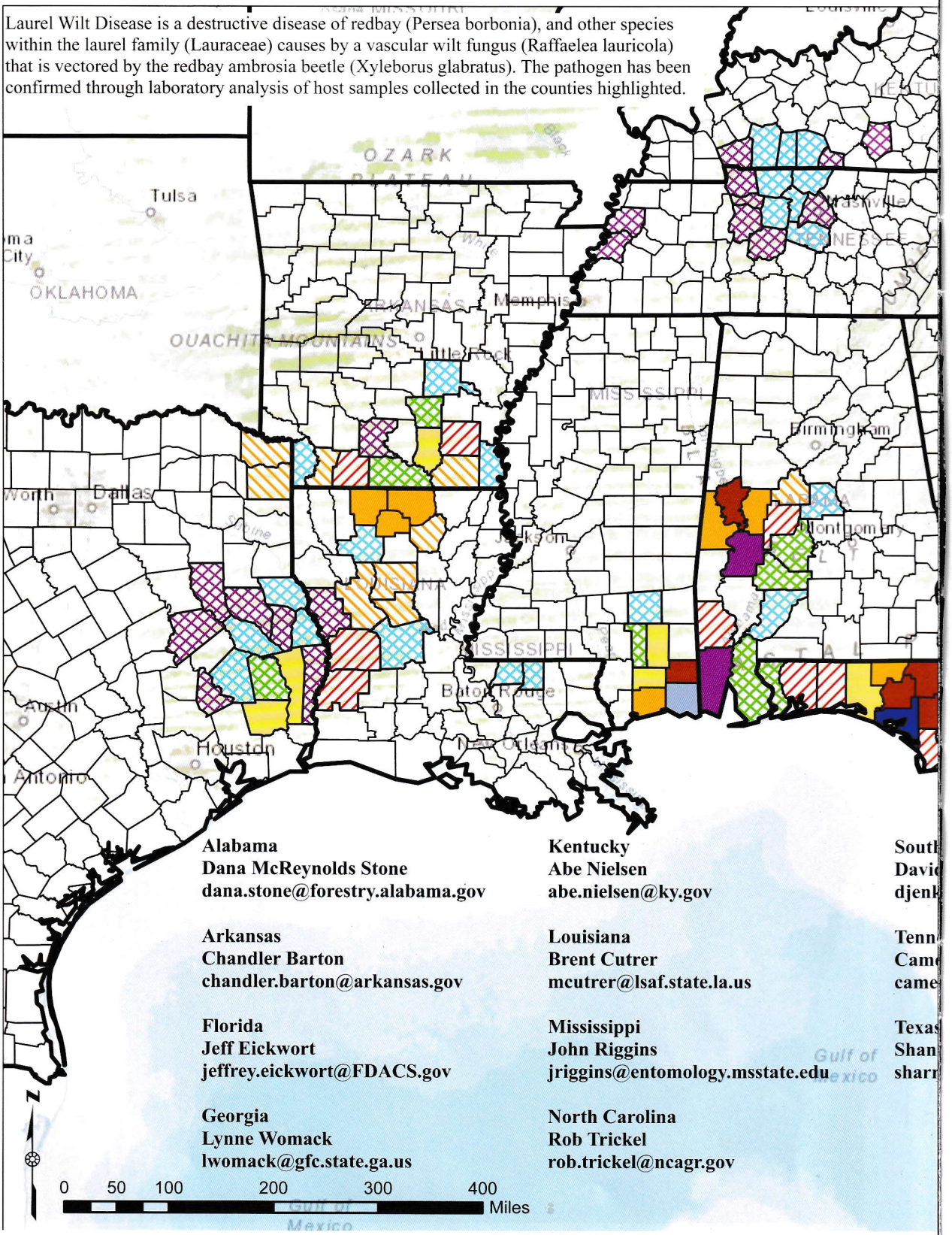
Palamedes Swallowtails were abundant flagship butterflies of southeastern swamps; now their future is in question.

Above: Sept 4, 2009. Lake Mattamuskeet NWR, Hyde Co., NC.

Opposite page: June 27, 2010. Research Road, Everglades NP, Miami-Dade Co., FL.

Distribution of Counties with Laurel Wilt Disease* b

Laurel Wilt Disease is a destructive disease of redbay (Persea borbonia), and other species within the laurel family (Lauraceae) causes by a vascular wilt fungus (Raffaelea lauricola) that is vectored by the redbay ambrosia beetle (Xyleborus glabratus). The pathogen has been confirmed through laboratory analysis of host samples collected in the counties highlighted.



Alabama
Dana McReynolds Stone
dana.stone@forestry.alabama.gov

Arkansas
Chandler Barton
chandler.barton@arkansas.gov

Florida
Jeff Eickwort
jeffrey.eickwort@FDACS.gov

Georgia
Lynne Womack
lwomack@gfc.state.ga.us

Kentucky
Abe Nielsen
abe.nielsen@ky.gov

Louisiana
Brent Cutrer
mcutrer@lsaf.state.la.us

Mississippi
John Riggins
jriggins@entomology.msstate.edu

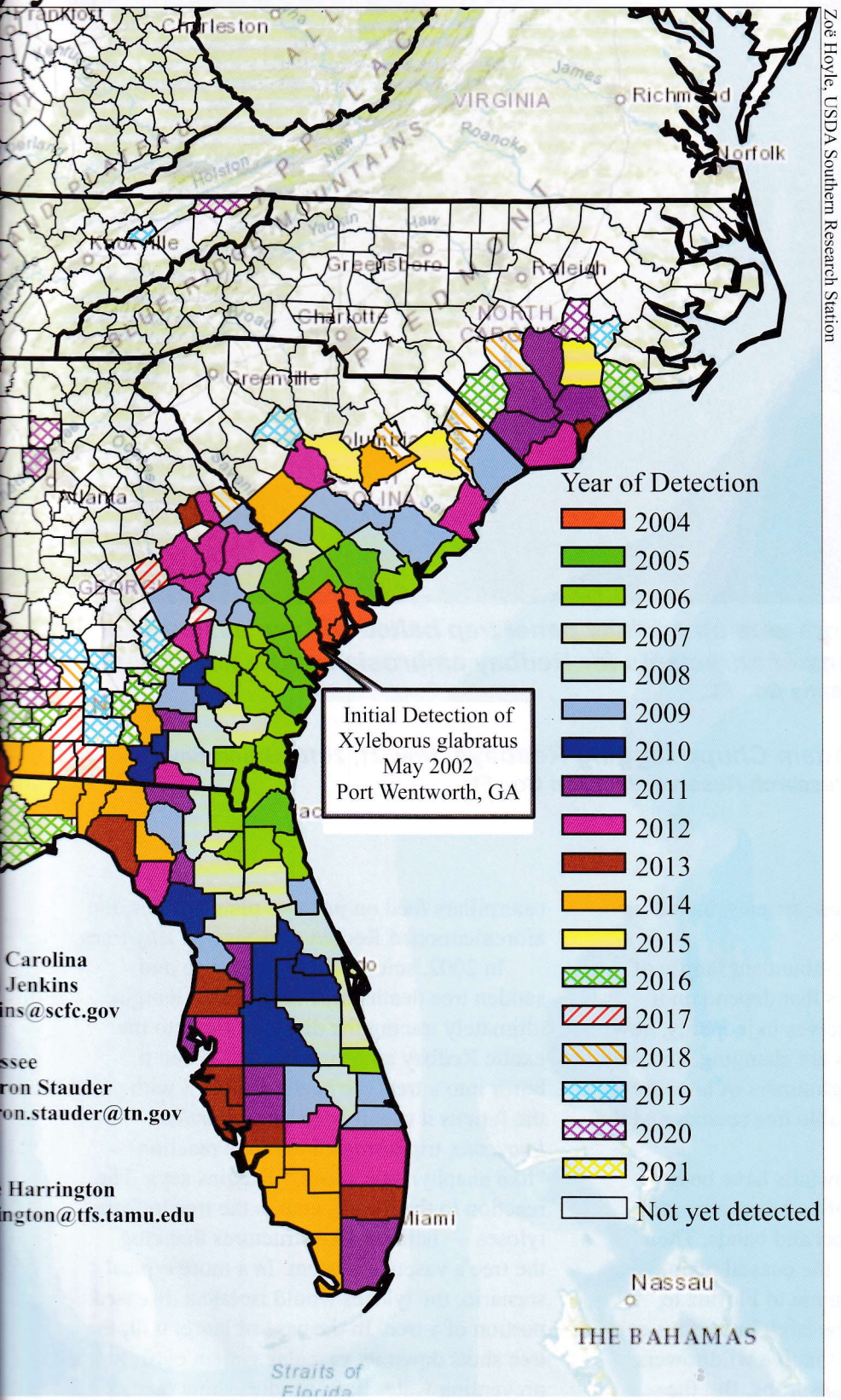
North Carolina
Rob Trickel
rob.trickel@ncagr.gov

Soutl
Davi
djenk

Tenn
Cam
came

Texa
Shan
sharr

y year of Initial Detection



Zoë Hoyle, USDA Southern Research Station

Carolina
Jenkins
ins@scfc.gov

ssee
ron Stauder
ron.stauder@tn.gov

Harrington
ington@tfs.tamu.edu

Stephen R. Ausmus/ USDA-ARS

Above: Paul Kendra sets up a sticky panel trap baited with an essential oil lure for evaluations of attractants for Redbay ambrosia beetle. ***May 21, 2012. Lake June SP, Highlands Co., FL.***

Opposite page: Adam Chupp tagging Redbays. ***Nov. 21, 2010. Grand Bay National Estuarine Research Reserve, Jackson Co., FL.***

to afflict other Lauraceae species, including Sassafras and Avocado.

Here's how a once-abundant family of trees and the butterflies that depend on it suddenly found themselves in jeopardy, how the Southeast's forests are changing, and why some researchers see glimmers of hope for a diminished but still viable tree species and the life they sustain.

Palamedes Swallowtails have bodies the color of roasted coffee beans accented with butter-yellow spots and bands. Their range roughly follows the coastal plain, from southeastern Virginia to Florida to Louisiana to Texas. The adult butterflies enjoy nectar from an array of native wildflowers and flowering trees and shrubs. But the caterpillars feed on just two plant species, the aforementioned Redbay and Swamp Bay trees.

In 2002, scientists noted strange and sudden tree deaths near Savannah, Georgia, ultimately tracing the disease source to the exotic Redbay ambrosia beetle. When it bores into a tree, the beetle infects it with the fungus it usually carries, *Raffaelea lauricola*, triggering an extreme reaction — "like anaphylactic shock," Riggins says. The reaction to the fungus causes the tree to form tyloses — balloon-like structures that clog the tree's vascular system. In a more typical scenario, the tyloses would isolate a diseased portion of a tree. In the case of laurel wilt, the tree shuts down its vascular system entirely, preventing water flow. Studies show that

Loretta Battaglia

Stephen R. Ausmus/ USDA-ARS (2)

Above: A Redbay ambrosia beetle. ***May 21, 2012.***

Above right: A cross section of a Swamp Bay tree trunk shows the Redbay ambrosia beetle's galleries (white lines) that are filled with the fungus **Raffaelea lauricola,** ***the cause of laurel wilt disease.*** ***May 22, 2012.***

Opposite page: A Swamp Bay blossom. ***June 18, 2013. Carolina Sandhills NWR, Chesterfield Co., SC.***

Infected trees usually die within a mere 15 months from infection. The beetles go after large, mature trees, punching holes throughout southern forest canopies.

The trees' susceptibility is extreme. An inoculation of as few as 100 spores will cause a fatal infection. Both the beetles and fungus can reproduce clonally, which would have made early containment nearly impossible — if their presence and potential for havoc had been detected. In fact, a single beetle may have set off the entire chain reaction, according to Jason A. Smith, an associate professor of forest pathology at the University of Florida who has studied laurel wilt extensively.

"Nobody would have predicted this would happen here," he says. That's in part because ambrosia beetles are unlikely tree assassins. They typically seek out dead and dying trees — not vibrant, healthy ones. The Redbay ambrosia beetles themselves don't impart such devastation back home in Asia. But landing in a new ecosystem seems to have scrambled their signals. Such biological malfunction isn't unusual, explains Albert "Bud" Mayfield, a research entomologist with the U.S. Forest Service's Southern Research Station in North Carolina. It can happen when two organisms without a shared evolutionary history are thrust together. "In common vernacular: They do not know what to do with each other. There's a mismatch in more than one way," Mayfield says.

Laurel wilt has killed more than 300 million Redbays alone, a third of the tree's population, since the beetle's introduction.

That's a lot of host plants.

Quantifying the impact on Palamedes Swallowtails across its range is difficult, but common sense says the butterfly's outlook is grim. "If their food source is wiped out, their chances are not great. And essentially that's what this pathogen is doing," says Riggins. Laurel wilt has been detected in eleven states, including the entire Florida peninsula, according to the U.S. Department of Agriculture.

Will Stuart

A study Riggins co-authored in 2018 examining portions of forests in North Carolina and Mississippi offered one snapshot of decline: The mean number of Palamedes Swallowtails encountered in the laurel wilt-infected study areas were sixfold less than in the uninfected areas. Palamedes Swallowtails aren't the only native insects of concern; at least twenty-four others are dependent upon Lauraceae host plants, Riggins noted in the study. That's not to mention other cascading effects on other species — on birds, for example — that feed on the butterflies, or on plants that rely on Palamedes Swallowtails for pollination.

"A lot of these things are relatively unstudied," Riggins says. "[Palamedes] were so common before — probably one of the most common large, showy butterflies in that portion of the Southeast. Sometimes things like that don't get studied until there's a problem," he says.

He puts an even bigger damper on the situation: "There is evidence that the pathogen is carried by other ambrosia beetles, not just Redbay ambrosia," he says. It's likely that other beetles picked up the *R. lauricola* fungus by feeding in infested trees. "This thing really is the perfect invader," Riggins says.

But neither the trees nor the butterflies are a lost cause — at least not yet.

If your food source were destroyed, you'd hold your nose and figure out some other means of staying alive, unpalatable though it may be.

Adam D. Chupp, Ph.D., wondered if Palamedes Swallowtails might do just that. In a 2014 study, with Loretta L. Pattaglia, he examined whether Palamedes Swallowtails could switch hosts.

Chupp, then at Southern Illinois University and now an assistant professor in the Department of Biology at the University of South Alabama, decided to look more closely at Camphortree, a member of the Laurel family that originated in Asia, was imported to the United States in the late 1800s and now grows abundantly in the South. Camphortrees, he notes, are not succumbing to laurel wilt.

"There is probably some evolutionary history between Camphortrees and the

beetle and the fungus that goes way back," Chupp says. "Camphortrees do not seem to be too bothered by laurel wilt." They are, however, classed as invasive by numerous organizations.

In controlled experiments, he found that about 50 percent of Palamedes Swallowtail caterpillars survived on Camphortree. He says "It's not great, but they're surviving," But there's a major caveat: Female Palamedes Swallowtails generally won't lay their eggs on Camphortrees. "Any kind of host switch, it seems, would be limited by the females' ability to adapt," Chupp says.

It's possible, he adds, that if females were to accept a new host plant, their offspring may, in turn, remember the tree nourished them and return to it as adults to lay their own eggs.

For now, that's a big "what if."

Here's another — and one not dependent on finicky insects: What if we don't have to count out the Lauraceae?

"I think the story needs to be not that Redbay is going extinct. It's more nuanced than that," says Smith at the University of Florida. Some of the research emerging from his lab and elsewhere give scientists reason to believe Lauraceae may survive laurel wilt, particularly if supported with new forest management strategies.

Redbay, Swamp Bay and other Lauraceae have a tremendous ability to coppice, or grow shoots from their stumps, offering hope of renewal and suggesting that redbay could subsist if managed as smaller trees. Redbay produces vast numbers of seeds, even as young trees, ensuring their genetics persist. And some select trees, says Smith, appear to be resistant to laurel wilt.

He and his team surveyed sites in Georgia, South Carolina and Florida looking for surviving Redbays greater than six inches in diameter (the beetles generally attack mature trees, not saplings).They identified about 100 individuals, and set about growing new trees from cuttings, creating clones with the genetic resistance. Their success in doing so may have important implications for forest restoration.

Smith also found success with applying naturally occurring compounds, methyl salicylate and verbenone, to Redbay logs, which repelled the beetles. Deploying beetle traps created a "push-pull" system and made the strategy even more effective.

There's evidence fungicides work, too, though the process is labor intensive and practical only for high-value trees.

None of this is to say southeastern forests will ever be the same. "Redbay is hanging on as a very small diameter tree," Mayfield says. "But it is being eliminated as a midstory and canopy tree in the forest."

One good note about the Palamedes Swallowtails: They may insist on laying eggs on Redbay and Swamp Bay, but they don't seem to care much about the size of those host trees. Chupp's research suggests that Palamedes Swallowtails appear to fare as well on small Redbays as they do on mature ones. "The question is: Is there enough of it?" he says. Further research is also needed to examine whether swallowtails reared on smaller trees are more susceptible to predators than those hatched on mature ones.

Only time will provide answers.

To borrow again from myth, there's no putting the lid back on this Pandora's Box. In addition to Redbay and Swamp Bay's devastation, scientists now are watching laurel wilt attack Sassafras, and they're wincing at what the disease could do to another laurel species and the $9 billion Avocado industry.

Even faced with those grim realities, Smith remains cautiously hopeful. He has returned to study plots ten years after his original surveys and found widespread Redbay regeneration.

"Yes, we've lost a ton," he says. "There is no doubt the ecosystem has changed. The forest structure and the composition has changed. The butterfly populations are absolutely being impacted."

But with the potential for new management and restoration strategies on the horizon, he adds: "I don't feel as pessimistic as I did before."