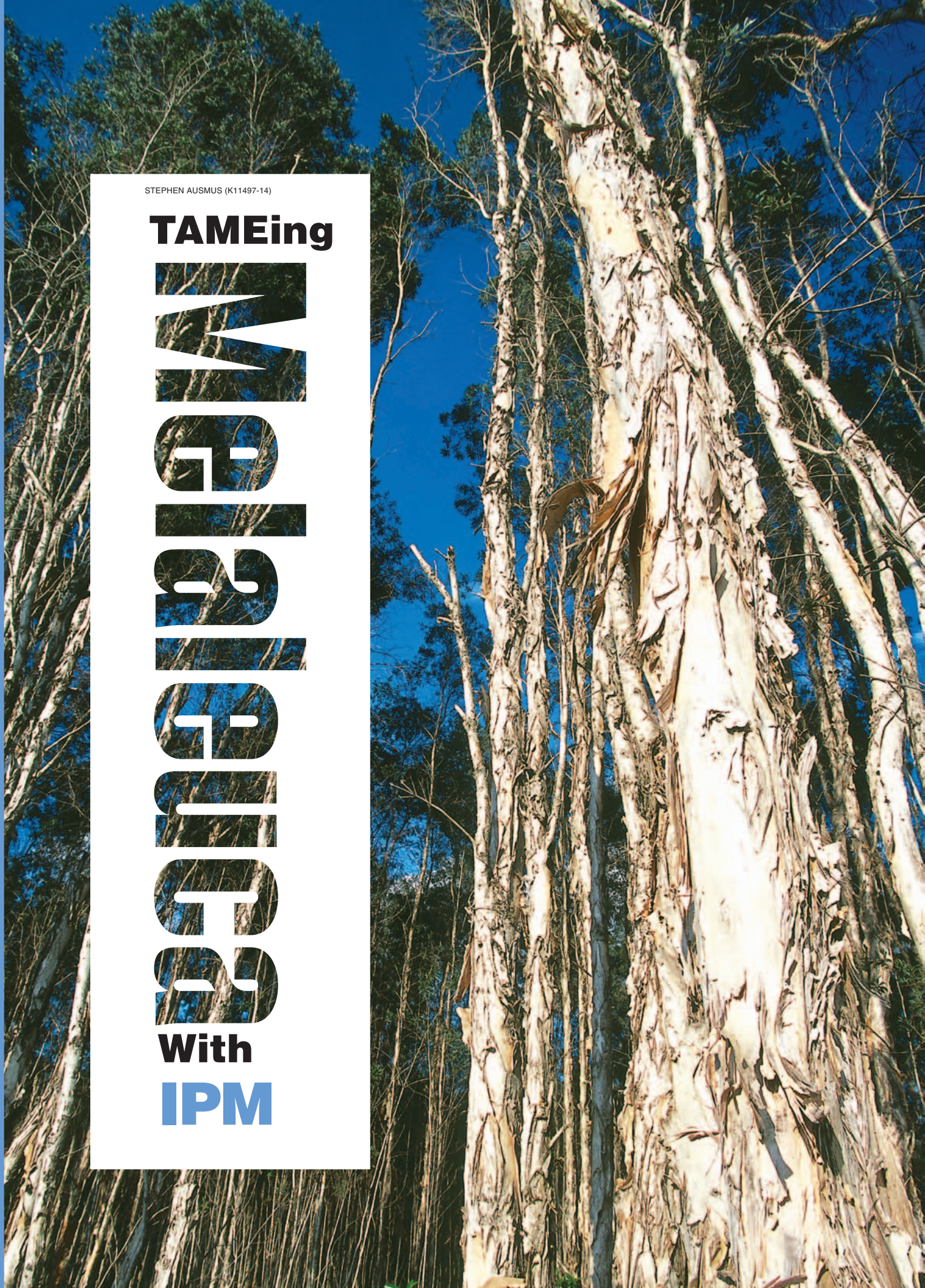

STEPHEN AUSMUS (K11497-14)

TAMEing Mealybugs With IPM

Melaleuca is an exotic invasive plant species that was introduced into South Florida in the late 19th century. The tree was used extensively as an ornamental plant and as a soil stabilizer near lakes and canals. At that time, no one guessed that it would one day displace native plants and animals, dry up wetlands, and create a fire hazard.

Now, over a century later, melaleuca *(Melaleuca quinquenervia)* is seen as one of the Florida Everglades ecosystem's worst enemies, causing as much as $168 million in environmental losses every year and taking over 14 to 15 acres a day. During the dry season in South Florida, huge forest fires—aggravated by the high oil content of melaleuca leaves—scorch thousands of acres of natural areas and encroach on developed ones, endangering lives, homes, and businesses.

◀ ***Melaleuca quinquenervia,*** **also known as the "paperback tree," forms dense forests that can reach heights of over 20 meters.**

STEPHEN AUSMUS (K11495-1)

▶ **Seven years after its Florida release, the melaleuca leaf weevil *(Oxyops vitiosa)* has significantly reduced melaleuca flowering and growth.**

Early Successes

In 1990, the South Florida Water Management District (SFWMD) began an aggressive campaign to lower melaleuca populations across South Florida. As a result, melaleuca acreage on public lands has decreased dramatically. But the 60- to 100-foot-tall trees continue to spread at such a high rate on private property that there has been little decrease in overall acreage covered.

"That's because controlling melaleuca is tricky," says Cressida Silvers, an entomologist with the Agricultural Research Service (ARS) Invasive Plant Research Laboratory (IPRL) in Fort Lauderdale. "The high volume of seeds held in the tree's canopy helps this species to disperse and establish." Any stress to the trees, such as fire, cutting, or spraying, causes millions of little seeds to fall from the canopy and quickly germinate. This creates what looks like "a carpet of tiny seedlings," according to Silvers.

Traditional controls, such as spraying the trees with herbicide or cutting them down and applying herbicide to the remaining stumps, were effective, but a comprehensive approach was needed to increase the long-term efficacy of management efforts.

In 2001, ARS created The Areawide Management and Evaluation of Melaleuca (TAME Melaleuca) project. Paul Pratt, an entomologist at IPRL, is the project's director. Silvers serves as coordinator, and John Scoles is the writer for the project's publications. The purpose of the project is to promote areawide melaleuca management on both public and private lands and to demonstrate effective integration of biological control into current management strategies.

IPRL has a long history of researching, developing, and evaluating the effectiveness of biological control agents, especially their use in integrated pest management (IPM).

IPM involves strategic use of a combination of methods to achieve long-term results. Extensive knowledge of melaleuca's life cycle drives the selection of biological agents and application of control treatments that reduce existing infestations and prevent new ones, while minimizing risks to nontarget organisms.

A Trio of Biocontrols

By February 2005, the TAME Melaleuca project will have several demonstration sites across southern Florida.

"One of the project's major goals is to show land managers and homeowners how to control melaleuca," says Amy Ferriter, a team leader for the project and a SFWMD scientist. "We hope our demonstration sites will get the word out that we're here to help."

When the sites are up and running, public and private landowners will be able to see firsthand how biological control works in conjunction with various traditional control methods.

"There is no way to effectively control melaleuca with just one treatment," says Silvers. "You need a combination of treatment methods—not just herbicide,

not just mechanical, not just biological control. Limiting yourself to just one treatment type might eventually cause more harm than good."

Two insect biological control agents are currently at work on melaleuca, and a third is about to be released.

The first biological control agent—the melaleuca leaf weevil, *Oxyops vitiosa*—was released in 1997. At that time, more than 8,000 weevils were distributed at 13 melaleuca-infested locations in South Florida. Today, millions of the quarter-inch-long weevils are eating the young leaves of melaleuca trees. This little workhorse of a critter is a natural enemy of melaleuca in Australia—home to both.

"Feeding by the melaleuca weevil results in an 80-percent decrease in the tree's ability to reproduce," says Pratt. "But the weevil matures underground and has not flourished in areas that are permanently flooded."

ARS scientists and colleagues have found great success with the second biological control agent, the aphid-like psyllid *Boreioglycaspis melaleucae.* This tiny insect is another natural enemy of melaleuca from Australia, and both adults and young psyllids feed on the tree's sap. Young seedlings are the most vulnerable to the psyllids' attack, but the insects can also stunt growth of bigger trees and reduce flowering and seed production.

To date, some 350,000 psyllids have been released at a variety of South Florida locations. The psyllids' presence there is the result of more than 5 years of research by IPRL scientists in cooperation with the Australian Biological Control Laboratory in Indooroopilly, Australia, near Brisbane, and their colleagues with Australia's Commonwealth Scientific and Industrial Research Organization.

Biological control agent number three is the melaleuca bud gall fly, *Fergusonina turneri,* which may prove effective in attacking melaleuca flower and leaf buds but in an entirely different way. The female gall fly lays her eggs in young buds, causing the plant to form galls. The gall fly larvae feed on this gall material. Because the plant must expend resources to

STEPHEN AUSMUS (K11483-1)

ARS entomologists Paul Pratt (left) and Cressida Silvers (center) discuss melaleuca treatments used at the Prairie Pines demonstration site, one of the largest in the TAME Melaleuca project, with Anik Smith, Lee County land manager.

STEPHEN AUSMUS (K11490-2)

Entomologist Greg Wheeler and technician Kelly Macdonald collect emissions from melaleuca plants in search of compounds that may cue the melaleuca leaf weevil to feed and lay eggs.

STEPHEN AUSMUS (K11486-1)

In a biological control impact study, research leader Ted Center climbs up to inspect a melaleuca tree that is protected from biocontrol agents with insecticides, while entomologist Cressida Silvers checks one that was planted at the same time and inoculated with biocontrol agents. Note that the biocontrol-inoculated tree is much smaller.

STEPHEN AUSMUS (K11493-1)

Melaleuca's compound flowers give rise to clusters of seed capsules. Each capsule contains 200 to 300 tiny seeds that release when the tree is stressed.

STEPHEN AUSMUS (K11494-1)

In areas where melaleuca is interspersed with native trees, mechanical removal with the brontosaurus is an option. The device, a set of steel blades, is mounted onto a normal excavator in place of the excavator's scoop. The brontosaurus blades grind the trees into mulch, starting from the tops of the trees down to the soil.

STEPHEN AUSMUS (K11489-1)

In Broward County, environmental scientist Amy Ferriter of the South Florida Water Management District, and Cressida Silvers inspect melaleuca mulch left over from mechanical grinding. The mulch can vary from 12 to 24 inches in depth and may inhibit emergence of melaleuca seedlings.

STEPHEN AUSMUS (K11487-1)

Plant pathologist Min Rayamajhi studies interactions between the melaleuca leaf weevil *(Oxyops vitiosa)* and the melaleuca rust *(Puccinia psidii).*

form the galls, it devotes fewer resources to producing flower and leaf buds.

Adding the New to the Old

Currently, applying herbicide is the most common method used to control melaleuca in South Florida. Mechanical control is popular and effective but can be cost prohibitive and may damage environmentally sensitive areas.

Biological control agents have been proven to be a successful complement to these and other melaleuca treatment methods and are, in fact, a crucial part of the IPM process. A major function of TAME Melaleuca is not only making land managers and homeowners aware of the uses of IPM, but also instructing them on how to implement an effective program from start to finish.

One of the more popular methods of combining control treatments is what is known in the industry as "hack and squirt." Manual laborers use machetes to cut into the bark of melaleuca trees to where the living, nutrient-conducting tissue is located, and then they apply herbicide to the exposed area. A shower of seeds inevitably falls from the canopy, but biological control agents will feed on and suppress any new seedlings. Land managers can significantly reduce costs and additional effort that would have been required for follow-up treatments of the seedlings.

Herbicide is also sprayed from aircraft over large areas where melaleuca is dense or hard to reach by other means. Aerial applications kill standing melaleuca, but after the treated trees release their seeds, the emerging seedlings require treatment. Because biocontrol populations are self-perpetuating, they are an ideal tool for locations that are difficult to reach.

In some cases, mechanical treatment might be the right approach for control. Which type to use depends on the land manager's budget, tree densities, land size, and conditions.

The biggest of them is the brontosaurus, a monster of a machine that chips a standing tree from the top down to the ground using a grinder attached to the

machine's head. All that's left of the once-gigantic tree is mulch that contains melaleuca seedlings—which may soon sprout. But biological control then attacks the new growth.

The feller buncher is a smaller machine, with pinchers and a saw at the end. It saws off the tree at the trunk, applies herbicide to the stump, takes multiple trees at a time with its pinchers, carriers them like a flower bunch, and stacks them in piles. Piling up the melaleuca trees limits the area where seeds will fall, making the inevitable carpet of seedlings smaller and more manageable.

The Barko chipper is very similar to a bulldozer, except that it has a grinder. The machine pushes the tree down, and then the grinder mulches it. Then the biological controls can get to work.

The TAME Melaleuca team is still collecting and analyzing data on the effectiveness of the melaleuca management strategies demonstrated and will publicize the results on the project's website (http://tame.ifas.ufl.edu), in handbooks and brochures, and at outreach events after the demonstration sites open next year across South Florida. The website will also have contact information for private landowners interested in applying the technology. Project staff members will supply biological control agents to those interested in participating in TAME Melaleuca.

Site locations include the Everglades buffer strip near Fort Lauderdale, Prairie Pines State Preserve in Lee County, Corkscrew Swamp Sanctuary in Naples, Lake Worth near West Palm Beach, and Fort Myers. The TAME Melaleuca team picked these sites for their ability to demonstrate the different control methods to various audiences.

Once completed, the TAME Melaleuca demonstration sites will show just how effective biological control and integrated pest management can be in taming melaleuca.—By **Alfredo Flores,** ARS.

This research is part of Crop Protection and Quarantine, an ARS National Program (#304) described on the World Wide Web at www.nps.ars.usda.gov.

Paul D. Pratt, John C. Scoles, and Cressida S. Silvers are with the USDA-ARS Invasive Plant Research Laboratory, 3205 College Ave., Fort Lauderdale, FL 33114; phone (954) 475-0541, fax (954) 476-9169, e-mail prattp@saa.ars.usda.gov, jscoles@saa.ars.usda.gov, csilvers @saa.ars.usda.gov. ★

STEPHEN AUSMUS (K11482-1)

Entomologists Paul Pratt (right, of ARS) and William Overholt (of the University of Florida) study colonies of melaleuca psyllid *(Boreioglycaspis melaleucae)* on a melaleuca sapling.

STEPHEN AUSMUS (K11496-1)

The melaleuca psyllid *(Boreioglycaspis melaleucae),* first released in Florida in 2002, can kill small seedlings, stunt new vegetative growth, and accelerate aging of mature leaves.