



The *Fight* to Save Hemlocks

WRITTEN BY GARY PEEPLES

In May 2002, a trail crew worker at Great Smoky Mountains National Park reported a funny-looking hemlock. On the underside of the branches were little white tufts of what looked like cotton. These white tufts hadn't been seen in the park before, although workers were trained to keep an eye out for them. This was the first reported incidence of the hemlock woolly adelgid in the Great Smokies.

Decades ago, the chestnut blight essentially wiped the American chestnut from North Carolina's forests. This disappearance manifested itself in falling deer and turkey populations as oaks, hickories and other trees filled the forest gaps. The makeup of the landscape was forever altered.

Get ready for Round Two. The hemlock woolly adelgid attacks and kills native Eastern and Carolina hemlock trees. North American predators don't affect it, and it's spreading rapidly. "I wouldn't be surprised to find it anywhere," said Kris Johnson, forestry supervisor at Great Smoky Mountains National Park. "It's in Cataloochee, Cosby, Fontana, Cades Cove. It's in parts of all the major drainages of the park."

The adelgid, a tiny insect native to eastern Asia, was first detected in the western United States in 1924, but western species of hemlocks have resistance to the adelgid. In 1954, the insect was first discovered in the East, near Richmond, Va.

SCIENTISTS ARE RACING TO STOP THE HEMLOCK WOOLLY ADELGID FROM KILLING NATIVE HEMLOCK TREES. DEVASTATION WROUGHT BY THE ASIAN INSECT COULD AFFECT OUR TROUT FISHERIES.

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After latching onto a hemlock, the hemlock woolly adelgid (inset, magnified many times) covers itself with its namesake white fuzz and stays there the rest of its life.

BILL LEE

Unfortunately, adelgid attacks are fatal to hemlocks found in the Appalachians. Since 1954, the adelgid has spread north and south from Virginia, leaving behind a path of dead hemlocks. In Virginia's Shenandoah National Park, 90 percent of the hemlock trees are dead or dying.

Imagine having hundreds of mosquitoes latch onto your body and begin sucking your blood. You can't swat them, and they never fly away; they just keep sucking. The adelgid crawls to the base of a hemlock needle and inserts its stylet—an appendage like a long, hollow tongue—into the vascular tissue at the base of the needle. Once tapped in, the adelgid covers itself in white, cottony tuft, and there it spends the rest of its days, a parasite on the tree. Thousands of adelgids can infest a single tree at a time. The tree's needles begin to lose their color and eventually fall off. The tree, unable to

send out new growth, eventually succumbs. Foresters and biologists warn that we face the loss of hemlocks in eastern forests.

The impact will be felt throughout the southern Appalachians. Rusty Rhea, an entomologist with the U.S. Forest Service, points out that while oaks and hickories moved in to fill the places left vacant by the loss of the American chestnut, there is nothing in the forest that can fill the role of the hemlock. "There's really no ecological substitute for the hemlocks, nothing to take their role in the forest if they die off," said Rhea.

The spaces left behind by dying hemlocks would likely be filled in by early successional species, hardwood trees and possibly invasive exotic plants like tree-of-heaven, Japanese barberry and Japanese stiltgrass.

ASSESSING IMPACT

Does it matter if a red maple grows where a hemlock once stood? At a parking area on the North Fork of the Mills River in

Henderson County, an angler, donning his fishing gear, explains that he's from Texas. His wife had to travel to Asheville for business, so when he found out there were trout here, he decided to tag along. He was standing under a canopy of hemlock trees, which are found up and down the Mills River.

It's no secret that trout need cold water. Many biologists are concerned about what will happen to trout populations if this evergreen disappears from our stream banks. Research by the U.S. Geological Survey at the Delaware Water Gap National Recreation Area in Pennsylvania and New Jersey has shown that streams in hemlock forests tend to have more consistently cool water temperatures. The study showed that in streams draining hardwood forests, water temperature rose above 68 degrees 18 percent of the time, compared to less than 3 percent of the time in streams that drained from hemlock forests. "If water temperature is 70 degrees for an extended period, even eight hours, stress and mortality [in trout] can result," said Scott Loftis, a fisheries biologist with the NC. Wildlife Resources Commission.

The study found that brook trout were three times more likely to be prevalent in streams shaded by hemlocks than in those shaded by hardwoods. Brown trout, twice as likely. "We're not sure what the effect would be on brook trout in North Carolina," said Loftis.

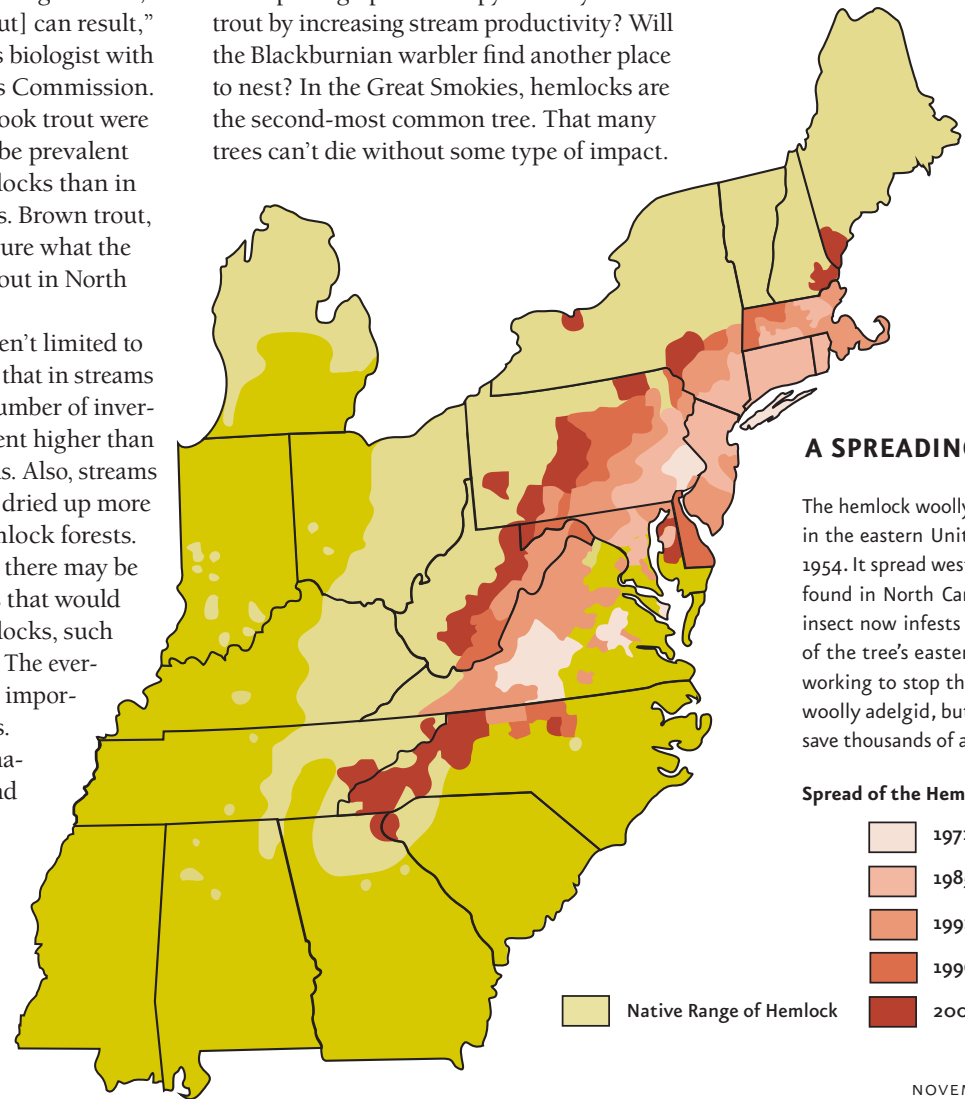
The stream impacts weren't limited to trout. The study also found that in streams lined with hemlocks, the number of invertebrate species was 37 percent higher than in hardwood-shaded streams. Also, streams draining hardwood forests dried up more than streams draining hemlock forests. Loftis also pointed out that there may be other less obvious changes that would result from the loss of hemlocks, such as changes in soil chemistry. The evergreen branches also play an important role for wildlife species.

"For wildlife, we're primarily talking about grouse and turkey, and primarily winter cover," explained Mike Carraway, a biologist with the Wildlife Commission. "The limbs on hemlocks compress under the weight of snow, making

a little pocket under the tree." This little pocket can provide an escape from harsh weather for game species such as grouse and turkey and even deer.

Several species of migratory birds have a preference for hemlocks as well. Harvard University researchers have found that black-throated green warblers, Acadian flycatchers and Blackburnian warblers nest almost exclusively in hemlocks. Their research also pointed out that in stands with high hemlock mortality, other species such as the red-eyed vireo and tufted titmouse were thriving. As is typical in nature, what may be detrimental for one species is beneficial for another. If all the hemlocks die, that would open up opportunities for other plants and animals. But what about those species that depend on the hemlocks?

What will happen to the grouse, the warblers and the brook trout is still up in the air. Will the streams become too warm? Will opening up the canopy actually benefit trout by increasing stream productivity? Will the Blackburnian warbler find another place to nest? In the Great Smokies, hemlocks are the second-most common tree. That many trees can't die without some type of impact.



A SPREADING PLAGUE

The hemlock woolly adelgid was first found in the eastern United States in Virginia in 1954. It spread west and north before being found in North Carolina in the 1990s. The insect now infests hemlocks in almost half of the tree's eastern range. Scientists are working to stop the spread of the hemlock woolly adelgid, but it might be too late to save thousands of afflicted evergreens.

Spread of the Hemlock Woolly Adelgid

- 1971–1984
- 1985–1990
- 1991–1995
- 1996–2000
- 2001–2003

Native Range of Hemlock



JODY DUGGINS



JODY DUGGINS

Top, Kathy Kidd works in a Cary laboratory to find beetle species capable of destroying the adelgid. Entomologist Rusty Rhea monitors the spread of the adelgid in the state's mountain forests.

“I don’t know what the impact will be, it’s such a big component of our forests,” said Carraway. The only thing for certain is that the loss of the hemlock will disrupt a natural system in ways we can only guess.

Adelgid-eating beetles grow and reproduce in laboratory enclosures (bottom). Scientists hope these beetles are the key to preventing the deaths of entire stands of hemlocks like the one below.



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PROACTIVE APPROACH

Researchers and land managers in the southern Appalachians are not taking this lying down. Although this scenario

is similar to the loss of the American chestnut, scientists now have a bit more experience with invasive pests.

“There are treatments for the adelgid, but you have to treat every tree,” Carraway said. Individual infested trees must be sprayed with horticultural soaps and oils, or the soil around trees must be injected with pesticide to be absorbed by the roots. “That might work for an individual landowner, but you can’t really do it on a large scale.”

Because of the limitations of chemicals, the hope for combating the adelgid on a large scale lies in its homeland. The adelgid appears impervious to any natural controls in North America, so scientists have searched its native Asia for predators that could safely be introduced into the United States. One of the predators they found is a poppy seed-sized relative of the ladybug. This beetle doesn’t even have a common name, at least not in English, so it’s known by its scientific name, *Sasajiscymnus tsuge*.

Using a biological control is not a task taken lightly. The prospect of introducing one exotic insect to deal with another one raises eyebrows. However, studies to determine if *S. tsuge* would be appropriate for release have found that it feeds only on adelgids, and once this food supply runs out, it quits reproducing and dies.

With *S. tsuge* passing the test for use as a biological control agent, the race is on to introduce it into the environment in numbers large enough to impact adelgid populations. The limiting factor is simply having enough facilities to produce and rear the predator beetles in captivity.

In an unmarked, nondescript brick building in Cary, thousands of these beetles are being churned out. It’s a branch of the NC Department of Agriculture and Consumer Services that helps deal with pests such as fire ants, gypsy moths and the hemlock woolly adelgid. Much of the technology and know-how for rearing these predator beetles was developed by the New Jersey Department of Agriculture, but this lab was the first in the Southeast to produce them.

The Cary lab can turn out as many as 1,500 predator beetles a week during the six months of the year the beetles are active. This effort has been joined by labs at Clemson University and the University of Tennessee, and there is talk of more

labs to come. These beetle labs produce thousands of predator beetles a year, which are then released into the wild.

More than 25 beetle releases into Great Smoky Mountains National Park targeted heavily infested areas with a strong hemlock component that can’t be treated by other methods. Additional releases are taking place on national forests, including Joyce Kilmer Memorial Forest, home to hemlocks that are hundreds of years old and thoroughly infested with the adelgid. But *S. tsuge* isn’t the only hope.

“I think it will take more than one beetle. The *Laricobius* beetle holds a lot of promise,” said Kathleen Kidd, director of the Cary lab, referring to *Laricobius nigrinus*, a second insect examined for release. Several species of the beetle genus *Scymnus* are also being studied, the idea being to create a suite of predators that will go after the adelgid.

At this point, control, not eradication, is the goal, explained Rhea. Humans brought in an exotic species that has spread rampantly in the Appalachians. The hope now is to fill in the predator side of the predator/prey equation by establishing a population of insects that feed exclusively on the adelgid. It is a large-scale tweaking of the ecosystem to offset a human-induced imbalance.

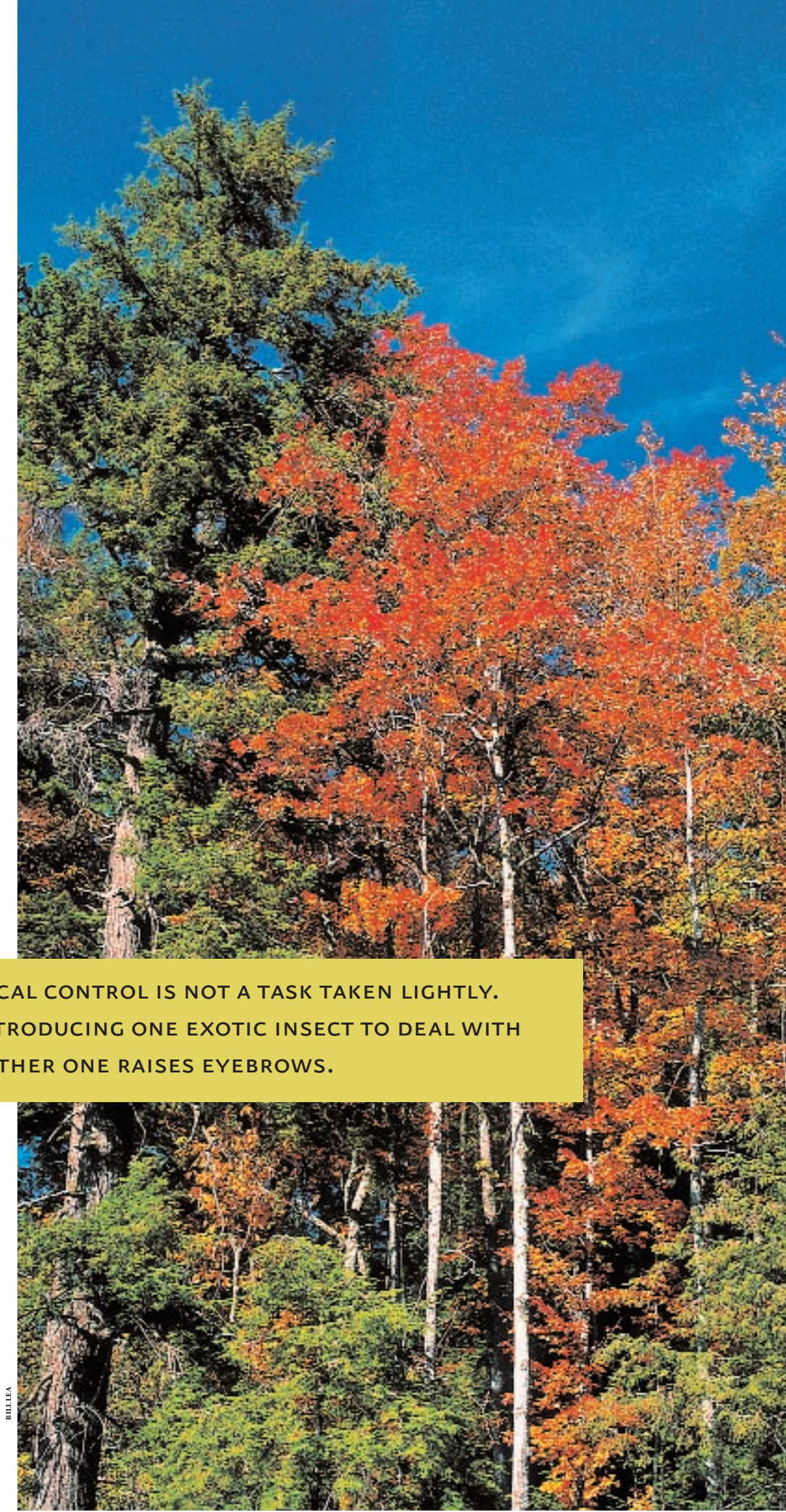
While there is little that we can do to help treat adelgid outbreaks, there are things we can do to help control the pest’s spread. If you buy hemlocks at a nursery or garden

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center, ask to make certain they are free of adelgids. If you see tiny white tufts on the underside of the hemlock branches where you are hiking or fishing, wash your clothes before visiting another area with hemlocks.

“We all need to work together, because we can contribute different things,” explained Kidd, sitting in a lab, miles from the nearest infested tree, contributing. ♦

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