

# TREE MAINTENANCE



Dead or dying hemlock trees ravaged by hemlock woolly adelgid (HWA) throughout the Cataloochee Valley of the Great Smoky National Park in North Carolina. Photo by David Huff

## By Emily Dahlbeck

Drive along many scenic highways in the eastern United States and you will likely notice hosts of graying hemlock trees rising above the canopy like giant, crumbling bottle brushes in an otherwise healthy forest. These dying pillars have become steady reminders that the majestic hemlock is just the latest in a series of tree species threatened by invasive pests and, some say, going the way of the American chestnut.

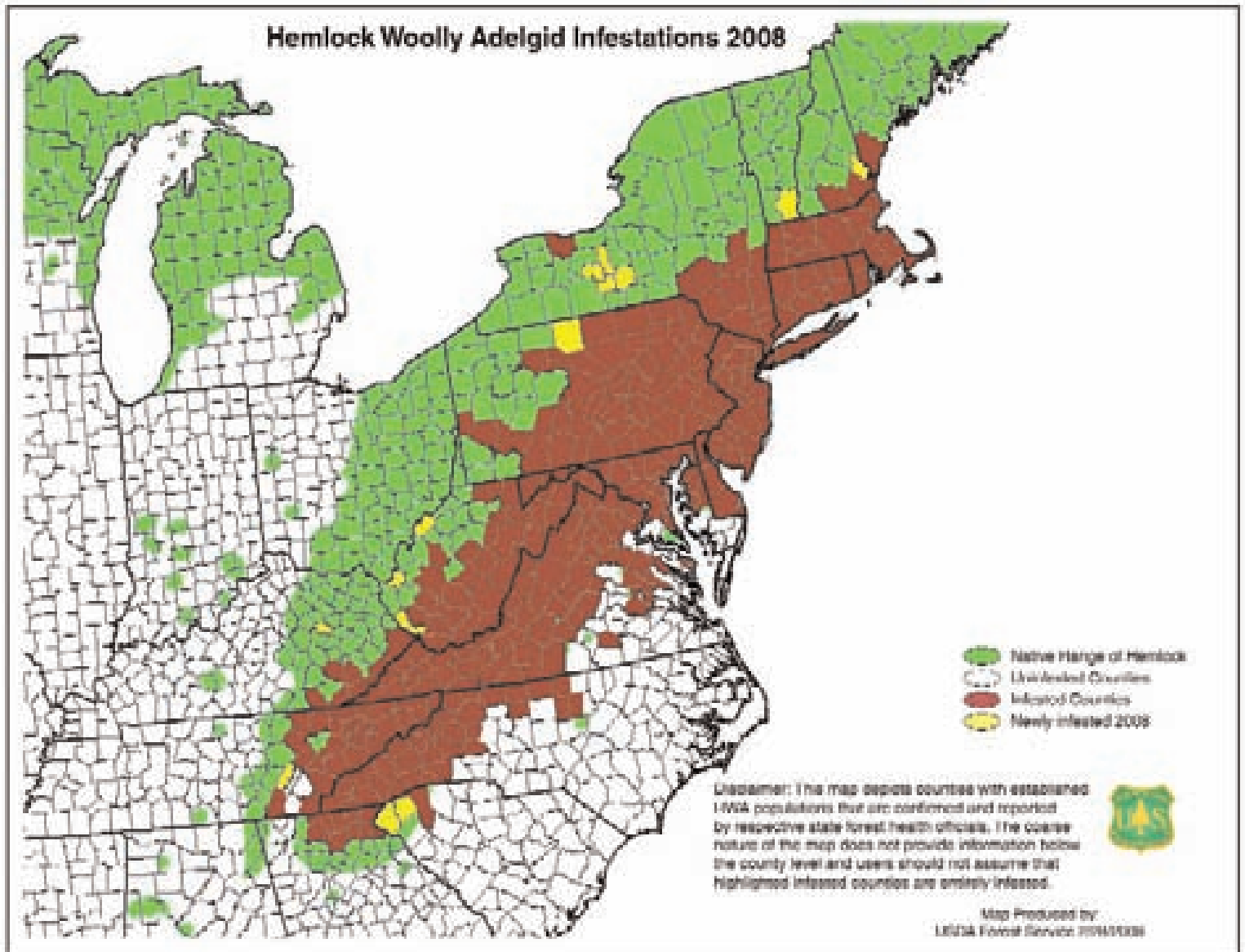
For several decades, hemlock trees — both the eastern and Carolina hemlock species — have been under unrelenting attack from an insect: the hemlock woolly adelgid (HWA). The USDA Forest Service estimates that HWA has already killed millions of hemlocks, and that many more are headed in that direction as the pest continues its devastating march across the eastern United States.

### The importance of the hemlock

For 16 years, Richard Evans, an ecologist with the National Park Service, has been studying and fighting HWA on approximately 3,000 hemlock-

dominated acres of the 65,000-acre Delaware Water Gap National Recreation Area he works to protect in New Jersey and Pennsylvania. During this time, his team has been documenting the spread of HWA and the consequences of hemlock tree loss to the hemlock tree in its natural ecosystem. To help monitor the HWA situation in his park, Evans — with assistance from the USDA Forest Service — set up a system of permanent forest plots to track infestation levels, new growth and crown conditions. He said the plots now have 100 percent HWA infestation.

“In the early ‘90s when we started monitoring, roughly 90 percent of the trees in the plots were considered ‘healthy.’ Compare that to less than one percent of ‘healthy’ trees in the plots today and a 30-percent overall mortality rate,” Evans said. “Of the hemlocks that haven’t completely died, all are in some stage of deterioration, with more than 90 percent in what I classify as ‘substantial decline.’ This is really affecting not only the beauty of the park, but the health of the entire ecosystem, including birds and such fish as brook trout. Non-native plants like Tree of Heaven and Japanese barberry also are invading as the hemlocks decline.”



Map courtesy of Dr. Richard Cowles

Evans said the decline of hemlocks is especially troubling in the park, because many of the dying and potentially hazardous trees are situated in some of the park's most popular and scenic areas, including along trails, streams and rest areas.

Will Blozan, North Carolina-based owner of Appalachian Arborists, Inc., and president of the Eastern Native Tree Society, said that, in addition to their beauty and appeal to the general public, hemlocks are absolutely vital to sustainability of forests, waterways and residential settings.

"There really is no tree more important than the hemlock in our area; virtually every property in the western Carolinas has a hemlock on it," said Blozan. "It is more shade-tolerant than any other tree, and can grow in moist, acidic, high-elevation areas where other trees cannot survive. As a result, hemlocks play a special role in providing cover, holding soil and buffering temperatures of nearby streams, whose aquatic residents are important to southern Appalachia."

#### A look at HWA

The non-native HWA (*Adelges tsugae*) is believed to have been introduced to the United States from Asia in the 1950s. With no natural predators in North America, the HWA population has spread quickly throughout the vast hemlock forests of the eastern United States — with heavy infestations from South Carolina to Maine.

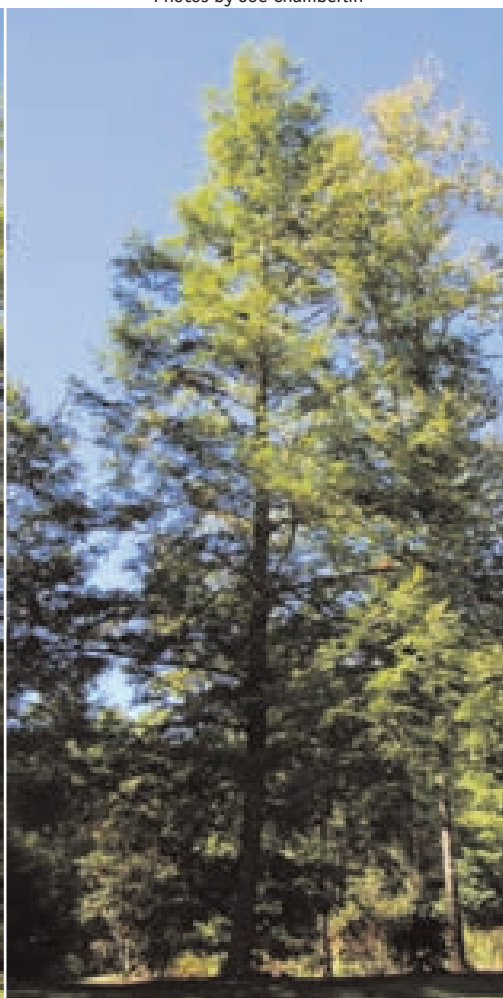
The pest is named for the white, wool-like wax it produces while feeding in the hemlock's nutrient storage tissues, which are located at the base of the needles. The HWA nymphs and adults suck sap from the hemlock twigs, causing yellowing of the needles and eventually massive and life-threatening defoliation. The pest has two generations each year, ceasing feeding only during mid- to late summer.

Dr. Richard Cowles, an entomologist at Connecticut Agricultural Experiment Station's Valley Laboratory, said the speed of the hemlock defoliation from HWA can vary based on a number of geographical and biological factors.

Photos by Joe Chamberlin



An untreated hemlock tree suffering from HWA. Very little new growth is present.



A hemlock tree treated with imidacloprid shows some new growth at 2 years after treatment.



A hemlock tree treated with dinotefuran shows abundant new growth 2 years after treatment.

“In the more northern regions, where colder temperatures can help kill the overwintering adelgids, HWA may affect a tree more slowly — even infesting a tree for more than 10 years before the damage becomes substantial,” Cowles said. “But HWA is a persistent pest and will eventually cause significant damage to a stand if not addressed.”

Blozan said the current drought and warmer winter temperatures have greatly expedited the devastation and spread of the pest in North Carolina and other parts of the southern Appalachians.

“I have seen very large trees go within 2 to 3 years of infestation,” Blozan said. “The window of preservation opportunity is extremely short here and time and weather is not on the side of our hemlocks right now. They’re attempting to recover, but the infestation has progressed so far that the trees are in very low vigor.”

Despite the dire circumstances, Blozan remains optimistic about the potential recovery of hemlocks in his area. “We’re well on track to losing all hemlocks in our area and beyond if something isn’t done. But that’s just the point, something can be done.”

#### **Determining the treatment program for your situation**

Evans, Blozan and Cowles all agree: an effective HWA treatment program takes time, strategy and a variety of controls to truly manage the situation.

“The first thing you need to do when evaluating a tree with HWA is to assess the degree of infestation,” said Cowles. “In essence, you must conduct triage and address the sickest trees first to determine if they are salvageable and how they should be treated.”

Cowles said late fall and winter (October–March in most areas) are ideal times to scout hemlock trees for HWA infestations. During this time, HWA infestations are primarily located on newly formed twigs, which makes it easy to identify live adelgids and evaluate the efficacy of control. In the spring, the adelgids produce a second generation on the same twigs where the previous generation fed. This means that twigs have old and new wool from two generations of adelgids, making population assessment more difficult.

For trees with significant decline and needing immediate control, Cowles suggests that a soil injection or concentrated trunk spray of the systemic neonicotinoid dinotefuran has unique advantages. “It is extremely water soluble and is translocated throughout the tree very quickly. Adelgids and elongate hemlock scales start to die within two weeks of a dinotefuran application. Its ability to be absorbed through the bark may be an important attribute for trees in drier soils where less water is available to make systemic products from soil application available.”

Blozan, who is dealing with extensive numbers of extremely infested trees, has been able to rescue numerous hemlocks with dinotefuran — trees



The HWA leaves a wool-like substance on along the stem at the leaf base of hemlock trees. Here the egg sacs are exposed.  
Photo by Joe Chamberlin

which previously would have been considered too far damaged to treat. “I’ve seen noticeable HWA kills in three weeks or less after a soil injection of dinotefuran. It simply wipes the tree clean,” said Blozan. “This is important, because it helps buy the hemlock at least another year of recovery by protecting the tree from being constantly fed on by the HWA. Basically I can now look at a tree, know that it only has about two years left and soil treat it with dinotefuran to give it a fighting chance. We’ve never had that before.”

For trees that have either regained their vigor and are on the path to recovery, or have not yet experienced decline, Cowles suggests that imidacloprid, another systemic neonicotinoid, is useful. “Imidacloprid and dinotefuran are complementary tools,” said Cowles. “Imidacloprid acts more slowly, but provides long-lasting control. In more northern areas like Connecticut and Pennsylvania, we have seen more than five years of control with a single soil application of imidacloprid.”

Though he regularly warns arborists that peak control of HWA may not appear until more than one year after an imidacloprid treatment, Cowles said the multiple years of effective HWA control usually allow hemlocks to recover. Evans also has been using soil injections of imidacloprid on the hemlock trees in the park.

“Once it incorporates with water and is taken into the tree’s system, imidacloprid will provide good residual control,” said Evans. “It works very well when the trees are healthy enough to take it up, and it will stay put for a long time.”

Although a soil- or trunk-applied systemic is the best option for larger hemlocks, HWA may also be controlled on small trees and hedges with a foliar spray of various products, including horticultural oil. Oil is usually favored because it can suppress multiple pests (adelgids, scales and mites) while not causing long-term harm to their predators.

Additionally, all of the men acknowledge the importance of biological controls for HWA, such as predatory beetles. “When it comes to long-term HWA management, especially in forests, I think everyone recognizes chemical control is an important stop gap measure to buy time for a tree’s recovery,” Cowles said. “But we’re definitely looking at this holistically; the strategy is to keep the trees alive long enough for biological control to become effective.”

#### Helping your clients understand HWA

Blozan said when building long-term relationships with clients to treat HWA, an arborist must have a frank discussion with the homeowner about

his or her commitment to recovering the tree and encourage options other than immediate removal.

“I explain that HWA is fatal and they’re going to have to act either way: treat it or cut it down,” Blozan said. “So you have to understand the goal of the homeowner and help them understand the whole picture of what it means to either treat or remove a tree. Most homeowners think their tree is doomed, but ultimately realize that they want to keep the tree for aesthetics, shading or any number of reasons. And when they understand that treatments are significantly less expensive to them in the long run, it’s just a matter of figuring out the best plan to keep that tree alive.”

However, Blozan said, the homeowner must realize that HWA is a persistent pest which is not cured “with a single shot.”

“The first thing I tell the client is they are putting their trees on life support and they have to actively and financially support their trees,” Blozan said. “Once they realize they are investing in the lives of their trees and, basically, their property, they grasp the value of the commitment. Hemlocks are hard to replace and by preserving these trees, we’re helping preserve the beauty and integrity of their landscape and home’s value.” **AA**

**Author’s note:** In an effort to raise awareness about the HWA situation in the southern Appalachian Mountains, Blozan teamed up with North Carolina-based Back 40 Films and filmmaker David Huff to develop the documentary “The Vanishing Hemlock: A Race Against Time.” The film follows Blozan as he fights HWA and explores the devastation the pest is causing in his region. For more about the documentary, visit [www.thevanishinghemlock.com](http://www.thevanishinghemlock.com)

#### Additional resources

There are a variety of sites established to help monitor the spread of HWA and share treatment information with arborists and tree care specialists:

- National Park Service: <http://www.nps.gov/grsm/naturescience/hemlock-woolly-adelgid.htm>
- USDA HWA Information: <http://www.invasivespeciesinfo.gov/animals/hwa.shtml>
- Eastern Native Tree Society: <http://www.nativetreesociety.org/>
- HWA Fighters: <http://hwafighters.blogspot.com>

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