



**Rivals.** Hemlock woolly adelgids (white insects) may hurt their host plant less when forced to compete with a second introduced pest, the elongate hemlock scale (oval insects on foliage).

Credit: Jeffrey Backer

## Two Enemies Better Than One?

By Elsa Youngsteadt  
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Commanders should "endeavor with every art to divide the forces of the enemy," advised Renaissance philosopher Niccolò Machiavelli in *The Art of War*. Eastern hemlock trees (*Tsuga Canadensis*) are no military strategists, but they might also benefit from a divided enemy. Ecologists have found that trees infested by two competing invasive herbivores may fare better than trees hosting a single alien species.

Since the hemlock woolly adelgid (*Adelges tsugae*) arrived in Virginia from Japan in the 1950s, the insect has devastated U.S. forests from Massachusetts to Georgia. The millimeter-long adelgid spends most of its life immobile on hemlock twigs, sipping sap and injecting saliva that may be toxic to the trees. Lacking natural predators in North America, adelgid infestations often kill a tree within 10 years. Thousands of hectares of hemlock forest in the eastern United States have died, a loss that is particularly severe because hemlock grows on rocky slopes where other trees cannot, plays a central role in forest nutrient cycling, moderates stream temperatures, and creates unique habitats with its drooping branches.

Still, the losses haven't been as bad as some ecologists feared. By the mid-1990s, "the hemlocks were supposed to just tank," says community ecologist Evan Preisser of the University of Rhode Island, Kingston. But New England still has some fairly healthy hemlock stands--even though another introduced insect that attacks the trees, the elongate hemlock scale (*Fiorinia externa*), began to spread rapidly through the region in the mid-1990s. Preisser and entomologist Joseph Elkinton of the University of Massachusetts, Amherst, wondered if it was more than coincidence that the trees' unexpected survival corresponded to the scale's spread.

The researchers introduced the insects to 20 previously uninfested trees in Massachusetts. To make the transfer, they enclosed 100 branches in mesh bags with hemlock clippings bearing scale, adelgid, both, or neither. Every 6 months for 2 years, they counted the insects and measured new growth on each branch. When the two insects occurred together, the density of each species ended up about 30% lower than when it had a branch to itself--a telltale sign that the two species were competing for resources. Branches with both pests grew about 25% more than those colonized by the adelgid alone, the researchers reported this month in *Ecology*. Both insects weaken trees by feeding on them, but if adelgid saliva is also toxic, it makes sense that branches were better off with fewer adelgids, Preisser says.

"I don't think the trees are in the clear if they have both insects," cautions David Orwig, a forest ecologist at Harvard University's Harvard Forest in Petersham, Massachusetts. He says the results could help identify hemlock stands urgently in need of chemical pest control--those with high adelgid density and few scales.

Insect ecologist Ian Kaplan of Cornell University adds that the research is novel because it calls attention to competition between invasive species, a phenomenon that can only become more important "as time goes on and we add more non-native species" to every ecosystem.