Virginia Forest Landowner Update
Volume 21, No. 1 Winter 2007

You Ain't From Around Here! Exotic Invasive of the Quarter: Hemlock Woolly Adelgid (*Adelges tsugae*).
By: Jennifer Gagnon, Virginia Tech Dept. of Forestry

I will be featuring an invasive plant species in each newsletter. This section will provide resources to help you identify and control these plants and insects, hopefully before they become a problem!

Exotic invasives are non-native plants and insects that are able to thrive and spread aggressively outside their natural range. When spread is extensive, they can alter ecosystem function by replacing native species, changing forest structure, and decreasing forest productivity and biodiversity. Some key characteristics include: prolific seeding or reproduction, efficient dissemination, adaptability to different environments, rapid growth, and lack of natural controls. Landowners can help stop invasives before they get out of control by 1. inspecting their property regularly, 2. maintaining a healthy forest with minimal disturbance, 3. treating invasives as soon as they are detected and 4. rehabilitating sites after eradication.

A dead hemlock emerging from the stump of an American chestnut at Bottom Creek Gorge, Montgomery County. Photo by: Jennifer Gagnon

Being an optimist, I have been featuring exotic invasives for which there are some practical and effective means of control; and putting off writing about those for which the outlook isn't so bright. However, every time I go out hiking, I see the devastation caused by the hemlock woolly adelgid (HWA), and so am compelled to tell its story. Upon researching the species, I learned that there are some potentially effective controls being developed and some things landowners can do to protect the hemlock in their yards.

Native to Japan, the first occurrence of the HWA in the eastern U.S. was near Richmond in the 1950's. By the 1980's, significant problems were apparent from Massachusetts to North Carolina, with the insect spreading 10-20 miles a year. HWA has infested more than 50% of hemlock's native range and is in 17 of the 24 states in which hemlock grows. New Hampshire, Vermont and Maine have imposed strict quarantines in an effort to prevent the arrival of the critter in their states. Both Carolina and eastern hemlock are susceptible to HWA.

Like most adelgids, HWA has a complex life cycle. There are two parthenogenic (all female and reproduce without mates) generations of HWA's a year. In October, the over-wintering generation (sistens) begin to feed on new hemlock needles. In February and March, the sistens lay between 100-300 eggs. They lay two types of eggs – some will hatch into winged migratory adelgids, which need to reproduce on spruce, although they have been found in


Wooly sacs at the base of hemlock needles (left) and HWA eggs (right). Photos by Michael Montgomery, USDA Forest Service

areas with heavy HWA infestations and severely stressed hemlocks. These are generally not considered pests. The rest of the eggs hatch into wingless adelgids (progrediens). These crawlers are dispersed by wind, people, animals and birds. Eventually they settle at the base of hemlock needles and develop a white woolly waxy coating around their bodies – this is what we usually see on infected trees. The settled progrediens, under the waxy coating, are black with a white fringe around the perimeter of their bodies. The progrediens lay eggs in June and July, which hatch out and become the sistens generation. The sistens also develop a waxy coating and are dormant at the base of the needles until October, when they begin feeding and the cycle goes around again.

You can identify infected trees simply by looking for white woolly sacs at the base of the needles. The adelgids damage hemlock by sucking the sap from new needles, first causing a grayish hue, then premature needle fall. They may also inject a salivary toxin into the needles. The stress of premature needle fall eventually leads to death – in as little as four years, although some infected trees can survive up to 10 years or longer.

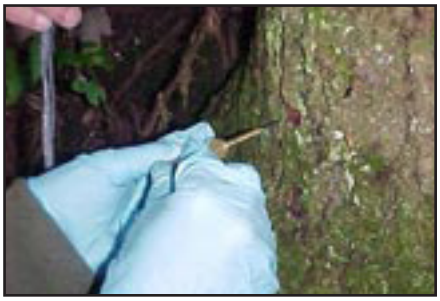
How to Prevent/Control HWA

Protecting hemlock in your yard is possible. First, if HWA is not present, simple things like placing your bird feeders away from hemlock and being careful when moving equipment from an infected area to a non-infected area, can help slow the spread. Keep your trees vigorous by watering them. Fertilizing uninfested trees is ok too – but DO NOT fertilize infested trees – fertilization increases adelgid survival and reproduction.

Spraying Imidacloprid on forest trees. Photo from: Great Smoky Mountains National park, Resource Management Archives, USDI National park Service

If your hemlocks are already infested, insecticides can be used to eradicate HWA. Insecticidal soaps and horticultural oils (which are available at garden centers), are effective and pose little threat to the environment. Following the label directions, mix 2 ounces of soap or oil with 98 ounces of water to make a 2% solution (a 1% solution of oil may be all that's needed between May and September) in any type of pump sprayer. The entire tree must be thoroughly sprayed. Treatment is most effective in March and April and late August and September. A few words of caution: do not spray when the new twigs are growing or when temperatures are above 75°F or below 45°F.

Another option for both yard and forest trees is Imidacloprid. If you are not a certified pesticide applicator, look for the brand name Bayer Advanced®. Certified applicators will use different



Stem injection of Imidacloprid (left); soil injection of Imidacloprid (right). Photos from: Great Smoky Mountains National Park, Resource Management Archives, USDI National Park Service

name brands. This product should be mixed according to the directions on the label. If the tree is >50 feet from a waterway, the soil surrounding the tree can be "drenched" by pouring a light stream of insecticide over the soil, or the insecticide can be injected into the soil, between September and November. The roots will take up the insecticide and deliver it to the entire tree. If the tree is < 50 feet from a waterway, stem injection should be used. This is more expensive than soil drenching and must be done by a trained arborist, and soil treatment is more effective and longer lasting.

At the landscape level, some biological control agents hold promise. Two ladybird beetles, *Sasajiscymnus tsugae* and *Scymnus sinuanodulus* (from China), and the *Laricobius nigrinus* beetle, a native to western North America, all adelgid predators, are approved for release on public lands. Additionally, new agents are actively being sought in China, Japan, and the Pacific Northwest. However, there are some difficulties associated with this means of control: the insects must be identified, transportation to laboratories for rearing, tested for host-specificity (meaning they ONLY feed on adelgids, and not on beneficial insects), and they must be able to reproduce in the wild. Recent surveys have shown L. nigrinus capable of abundant reproduction in the wild but there is little evidence that *S. tsugae* has reproduced significantly outside the lab.

Scientists at Camcore, a non-profit international program housed at NC State University, are collecting seeds from hemlock across its native range in an attempt to preserve genetic materials. The idea is to establish populations of hemlock outside the native range until a means for controlling HWA can be found. Then the species can be reintroduced to its native range. Additionally, scientists are looking for hemlocks which are resistant to the HWA, in hopes that a breeding program can introduce the genes for resistance into seedlings.

A healthy hemlock with no sign of infestation on Mt. Rogers. Photo by: Jennifer Gagnon

So, what does the future look like for hemlock? We're still not sure. But just in case, get out there and explore a hemlock stand soon.

Special thanks to Scott Salmon, Associate Professor of Entomology at Virginia Tech for his helpful comments.

References:

Hunter, Elizabeth. 2006. Toolboxes & Trees - The Fight to Save the East's Hemlocks. In: Blue Ridge Country V19, No. 9/10

Salmon, Scott. 1999. Hemlock Wooly Adelgid: A Major Threat to Eastern Hemlock. Virginia Forest Landowner Update V13, No. 2

USDA Forest Service. Pest Alert: Hemlock Wooly Adelgid. NA-PR-03-94

USDA Forest Service Northeastern Area: http://www.na.fs.fed.us/fhp/hwa/