

Hemlocks Threatened By Woolly Adelgid

In the spring of 1989, many eastern hemlock (*Tsuga canadensis*) trees were observed to be in poor health in the Thornton and Frazier Hollow drainages in the North District of the Park. Many trees had lost their needles and were already dead, while many others had partial foliage loss and yellowing needles. The bark of several trees had been flaked from the tree by woodpeckers, revealing the deep rust color of the inner bark. Several dozen trees in both drainages were apparently affected to varying degrees, and many trees, including several trees over 200 years old, were dead.

Upon investigation the following winter, Park personnel detected woolly masses at the base of the needles and twigs. Within each woolly mass was a small, soft-bodied, rounded, aphid-like insect. Specimens were confirmed to be the hemlock woolly adelgid, *Adelges tsugae*.

American entomologists suspect eastern Asia to be the homeland of the hemlock woolly adelgid. The insect was introduced into the United States in the Pacific Northwest sometime in the 1930's, and into Virginia in 1953, most likely on imported nursery stock. The insect has gradually expanded its range, in many areas causing extensive mortality of both ornamentally grown and forest hemlocks. Presently, the hemlock woolly adelgid occurs in nine eastern states and the District of Columbia, and in the western coastal states, including Alaska.

The hemlock woolly adelgid is a sap-sucking insect closely related to aphids, whiteflies, and scales, in the Order Homoptera. Adelgids typically live on two tree species, with spruce being the primary hosts. Since little native spruce exists in Shenandoah National Park, populations of the adelgid develop on eastern hemlock, their secondary host.

The adelgid feeds on the inner bark, or phloem tissues, of the hemlock by inserting its stylet-like mouthparts through the outer bark of small twigs and branches. Damage to the host occurs when large infestations withdraw large amounts of life supporting fluids from the tree. Additionally, some scientists believe that a mild toxin is produced during feeding and further destroys vascular tissues in the tree. In consequence, the trees lose vigor and become susceptible to other, more damaging factors. Some authorities believe that heavy infestations alone can cause hemlock mortality. In Shenandoah, heavy populations along with other stress factors, such as drought, defoliation, or acid precipitation, can cause the death of infested hemlocks. Management of this species is very expensive, difficult, labor intensive, and time consuming. Traditional chemicals available for control are also toxic to other "non-target" organisms and are unacceptable for use in National Park ecosystems. Potential "safe" control agents are not only expensive, but are untested for their effectiveness in adelgid management. Natural parasite and predator complexes are poorly known.

Shenandoah National Park managers are conducting field surveys to determine the distribution of adelgids in hemlock stands throughout the Park, and are establishing a monitoring system in uninfested stands. This system will allow resource specialists to detect and monitor the effects of the hemlock woolly adelgid in hemlock stands throughout the Park. Any suspected observations should be reported to the Division of Natural Resources and Science, Shenandoah National Park, (703) 999-2243 x 412.

The adelgid has been found throughout the Park in all districts and elevations, and is present in 84% of the surveyed hemlock stands. This insect has been in the Park for many years, perhaps decades, with little mortality observed. The hemlock woolly adelgid is certain to remain in Shenandoah National Park as long as the hemlocks remain, and some mortality can be expected, particularly when associated with other stress factors. The outlook for the hemlock stands in the Park remains unclear due to the uncertainty that surrounds the adelgids' true potential as a contributor to hemlock mortality.

by J. Keith Watson