

## In the Spotlight: *Hemlock-mixed Forests and Associated Species*

Eastern hemlocks (*Tsuga canadensis*) form an extensive range, from Nova Scotia southward through the Appalachians to northern Alabama (see map, p.8). Hemlock trees grow on almost 19 million acres of forest in the Eastern United States<sup>1</sup> and eastern hemlock is the predominant species on 2.3 million acres.<sup>2</sup> In Kentucky, eastern hemlock communities occur primarily in the Appalachian Plateaus and Cumberland Mountains. Outliers also extend into the eastern Knobs and the Shawnee Hills of western Kentucky. Eastern hemlock is the most shade-tolerant and one of the most long-lived tree species in Eastern North America.<sup>3</sup>

Rich (productive) forests dominated by eastern hemlock are classified as hemlock-mixed forests in Kentucky. These forests are most often found in rugged landscapes along mesic (moist) stream corridors and sheltered slopes and coves. Almost always a dominant species in the canopy of this community, eastern hemlocks often form dense stands that provide a unique habitat for many plant and wildlife species. Because of this dense canopy and the hemlocks' evergreen needles, these forests remain deeply shaded and cool, even on warm, sunny days. With such an abundance of hemlock, needle drop is recurrent and accumulates into a duff (litter) layer, leading to the development of high-acid soils.

While acidic soils, cool temperatures and dense shade can restrict many plants, other plants are highly adapted and thrive in this forest. For



Photo by Ben Begley

instance, a variety of mesophytic trees co-occur in the canopy such as tulip tree, sweet birch, basswood, yellow buckeye and beech. Understory trees include flowering dogwood, American holly and magnolias. The shrub layer often includes great rhododendron and sometimes mountain laurel. Like hemlock, great rhododendron can form dense stands. Aply named "rhodo hells," these form gnarly shrub-thickets which are nearly impenetrable to humans but are favored cover for species like black bears and hooded warblers. Due to low-light levels and midstory competition, herbaceous density and diversity is usually limited. Typical species include early yellow violet, partridgeberry and Christmas fern.

Cold headwater streams sheltered by hemlock provide the stable conditions for rare fish species like the blackside dace and arrow darter. Forest birds like black-throated green warblers, worm-eating warblers, hooded warblers, northern parulas, blue-headed vireos, and Acadian flycatchers utilize hemlock-associated habitats throughout all or part of their life cycle. Hemlock forests also provide suitable (and often favored) habitat for large mammals like black bears, large reptiles like timber rattlesnakes and small amphibians like salamanders. While these species find hemlock-mixed forests to be suitable or preferred habitat, many of them also depend on surrounding forests for survival. Thus at a broad scale, hemlock forests embedded in a large matrix of other forest types (e.g. from rich deciduous forests to dry pine-oak woodlands) form a connected ecosystem that provides habitat and necessary corridors for healthy, reproductive populations of plants, animals and fungi.

Although currently considered secure, hemlock forests in Kentucky are under serious attack from the hemlock woolly adelgid (HWA), an invasive species from Asia. Found in 2006, HWA populations are spreading quickly in the Commonwealth and will likely severely impact hemlock forests throughout the state in the next few years.

1. Schmidt, T.L.; McWilliams, W.H. 1996. Status of eastern hemlock in the northern U.S. In: Mroz, G.; Martin, J., eds. Proceedings of a Regional conference on ecology and management of eastern hemlock. Madison, WI: University of Wisconsin: 61-72.
2. McWilliams, W.H.; Schmidt, T.L. 2000. Composition, structure, and sustainability of hemlock ecosystems in Eastern North America. Available online: [www.treesearch.fs.fed.us/pubs/14631](http://www.treesearch.fs.fed.us/pubs/14631)
3. Ward, J.S., et al. 2004. Eastern Hemlock Forests: Guidelines to Minimize the Impacts of Hemlock Woolly Adelgid. Available online: [www.treesearch.fs.fed.us/pubs/11508](http://www.treesearch.fs.fed.us/pubs/11508)

### *Chrosomus cumberlandensis* Blackside Dace

**KSNPC STATUS:** Threatened

**USFWS STATUS:** Threatened

**GENERAL DESCRIPTION:** A brilliantly colored minnow; up to approximately 3 inches long.

**HABITAT:** Cool headwater streams with suitable pool habitats which provide areas for spawning and feeding.

**RANGE:** Restricted to the upper Cumberland River system (above Cumberland Falls).

**REASON FOR PROTECTION STATUS:** Exists entirely within the Appalachian Highlands. Coal mining and associated problems (mine drainage, etc) has eliminated several streams within its range and poses a threat to its survival in many locations. Poor logging and streamside practices can contribute large amounts of silt which can degrade/eliminate spawning habitat.



Photo by Ellis Lauderdale, KSNPC



## *Dendroica virens*

### *Black-throated Green Warbler*

KSNPC STATUS: None

USFWS STATUS: None

GENERAL DESCRIPTION: This small songbird has a bright yellow cheek, black throat (males), and greenish back. The species forages primarily for insects in the forest canopy. It is a neotropical migrant, migrating from its North American nesting grounds in fall to winter primarily in Central America.

HABITAT: Coniferous, mixed coniferous-deciduous, and entirely deciduous forests, including forest edge, second growth, hemlock forest, cedar-grown pastures, larch bogs, and swamps.

RANGE: Nests throughout the Appalachian Mountains, northeastern United States and across Canada (eastern provinces to northern Rocky Mountains); winters primarily in the Central and northern South America. In Kentucky nests in mature and second-growth mixed coniferous-deciduous forests of the Cumberland Plateau and Cumberland Mountains, primarily in association with eastern hemlock.



Photo by Michael Butler, Trent University

## *Listera smallii*

### *Kidney-leaf twayblade*

KSNPC STATUS: Threatened

USFWS STATUS: None

GENERAL DESCRIPTION: This little orchid is often found in moist forests underneath rhododendron thickets. It is between 6 and 12 inches tall with a delicate green to brown flower.

HABITAT: Damp humus in shady forests of Appalachian Mountains, often beneath rhododendron in acidic soil, also in sphagnum thickets and bogs.

FLOWERING PERIOD: June-July.

RANGE: From Georgia to Pennsylvania and west to Kentucky and Tennessee.

REASON FOR PROTECTION STATUS: This species is known only from eastern Kentucky and there are few records for this little plant. It may partly be because it is not easily seen underneath the rhododendrons where it typically occurs. Hemlock trees are likely important species in these forests in maintaining the moist conditions for this orchid. Also land-use conversion, habitat fragmentation, and forest management practices are reducing its habitat.



Photo by Jim Fowler

## *Lambdina fiscellaria*

### *Hemlock Looper Moth*

KSNPC STATUS: None

USFWS STATUS: None

GENERAL DESCRIPTION: A cream- to gray-colored geometrid moth with a wingspan of 1.2–1.7 inches.

HABITAT: Hemlock and oak forests of eastern Kentucky.

CATERPILLAR FOODPLANT: Hemlocks, firs, spruces, oaks.

FLIGHT SEASON: August-October.

RANGE: Labrador to South Carolina and west to Texas.



Photo by Ellis Laundermilk, KSNPC



# Invasive Species Highlight: *Hemlock Woolly Adelgid*

*Adelges tsugae*

*Hemlock woolly adelgid*

**DESCRIPTION:** A tiny invasive insect that feeds on the needles of Carolina hemlocks and eastern hemlocks. Adult adelgids are less than one-sixteenth of an inch long. They are called “woolly” because they are covered by wool-like projections made of wax.

**ORIGIN:** Native to Asia, this insect was accidentally introduced to western North America in the 1920s and again in the Richmond, Va., area in the early 1950s.

**EXTENT IN KENTUCKY:** First documented in eastern Kentucky in 2006, it currently is known to be present in 12 counties.

**IMPACT:** They feed on the sap in hemlock needles and typically cause an infested tree to die within two to 12 years. This tiny insect has already killed 80 percent of the hemlock trees along the Blue Ridge Parkway and in Virginia's Shenandoah National Park. The loss of hemlock creates stands of dead and dying trees, resulting in an ecological disaster for species dependent upon this habitat.

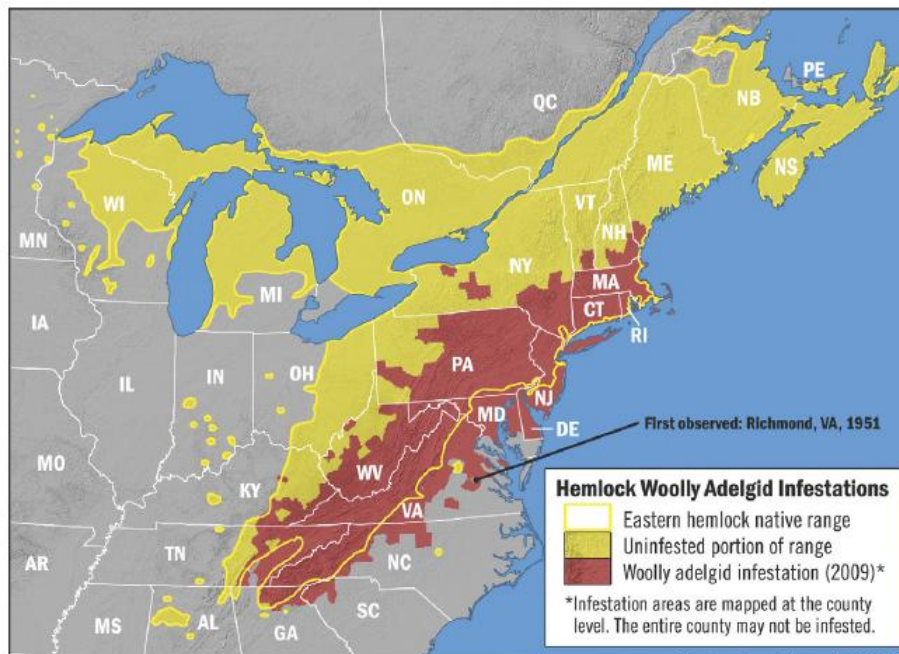
**MANAGEMENT:** Infested trees can be treated with the release of predatory beetles, sprayed with insecticidal soaps and horticultural oils or systemically treated with an insecticide containing the active ingredient imidacloprid. Optimal times to treat with insecticide are during March through April and from September to October. Soil drenching and soil injections are the most effective treatments.

**ADDITIONAL INFORMATION:** Visit [www.lyhemlocks.org](http://www.lyhemlocks.org) to learn more



infested hemlock branch

Photo by Connecticut Agricultural Experiment Station Archive, Bugwood.org



Map by Greg Abernathy, KSNPC  
Adapted from U.S. Forest Service Map



## Hemlock Woolly Adelgid Update - Fall 2009 Treatments

By Kyle Napier, Southeastern Region Preserves Manager

Hemlock tree treatments for fall 2009 started on Sept. 30 and ended on Nov. 12. The unusually wet fall provided optimal soil conditions for injecting the imidacloprid pesticide. It was exactly what we hoped for since treatments are more successful when applied to moist soils. During this extended time period we were treating four to five days a week.

Pesticide was provided through a grant from the United States Forest Service (USFS) and all treatments were conducted at Blanton Forest State Nature Preserve. Our crew consisted of myself and Kentucky Natural Lands Trust employees Clint Lester and Merrill Flanary. We also received two days of help from KSNPC employee Byron Brooks. Since most of the easily accessed trees along the trails had already been treated, the crew had to concentrate on the more difficult locations. This required a lot of time walking to and from the rugged treatment sites. The good thing is we were able to treat two really nice old-growth stands where most of the trees were over 20" dbh (diameter at breast height).

With all the effort needed to get to the treatment sites and the large sizes of the trees, this decreased our total number of treated trees considerably. But it definitely increased our quality. Much of the treated area showed old-growth characteristics. We were able to treat 2,696 trees within an approximate 38-acre area.

The total number of trees that have been treated during the spring and fall of 2008 and 2009 at Blanton Forest and Bad Branch is now 23,243 trees within an approximate 403-acre area. We are expecting to finish up the pesticide that the USFS provided when we return to Blanton Forest this spring. This should complete our task of treating the highest priority areas on these two preserves. Examinations of previously treated trees show new needle growth. Hopefully things will be bright in maintaining these areas for future generations. ☺



Hemlock-mixed forest, Bad Branch State Nature Preserve ~ Ellis Laudermilk, KSNPC



