



## Eastern Hemlocks at Prince William Forest Park

### Importance

- Eastern hemlocks are evergreen trees native to National Capital Region (NCR) parks.
- They often grow in patches along streamsides and provide cooling shade in winter and spring when other trees have no leaves
- Two non-native insect pests have killed many of the Eastern hemlocks in NCR forests.
- Some trees have survived, but many are being replaced by other tree species that can't shade streams year-round as hemlocks do.

### About Eastern Hemlocks

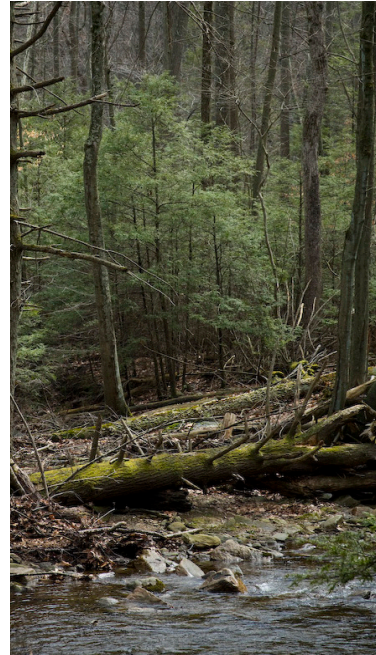
Eastern hemlock (*Tsuga canadensis*) is a long-lived, evergreen tree native to the eastern United States. In the National Capital Region (NCR), naturally occurring stands of Eastern hemlock are usually restricted to stream bottoms and north facing slopes in cool, steep terrain. In these habitats, hemlocks maintain cool stream temperatures by shading the water in winter and spring when many other tree species have no leaves.

While Eastern hemlock was never common in the NCR, it is becoming increasingly scarce as a result of attacks from two non-native insect pests: hemlock woolly adelgid (*Adelges tsugae*) and elongate hemlock scale (*Fiorinia externa*). These pests have had devastating impacts on hemlocks across much of their range, at a time when warming temperatures have already stressed these cool-climate trees. Yet even where the insects have been established for a decade or more, some trees still survive.

### Mapping Hemlocks

In 2015, the NCR Inventory & Monitoring Network (NCRN I&M) set out to document remaining stands of Eastern hemlock and to assess tree condition at these sites. We also collected data that would illustrate which species are replacing Eastern hemlocks in the forests where they are most impacted.

Based on information from parks, regional vegetation maps, and forest-related reports, NCRN I&M staff and interns from University of Maryland, Baltimore County identified areas where naturally occurring hemlocks were dominant (so-called "hemlock patches"). Potential hemlock patches were identified at 6 parks: Catoclin Mountain Park, Chesa-



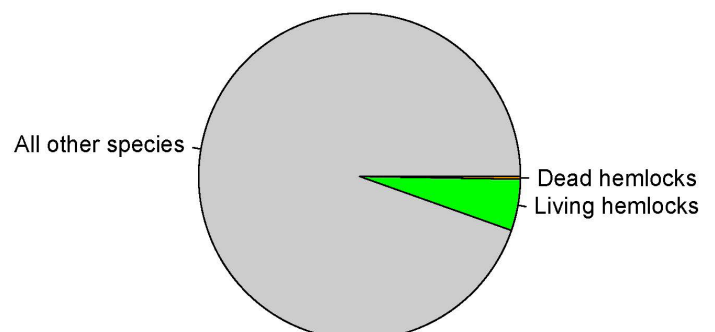
Photos: NPS/Paradis

**Left:** A patch of Eastern hemlocks along Big Hunting Creek in 2007.

**Right:** The white fuzz of hemlock woolly adelgid on a hemlock branch.

apeake & Ohio Canal National Historical Park, Harpers Ferry National Historical Park, Manassas National Battlefield Park, Monocacy National Battlefield, and Prince William Forest Park. The team mapped these patches with global positioning systems and collected vegetation data at randomly located inventory plots. At Catoclin, Prince William, and Harpers Ferry, the total area occupied by the patches was more than 50 hectares, most of it at Catoclin.

**Figure 1.** Living and dead hemlocks as a proportion of all standing trees in hemlock patches at Prince William Forest Park. Measured by basal area.



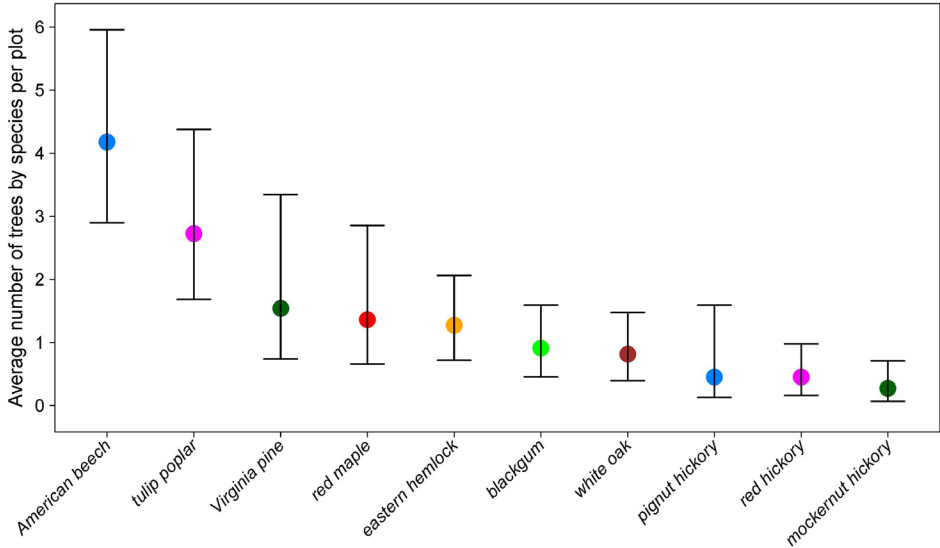
Hemlocks at Prince William

At Prince William we mapped 8.4 hectares of hemlock-dominated forests. Within these patches, we set up and sampled 11 randomly located plots to examine the condition of hemlocks and document all tree species of tree, sapling, and seedling size. We recorded 15 standing hemlock trees in these plots, 93% of which were alive. Among the living hemlock trees, none were infected by the adelgid or the scale.

Eastern hemlocks were a significant part of the canopy in stream bottom forests in Prince William Forest Park (Figure 1). Looking at all standing trees, both living and dead, hemlocks accounted for ~9% of the basal area present. Basal area is a measure of the volume of wood in a given area based on tree size, as opposed to the number of trees per area.

The other tree species that commonly occurred in Prince William hemlock patches included American beech (*Fagus grandifolia*), tulip tree (*Liriodendron tulipifera*), Virginia pine (*Pinus virginiana*), red maple (*Acer rubrum*), black gum (*Nyssa sylvatica*), white oak (*Quercus alba*), pignut hickory (*Carya glabra*), red hickory (*Carya ovalis*), and mockernut hickory (*Carya alba*). Even though hemlocks accounted for much of the basal area in these forest patches, it was only the fifth most

Figure 2. Tree species present in hemlock patches sampled at Prince William Forest Park in 2015.

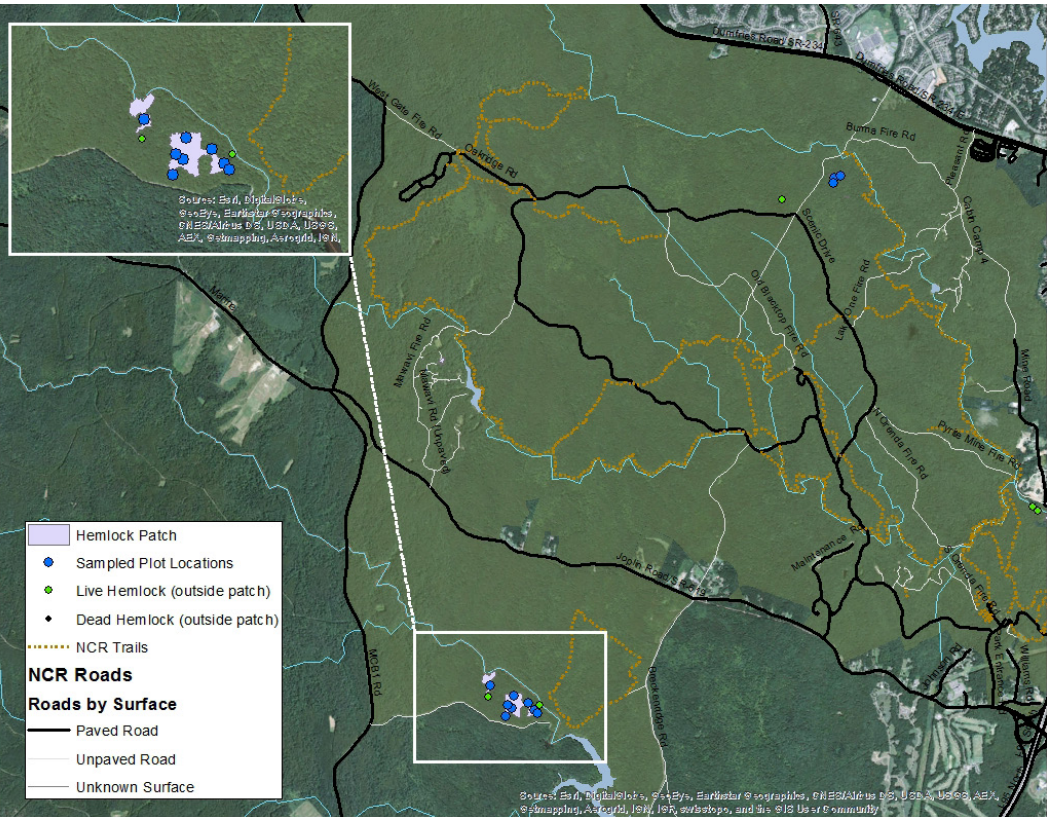


common tree species in 2015 (Figure 2). As hemlocks continue to decline, the other species present in hemlock patches may take the place of hemlocks in the forest canopy. However, since only Virginia pine is an evergreen species, the new canopy will be unable to replace the same amount of cooling shade hemlocks provided in winter and spring.

References

Data from the NCRN Hemlock Inventory Project is available at <https://irma.nps.gov/DataStore/Reference/Profile/2224947>. A geospatial dataset contains locations of mapped hem-

lock patches, sampled plots, and individual live and dead trees at Catoctin, C&O Canal, Harpers Ferry, Manassas, Monocacy, and Prince William. In the hemlock patches mapped, data was gathered on infection status of all hemlocks and all tree species present of tree, sapling, and seedling size.



Mapped hemlock patches, sampled plots, and individual live and dead hemlock trees in Prince William Forest Park.