

New York State Hemlock Initiative HWA Survey Protocol



Hemlock woolly adelgid (HWA) is a non-native invasive forest pest that infests native Eastern hemlock trees. Surveying for HWA is a vital contribution to early detection and management efforts around the state. Additionally, the New York State Hemlock Initiative uses HWA survey data to improve our biological control research.

These instructions complement the **HWA Survey Form** on the NYSHI website.

Complete a Hemlock Woolly Adelgid Survey:

Recommended Survey Materials List:

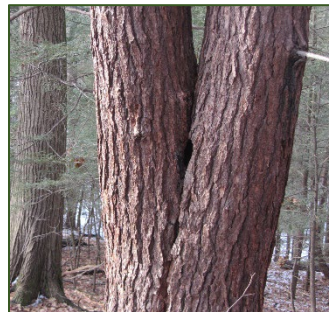
- Sturdy shoes and clothing for being outdoors
- Hand lens and/or magnifying glass
- Device for taking photos of infestations
- Device (cell phone or GPS unit) for noting survey GPS points (take point in middle of survey area)
- Cell phone in case of emergency
- Map of trails/survey area and compass
- HWA survey data sheets or field guides as needed
- Pack with water and snacks if needed

Step 1: Choose survey site

Choose a hemlock stand (a group of trees) for HWA surveying. Each survey form is for evaluating one group of hemlock trees. Data will represent average values across the stand describing the overall tree health and HWA presence/absence in that hemlock group. Once you choose a stand be sure to:

- Note the date and location of the HWA survey
- Add a GPS point in the middle of the hemlock stand
- Describe stand location and access directions

Hemlock Tree Identification:



Silhouette: Hemlocks have a vaguely pyramidal shape with a drooping leader at the top and feathery branching texture. Hemlocks can grow to be up to 175 ft tall. As they grow there may be fewer lower branches present.

Foliage: Hemlocks have lacy, feathery foliage. In the late spring and early summer, new hemlock shoots should show up bright, lime green at the ends of twigs. If you do not see new shoots emerge, it could be a sign of an HWA infestation.

Needles: Needles are flat with a shiny deep green top, two parallel white stripes on the underside, and a rounded tip. Needles are typically ~1/2" to 3/4" in length arranged opposite one another on the twig (not whorled around the twig as on a spruce).

Bark: Younger hemlocks will have rough greyish-brownish bark. Mature hemlock bark is rough, scaled, and fissured. It is typically brown in color with a reddish tinge.

Cones: Hemlocks have small, brown cones that grow to be ~3/4" to 1" in length. They have rounded scales and mature in the fall. Immature cones are green with a tapered tip, shaped like a football.

Step 2: Describe site characteristics

The data form for HWA surveys includes several site-related questions about the hemlock stand you are surveying:

- Stand size (approximate area and number of trees)
- Stand composition (Is the survey area mostly hemlock and other conifers, or is it mainly hardwood trees with a few hemlocks dispersed throughout? What species are those trees, if known? About what percentage of the stand is hemlock?)
- Approximate size classes of trees (Are the trees larger or smaller? Mixed sizes?)
- Terrain characteristics (Steep? Flat? Dry? Wet?)
- Water features (Is the stand near a stream, pond, or wetland?)

When surveying, it may help to make note of these data points by using a paper HWA surveying form in the field or by writing notes in a separate notebook and then inputting the data online later. Community scientists with smartphones may be able to submit data directly in the field by using the online survey form on the NYSHI website:

www.nyshemlockinitiative.info/report-hwa-finding/hwa-hunters-survey-form/

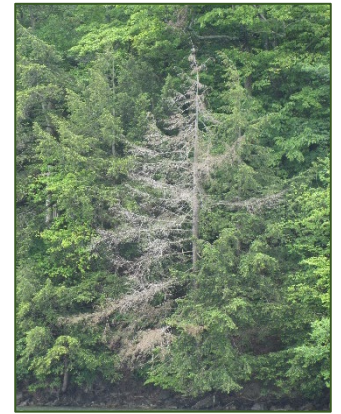
(If there is not data service at the field site, community scientists may make iMap points and fill out a submission form, then keep their browser app open until they are able to upload their survey form from a place with an internet connection.)

Step 3: Survey hemlock stand for HWA

Remember to:

- Check trees with reachable branches first
- Look at the underside of twigs and branches
- Check multiple branches on all sides of a tree
- Look on ground for branches that may have fallen from the canopy, especially in an area with many large trees and few reachable branches

HWA Identification:



Late Fall-Spring: (Photos above: left, second from left) HWA goes through four development stages or “instars” as it secretes its wool then lays its eggs as an adult. During this time an infestation will be characterized by white, waxy masses that are secreted around the bodies of the insect, always clumped directly on twigs near the base of the hemlock needles. *Tips: Sometimes the infestation is best seen while looking at the underside of a hemlock twig. In the case of a lighter infestation you may only see one or two woolly masses present*

Summer-Early Fall: (Photo above: third from left) This time of year HWA appears as small, black nymphs at the base of hemlock needles directly on the twig. The HWA nymphs are black, sesame seed-shaped, and have a distinct white halo surrounding their bodies. Finding HWA at this time of year may require use of a magnifying glass or hand lens (7x-10x magnification). *Tips: It may help to look at underside of twigs for HWA; remnants of wool from previous season may also be present.*

HWA Damage: (Photo above: right) A heavy or long-lived HWA infestation will cause crown damage and defoliation. Look up to check if the crown appears full and dense or thinning. Lots of dead branches and lack of needles could indicate an HWA infestation. HWA infestations can also cause hemlock trees to appear greyish rather than a healthy deep green. Hemlock trees with a greyish appearance can easily be seen from a distance. HWA will not cause yellowing or browning of needles. During late spring/early summer, hemlocks infested with HWA may lack new growth, which is apparent from an absence of new, bright lime green new buds.

Remember to keep track of:

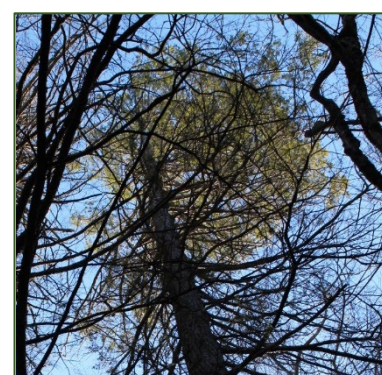
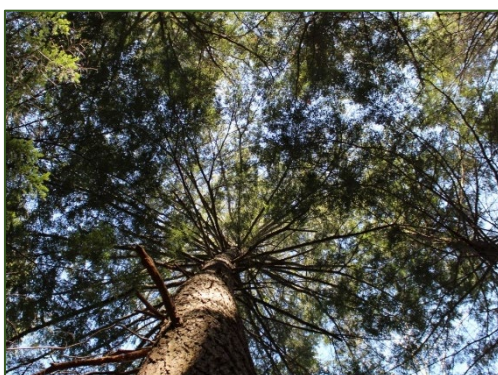
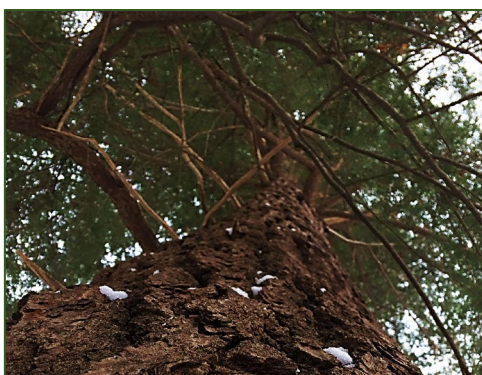
- Whether HWA is present or absent in the stand
- The density of HWA in a stand (low density with only a few woolly masses/individuals on a twig, or high HWA density with an adelgid per needle? See examples below)
- Approximate number of trees surveyed
- Stand health and characteristics
- Approximate amount of time spent surveying plus travel time to/from the site (the NYSHI survey form asks for this number in hours, so round to the nearest 15 minutes, or 0.25 hours)

Step 4: Assess overall tree health in stand

Use the following metrics to assess tree health:

- **Hemlock Canopy Health:** This metric describes the average canopy health across the stand on a scale from very healthy (little to no foliage loss, deep green foliage) to very weak (sparse foliage, dead branches).
- **Average HWA Density:** Number of ovisacs present on several sample twigs of several trees to estimate a stand-wide average. This gives an idea of infestation severity in the stand.
- **Presence of Low Branches:** Approximate amount of live hemlock branches within arm’s reach in a stand.

Hemlock Canopy Health Examples:



Photos:

Left— <20% canopy loss (80% of light blocked), healthy, deep green, dense foliage

Center— 20-40% canopy loss, foliage beginning to thin, still very green

Right— >80% of canopy lost, sparse foliage with only some tufts or branch tips remaining, in some cases “lollipopping” occurring, where foliage is only present at the very top of tree

HWA Density Examples:**Photos:**

Left—Light HWA infestation, only one or two woolly masses present

Center—Medium HWA infestation, some woolly masses present along twig

Right—Heavy HWA infestation, woolly masses present at the base of nearly every needle

Step 5: Report your findings

If completing a full survey including both HWA and tree health data for NYSHI’s research program:

- iMapInvasives mobile phone app—If you are an iMap user, please make an iMap submission EVEN IF YOU ARE ALSO REPORTING DATA TO NYSHI. The NYSHI survey form has a box to select if your survey location has an iMap point associated with it. If you are not an iMap user, please note GPS points for your survey area where indicated on the form (you may skip this step if you put in an iMap point)
- Use the NYSHI HWA Survey form: www.nyshemlockinitiative.info/report-hwa-finding/hwa-hunters-survey-form/

If you are working with several surveying volunteers, only one form needs to be submitted per survey group, just be sure to enter the total number of surveyors in the form where indicated. Please submit only one form per group.

If you have any questions about completing your survey or filling in data on your survey form, please contact Charlotte Malmborg at cm933@cornell.edu.