

## Invasive Forest Insect Species Survey Information

Invasive insect species pose a serious threat to many of Maine's native tree species. This guide will help you look for trees affected by invasive insects. Your surveys provide valuable support in the effort to keep these pests from damaging Maine's forests.

**Things to look for:**

**Unhealthy Trees-** The following symptoms are typical of an unhealthy tree and do not necessarily mean that a tree has an infestation of invasive species. These are very basic, visible symptoms that may catch your attention. Infestations may or may not have symptoms visible from a distance. Be on the lookout for both general and pest-specific symptoms.

**Dieback from the top down-** A tree that is in poor health due to root problems, girdling, or insect infestations may have a decreased amount of foliage at the top of the tree. As the problem progresses, the dieback may work its way down the tree. At the beginning of an infestation a tree may still have its entire canopy.



**Epicormic Shoots-** Epicormic shoots are short branches that arise from dormant buds. They are often obviously not part of a "normal" canopy, but they can be located anywhere along the tree's trunk and branches. Epicormic shoots can be triggered by increased exposure to light, mechanical damage, insect feeding, disease and other factors. If you see a tree with epicormic shoots, look for pest-specific symptoms to determine if there is an infestation.

**Discoloration-** May include but is not limited to: browning, yellowing not related to fall coloration, red coloration, and graying in conifers.

Photos: Edward Czerwinski, Ontario Ministry of Natural Resources, Bugwood.org, David R. McKay, emeraldashborer.info.

**Insects-** If you think you have found one of the insects listed in the guide try to capture it. Put it into a sealed container for storage. You may store it in the freezer until you can contact us. Also, a high quality photo can help determine if follow-up is necessary.

**Pest Specific Symptoms-** Certain invasive species prey on specific types of trees. If you see a tree that is unhealthy, please look to see what kind of tree it is. If the unhealthy tree is one of the following, please inspect it for signs of the specific pest species given below. [www.maine.gov/forestpests](http://www.maine.gov/forestpests)

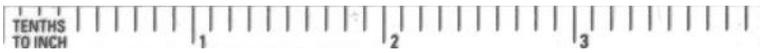
**Ash:** All species of ash (*Fraxinus*) are attacked and killed quickly by the emerald ash borer (EAB). If you see an unhealthy ash tree, please inspect for signs of EAB damage which include: [www.maine.gov/forestpests#eab](http://www.maine.gov/forestpests#eab)

- **Epicormic Sprouts-** These shoots can form where larval feeding damage has cut off the supply of water and nutrients.
- **Bark Splits-** If you see split bark then look for s-shaped galleries within the crack.
- **Exposed S-shaped Galleries-** The larvae of EAB feed in a characteristic s-pattern.
- **D-shaped exit (emergence) holes-** EAB exit holes are 1/8<sup>th</sup> " and D-shaped. The orientation varies.
- **Presence of the adult beetle from mid-May to September.**

**Maples, Birches, Elm, Willows, Poplars.** These trees, most notably **maples**, are the favorite targets of the Asian longhorned beetle (ALB). ALB infested trees may appear healthy. The following may be evidence of an ALB infestation. [www.maine.gov/ALB](http://www.maine.gov/ALB).

- **Oviposition pits-** egg deposit sites are shallow, linear, oval or circular depressions with rough edges.

If you suspect you have found these insects or their damage, please notify the Maine Department of Agriculture, Conservation and Forestry, Maine Forest Service at [www.maine.gov/forestpests](http://www.maine.gov/forestpests), (207) 287-2431, [forestinfo@maine.gov](mailto:forestinfo@maine.gov) or 168 State House Station, Augusta, ME 04333



- **Oozing Sap-** ALB oviposition pits often ooze sap and give the bark a wet appearance in the area of the pit. Ants, wasps and other insects are often attracted to the sap.
- **Frass** – Frass is a mixture of wood fibers and poop; it has the appearance of sawdust and accumulates in crevices and on less than vertical surfaces. Sometimes strings of it are pushed out of bark cracks.
- **Exit (emergence) holes-** ALB exit holes are large perfectly circular holes (pencil to dime-sized)
- **Adult feeding damage on leaves and young branches-** ALB adults scrape the bark off small branches, chew the stems of leaves, and eat along the main veins of leaves. This can cause early leaf-drop.
- **Presence of the adult beetle from July to November.**

**Spruce:** Spruce trees are vulnerable to the brown spruce longhorn beetle (BSLB). Attacks from the BSLB look similar to native pests. Be aware that the BSLB is a possible culprit when you see the following on spruce:

[www.maine.gov/forestpests#bslb](http://www.maine.gov/forestpests#bslb)

- **Crown discoloration-**depending on the stage of attack crowns may be yellow-green, yellow, brown, gray or red.
- **Excessive resin flow-** resin can be caused by other factors including native beetles, but is copious in the presence of a BSLB attack on a healthy tree.
- **Wide, frass-filled, meandering feeding galleries-**these galleries will lightly score the sapwood of the tree.
- **Exit holes-**exit holes are round to oval and about 4 mm wide, larger than the native spruce bark beetle.
- **Presence of the Adult beetles from spring through early summer.**

**Hemlock:** Hemlocks are attacked by the hemlock woolly adelgid (HWA) and elongate hemlock scale (EHS). These are the only invasive species mentioned on this checklist that are confirmed to be in Maine. HWA is only found on hemlock, and is usually on the underside of the outermost branch tips. Elongate hemlock scale is also commonly found on fir and spruce, especially planted stock. Look for these signs and symptoms on hemlocks:

**HWA** (Visible year round) [www.maine.gov/forestpests#hwa](http://www.maine.gov/forestpests#hwa).

- **Wool-** As the HWA matures it produces white, waxy material from pores on its body. The material looks like a cotton ball. It is visible throughout the year but is most prominent in the spring.
- **Settled Nymphs-** If you see a speck of white that looks like it may be adelgid wool, with no sign of the insect, inspect the branch tips, using a hand lens for the minute, black settled nymphs.
- **Foliage thinning, graying-** Adelgid damaged trees often do not produce normal amounts of new growth. As needles senesce the crown will appear thin and ghostly.
- **Branch dieback from the bottom up-** unlike most damages, dieback appears from the bottom up.

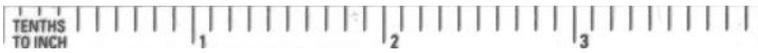
**EHS** (Visible year round) [www.maine.gov/forestpests#ehs](http://www.maine.gov/forestpests#ehs).

- **Note:** concentrate surveys on planted trees (hemlocks and fir of southern origin) and native and planted trees within the current distribution of hemlock woolly adelgid.
- **Settled insects on needle undersides-** Male will be covered with a fluffy white cocoon, female with a parallel-sided yellow-brown smooth waxy coating. Newly settled nymphs are pale yellow.
- **Needle discoloration-**affected needles will have a mottled yellow appearance
- **Floss-**Floss is waxy thread-like material produced by the insects, it will be evident on the undersides of the needles in heavy scale populations.
- **Wax residue-**heavy infestations are characterized by a buildup of wax on surfaces below the infestation.
- **Crown thinning and dieback:** affected trees may have thin crowns. Dieback is from the bottom up.

Photos of Pests (following pages): EAB: Simon Hinkley & Ken Walker Museum Victoria , ALB: PA DCNR, BSLB:CMF Pierce, HWA: MFS, EHS: MFS, Winter Moth, MFS

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**Emerald Ash Borer (EAB)--Not known to be in Maine**

<b>Hosts</b>	Ash (only!), ( <i>Fraxinus</i> spp.)
<b>Adults</b>	Small, metallic green, 0.25-0.5", in canopy, in pupal cell (under bark or in sapwood) June-September
<b>Eggs</b>	<1mm, reddish brown, laid on bark and in crevices
<b>Immature</b>	<u>Larvae:</u> up to 1.25" tape-worm-like, bell-shaped segments, under bark; <u>Pupae:</u> cream colored under bark or in sapwood
<b>Exit hole</b>	~1/8th" D-shaped
<b>Immature Feeding</b>	S-shaped feeding tunnels 0.12"-0.25" wide. Packed with frass.
<b>Adult Feeding</b>	Ash foliage, leaves a ragged edge
<b>Symptoms Visible from A Distance</b>	Crown dieback, and thinning from top down, Epicormic shoots, <b>Woodpecker activity</b>
<b>Other</b>	Longitudinal bark splits



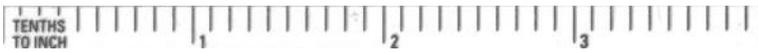
**Asian Longhorned Beetle (ALB)--Not known to be in Maine**

<b>Hosts</b>	Many hardwoods, especially: <b>Maple</b> , Birch, Elm, Willow, Aspen (Poplar)
<b>Adults</b>	Large, shiny black, 0.75" to 1.5", long striped antennae, on trees and objects around infested trees. July-Hard frost
<b>Eggs</b>	0.25", cream-colored, laid singly under bark in pit chewed by female
<b>Immature</b>	<u>Larvae:</u> Worm-like, segmented cream-colored. Up to 2.5" long. Small in sapwood, larger in heartwood <u>Pupae:</u> Cream colored, resembles adult in shape.
<b>Exit hole</b>	<u>Pencil to dime-sized, perfectly round.</u> Standard pencil will fit in and go straight into tunnel 1-2". Looks like tap hole.
<b>Immature Feeding</b>	<u>Tunnels in sapwood and heartwood (flattened to oval in x-section), pupation chamber (frass-filled).</u>
<b>Adult Feeding</b>	Leaf stems and young twigs chewed
<b>Symptoms Visible from A Distance</b>	Even heavily infested trees may appear healthy. Branch dieback, foliage discoloration (may be isolated to small sections). Broken limbs.
<b>Other</b>	<u>Oviposition pit (~0.6" wide), chewing marks usu. visible.</u> Oval stain in wood under pit. <u>Bark problems</u> Woodpecker activity, Foamy sap flow (attracts insects), <u>Coarse sawdust (frass) (esp. in crevices)</u>



**Brown spruce longhorn beetle (BSLB)—Not known to be in Maine**

<b>Hosts</b>	<b>Spruce</b> and other conifers
<b>Adults</b>	Flattened, brown beetle, small (0.3-0.7") antennae ½ body length. (Unlikely to see adult) May-September
<b>Eggs</b>	Laid singly or in pairs concealed under the bark
<b>Immature</b>	<u>Larvae:</u> Up to 0.75" long, cream colored, segmented. Feeds in inner bark and outer sapwood. <u>Pupae:</u> in sapwood or inner bark, pupation chamber J-shaped in cross-section.
<b>Exit hole</b>	<u>Oval to round, ~0.15"</u>
<b>Immature Feeding</b>	Irregular, meandering tunnels packed with fine-grained frass
<b>Symptoms Visible from A Distance</b>	<u>Crown discoloration (yellow, brown, dead red)</u> <u>Resin flow, especially on lower portion of trunk</u>
<b>Other</b>	Woodpecker activity



**Hemlock woolly adelgid (HWA)—Known in Maine**

<b>Hosts</b>	<b>Hemlock (only!)</b>
<b>Adults</b>	Dark-colored, soft-bodied wingless, covered in white waxy wool-like material (w/covering can be up to 0.25" diameter). Attached to hemlock twig.
<b>Eggs</b>	Wine-colored, oval, deposited behind adult under wool. Only visible with magnification
<b>Immature</b>	<u>Crawler</u> : minute reddish, oval, 6-legged mobile stage (Apr-Jul) <u>Nymph 1</u> : black, sesame seed-shaped w/ wax fringe attached at base of needle. <u>Nymph 2+</u> : dark, soft-bodied, covered in white wax
<b>Symptoms Visible from A Distance</b>	Fine branch dieback from the <i>bottom up</i> . Advanced stage: crown thinning, grey cast to crown
<b>Other</b>	Undersides of twigs Attached to twigs (not mobile) Discrete cotton-ball-like Dry/waxy



**Elongate Hemlock Scale (EHS)—Known in Maine**

<b>Hosts</b>	<b>Hemlock and fir</b> (spruce and other conifers secondary)
<b>Adults</b>	Male: yellow to amber, winged, translucent, soft-bodied , ~1mm (0.04"). Female: covered in yellow-brown parallel-sided waxy coating (test) on underside of needles (Year Round)
<b>Eggs</b>	hidden under female's waxy covering
<b>Immature</b>	<u>Crawler</u> : 0.1-0.2mm (0.004 -0.008")translucent, yellow <u>Nymph</u> : settled on undersides of needle, gradually covered w/ either characteristic female test or fluffy white male cocoon (growing season), white floss-like material
<b>Symptoms Visible from A Distance</b>	Crown thinning, Fine branch dieback from the bottom up, Wax buildup on branches under scale infestation (fertilized trees)
<b>Other</b>	Needle yellowing (mottled), Insect attached to needle, usually undersides, crawlers and adult males mobile



**Winter Moth (*Operophtera brumata*)—Known in Maine**

<b>Hosts</b>	Many hardwood trees and shrubs including oak, maple, elm, ash, apple, crabapple, cherry, blueberry
<b>Adults</b>	Male: tan, fragile moth, ~1/2" attracted to lights and females. Female: Flightless, ~1/4", looks like a fat mosquito, on hosts November, <b>December</b> , <b>January</b>
<b>Eggs</b>	Deposited on host bark, buds, twigs after mating
<b>Immature</b>	<u>Larvae</u> : Looper (inchworm) caterpillar, green with pale stripes, up to 1/2" long. April-early June <u>Pupae</u> : Encased on cocoon made of silk and soil; looks like a small piece of dirt. June-November
<b>Immature Feeding</b>	Swiss-cheese appearance from early feeding; feeding along margins as grow; silked together emerging leaves
<b>Symptoms Visible from A Distance</b>	Defoliation
<b>Other</b>	Plant material is a major vector for this pest; look for it near areas with lots of 2 <sup>nd</sup> homes with owners based out of southern New England