

Oregon Forest Pest Detector Field Guide

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Emerald ash borer (top) and Asian longhorned beetle (bottom).

Photo: David Cappaert, Michigan State University, Bugwood.org; CC BY-NC 3.0;
Kenneth R. Law, USDA APHIS PPQ, Bugwood.org; CC BY 3.0

About this guide

This publication was developed for Oregon Forest Pest Detectors as a field reference guide.

OFPDs complete an [online course \(https://workspace.oregonstate.edu/course/Oregon-Forest-Pest-Detector?hsLang=en\)](https://workspace.oregonstate.edu/course/Oregon-Forest-Pest-Detector?hsLang=en) and field workshop that prepare them to recognize and report the signs and symptoms of high-priority, invasive forest pests. This guide contains a summary of the highlights from the OFPD training, including quick facts, host species, insect identification, and signs of symptoms for each insect. This guide is meant to be used as a reference in the field to aid in the identification of a potential invasive insect infestation.

Take the online pest detection class

Scale up your ID skills with OSU's Oregon Forest Pest Detector online training. Engaging, interactive presentations will help you build your detective skills and defend Oregon forests.

Enroll now

(<https://workspace.oregonstate.edu/course/Oregon-Forest-Pest-Detector?hsLang=en>)

Oregon Forest Pest Detector program

Purpose

The purpose of the Oregon Forest Pest Detector program is to improve the likelihood of Early Detection and Rapid Response to a possible future introduction of forest pests in Oregon. The Oregon Forest Pest Detector program will assist with EDRR by increasing the number of skilled individuals that can recognize the signs and symptoms of the target pests and report suspected infestations.

Role

Oregon Forest Pest Detectors observe host trees for signs and symptoms of forest pests of concern in the course of their everyday work activities. They often serve as the first point of contact for the public, help filter public reports, and pass along reports of serious concern to state (Oregon Department of Agriculture) and federal (USDA-APHIS) government partners.

Key responsibilities

- Demonstrate skill in recognizing host trees and target pests by taking the training course, passing the quiz, and taking a short refresher quiz each year.

- Apply demonstrated skills during the course of regular work or volunteer activities by paying close attention to host trees that exhibit possible signs and symptoms of target pests.
- Use an agreed-upon reporting mechanism (Oregon Invasive Species Hotline) to alert state and federal government experts in the case of a possible infestation.
- Upon request and when convenient, follow up on public reports or inquiries.
- Refrain from publicizing a possible detection until it has been confirmed by an expert from a designated regulatory agency (Oregon Department of Agriculture or USDA-APHIS).
- Share appropriate public messages about preventing the spread of invasive forest pests (such as Don't Move Firewood).

[Learn more about the OFPD program \(https://extension.oregonstate.edu/ofpd\)](https://extension.oregonstate.edu/ofpd) and sign up for a training.

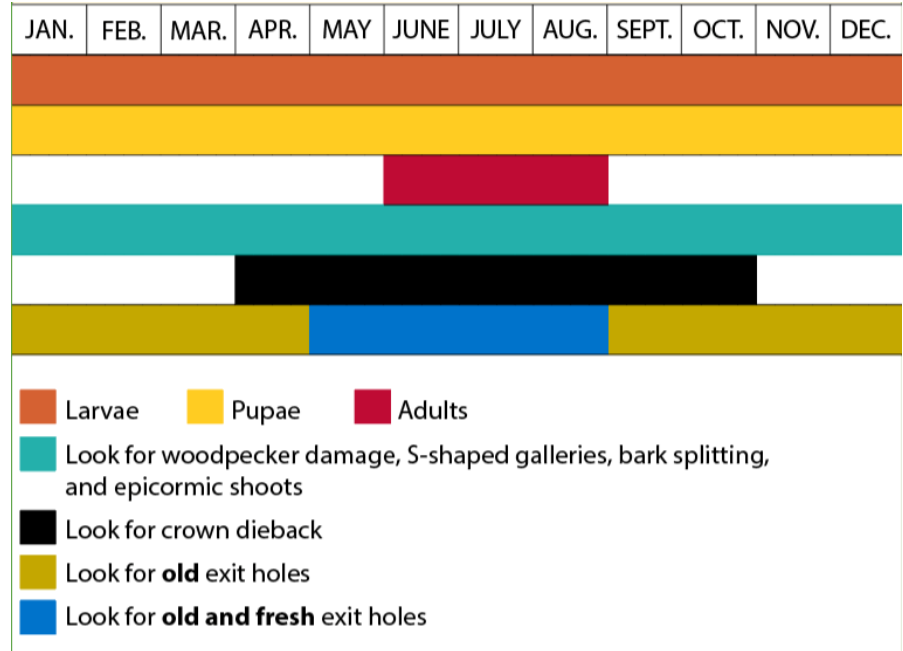
Emerald ash borer

Quick facts

Agrilus planipennis

- Invasive wood-boring beetle
- Originally from Asia; first reported in the United States in 2002 (Detroit, Michigan).
- Rapidly expanding across the U.S.
- Attacks and kills ash trees (*Fraxinus* spp.); kills about 99% of ash trees native to the U.S.
- Causes major damage to urban and natural forests.

Quick-reference Oregon monitoring calendar



Credit: © Oregon State University

Recognizing ash trees

EAB primarily attacks true ash (*Fraxinus* spp.), but it also attacks white fringetree (*Chionanthus virginicus*). The white fringetree is not native to Oregon, but it can be found (somewhat rarely) as a street tree in some urban areas.



Mature bark is gray-brown with ridges (often in a diamond-shaped pattern).

Credit: Brandy Saffell, © Oregon State University



Canoe-shaped ash seeds hang in clusters.

Credit: Brandy Saffell, © Oregon State University

Common ash look-alikes

Walnut, *Juglans* spp.

Not an EAB host.

- Alternate branches.
- Compound leaves with five to 25 leaflets.
- Large, round, hard-shelled nut with a green husk.
- Chambered pith.



Walnuts on the tree.

Photo: Rob Routledge, Sault College, Bugwood.org, CC BY 3.0



Walnut pith shows numerous chambers.

Photo: Paul Wray, Iowa State University, Bugwood.org, CC BY 3.0



Walnut twig.

Credit: Rob Routledge, Sault College, Bugwood.org, CC BY 3.0

Boxelder, *acer negundo*

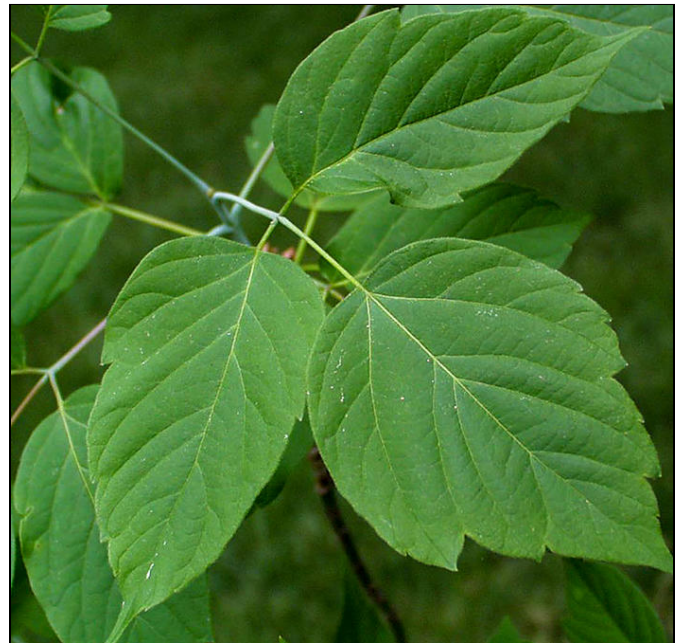
Not an EAB host.

- Opposite branches.
- Compound leaves with three to five leaflets.
- Paired samaras.
- Mature bark is light gray and not deeply furrowed.



Boxelder samaras.

Credit: Jan Samanek, State Phytosanitary Administration, Bugwood.org, CC BY 3.0



Boxelder leaves.

Credit: Paul Wray, Iowa State University, Bugwood.org, CC BY-NC 3.0

Mountain ash, *Sorbus spp.*

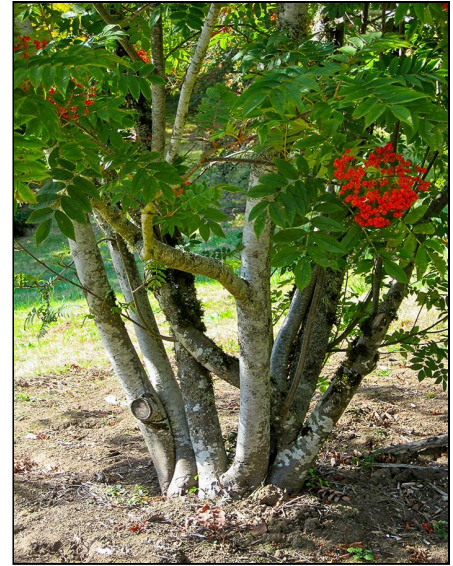
Not an EAB host.

- Large shrub or multi-stemmed tree.
- Alternate branches.
- Red berries in clusters.
- Mature bark is light gray and smooth.



Berries and leaves of mountain ash.

Credit: Brandy Saffell, © Oregon State University



Mountain ash can take the form of a large shrub or tree with multiple stems.

Credit: Brandy Saffell, Oregon State University

Note on Oregon ash

Oregon ash is a riparian species that is ubiquitous in wetlands throughout northern California and western Oregon and Washington. It often looks unhealthy even in its natural, native environment. It is not uncommon to see stands of Oregon ash with leaf blight (1) as well as crown dieback (2) and epicormic branches (3). These symptoms could easily be mistaken for an EAB attack. If you see crown dieback or epicormic branches on Oregon ash in a natural setting, do not feel obligated to check every tree with these symptoms for EAB. Instead, monitor the stand and spot-check for further signs of an EAB infestation.



1. Leaf blight on Oregon ash.

Credit: Brandy Saffell, © Oregon State University



2. Crown dieback on Oregon ash.

Credit: Wyatt Williams, ODF

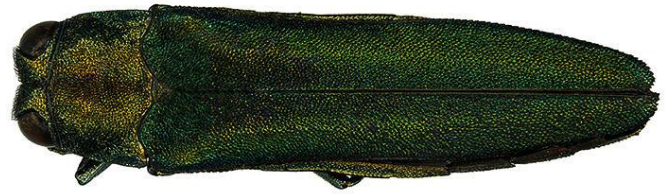


3. Epicormic branches, where shoots emerge from the trunk.

Credit: Wyatt Williams, ODF

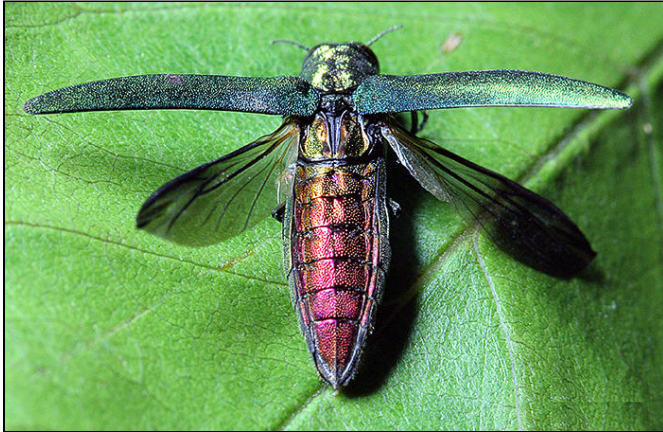
Identifying emerald ash borer

- Metallic green body.
- Coppery-red highlights and abdomen.
- ¼ to ½ inch long.
- Narrow, bullet-shaped body compared to other metallic green, native insects.



Emerald ash borer viewed from the top.

Photo: Oregon Department of Agriculture



Emerald ash borer adult.

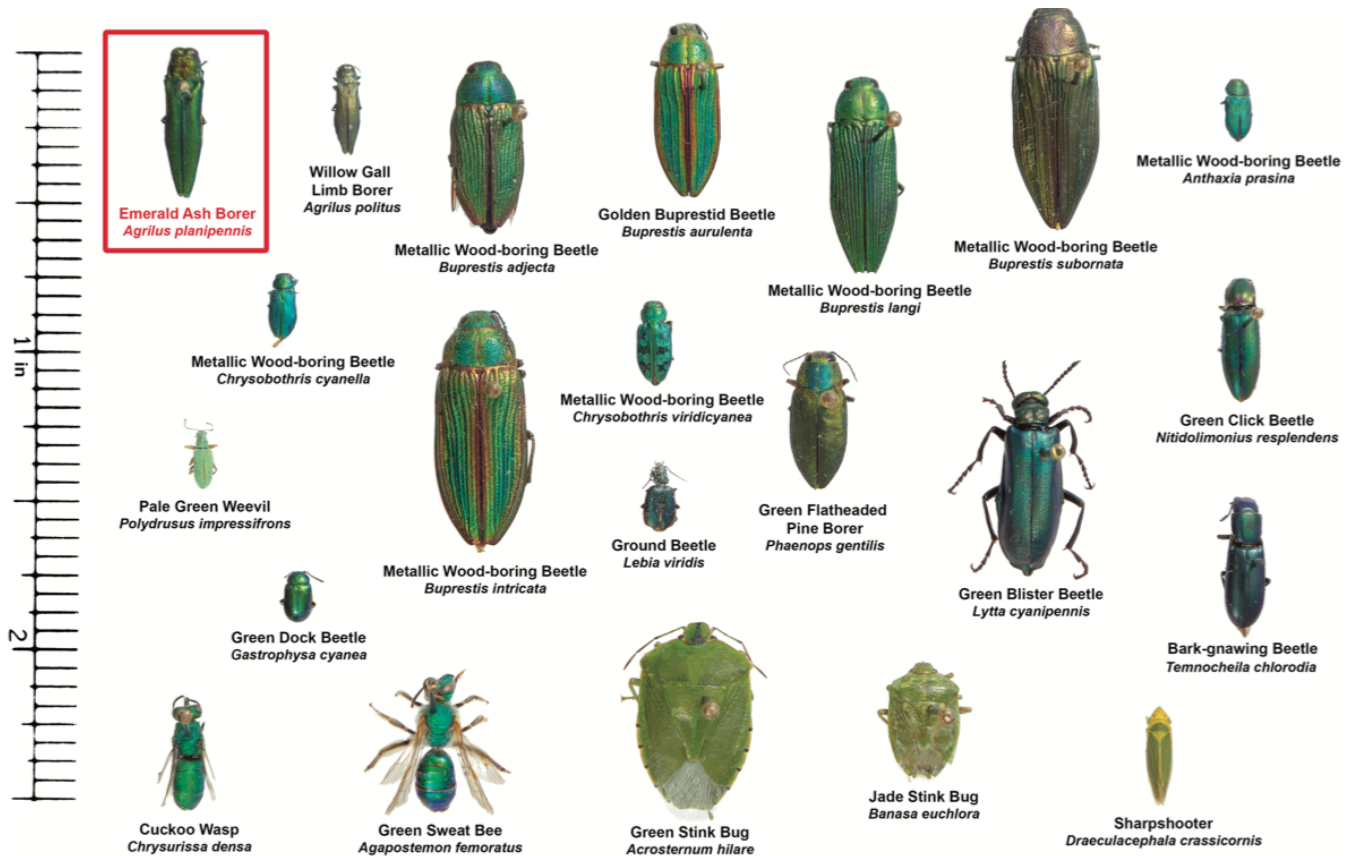
Credit: David Cappaert, Michigan State University, Bugwood.org, CC BY-NC 3.0



Emerald ash borer in the palm of a hand.

Credit: Marianne Prue, Ohio Department of Natural Resources–Division of Forestry, Bugwood.org, CC BY 3.0

Common EAB look-alikes



Credit: Oregon Department of Agriculture

EAB larvae

- About 3 cm long.
- Bell-shaped segments.
- Flat and tapeworm-like in appearance.

Note: If you find what looks like an EAB larva in a tree, make sure it is an ash tree.



EAB larvae.

Credit: David Cappaert, Michigan State University, Bugwood.org, CC BY-NC 3.0



EAB larvae are about 3 cm long.

Credit: David Cappaert, Michigan State University, Bugwood.org, CC BY-NC 3.0

EAB galleries

- S-shaped.
- Below bark. (Larvae only feed on phloem. They do not burrow deeply into the tree.)
- One of the first noticeable indicators of an infestation.
- Bark-splitting often reveals S-shaped galleries.



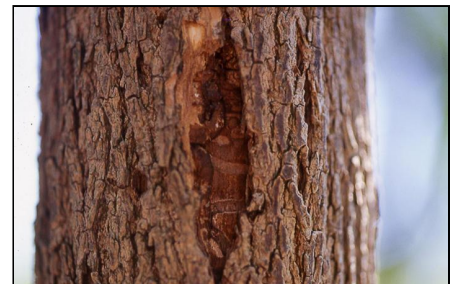
White lines known as galleries snake across the trunk.

Credit: Art Wagner, USDA-APHIS, Bugwood.org; CC BY 3.0



Galleries in wood.

Credit: John Hritz, Flickr.com, CC BY 2.0



A crack in the bark of an ash tree reveals S-shaped galleries below.

Credit: Joseph O'Brien, USDA Forest Service, Bugwood.org, CC BY 3.0

EAB signs and symptoms

Woodpecker damage

- Mottled, blanding appearance.
- Bark flaked away (not deeply excavated).
- One of the first noticeable indicators of an infestation.



Bark has flaked off this tree trunk, leaving a mottled appearance.

Credit: Kenneth R. Law, USDA APHIS PPQ, Bugwood.org, CC BY 3.0



A tree trunk with patchy, flaky bark.

Credit: Steven Katovich, USDA Forest Service, Bugwood.org, CC BY 3.0

Epicormic branches

- Branch sprouting from bark.
- Can be found anywhere along trunk.
- Often appear in late stages of infestation.



A branch sprouts from bark along the trunk — a phenomenon known as epicormic branching.

Credit: Minnesota Department of Natural Resources, Bugwood.org, CC BY 3.0

Crown dieback

- Top third of crown.
- May not be noticeable until tree is heavily infested.



Thinning crown.

Credit: Joseph O'Brien, USDA Forest Service, Bugwood.org; CC BY 3.0



Crown thinning.

Credit: Joseph O'Brien, USDA Forest Service, Bugwood.org; CC BY 3.0

EAB exit holes

- Adult emergence holes.
- D-shaped.
- About 3mm across ($\frac{1}{8}$ inch).



Emerald ash borer holes are shaped like the letter D.

Credit: Kenneth R. Law, USDA APHIS PPQ, Bugwood.org, CC BY 3.0

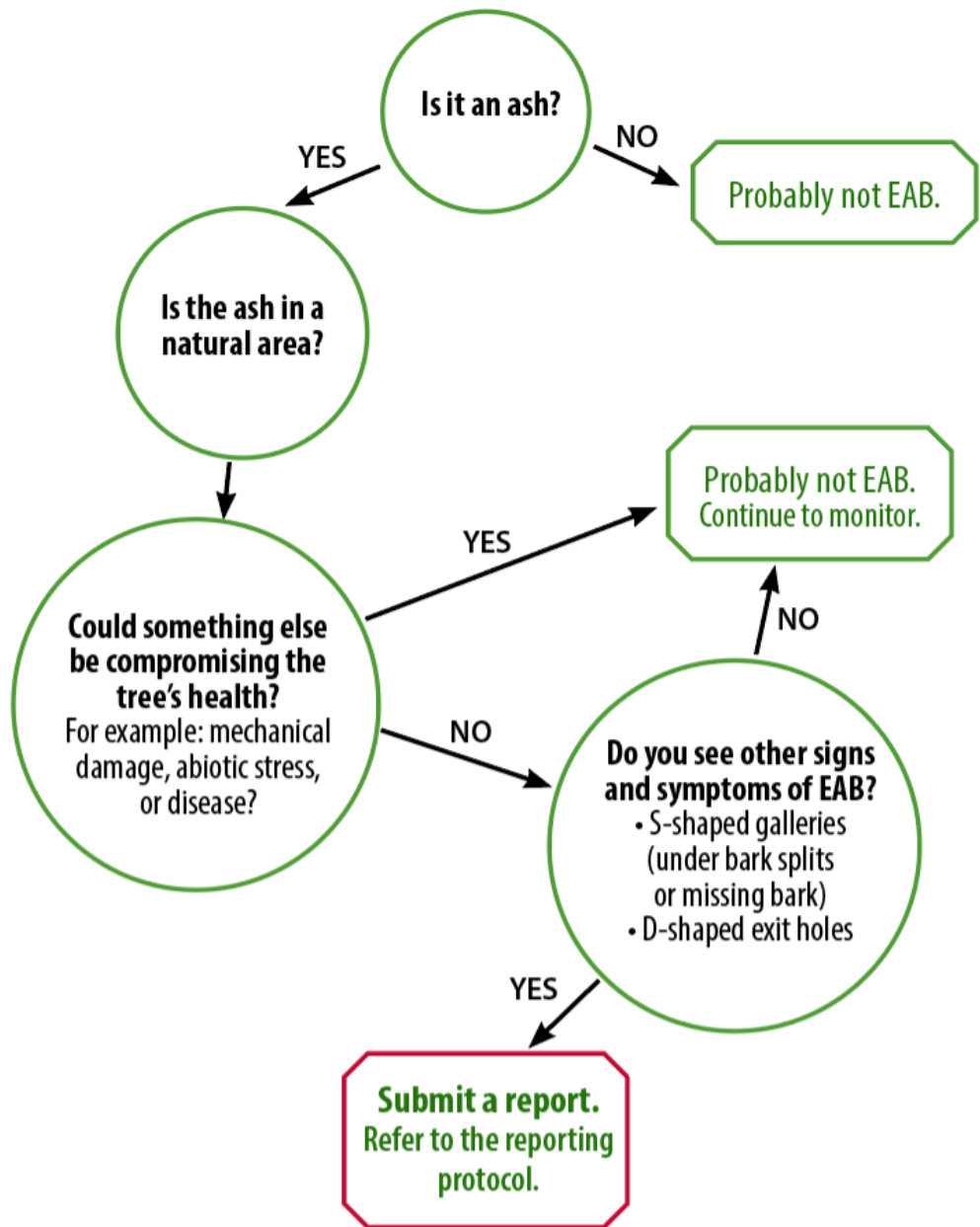


Not EAB: Ash bark beetle holes are similar in size but are round.

Credit: Whitney Cranshaw, Bugwood.org; CC BY 3.0

EAB reporting decision tree No. 1

You see an unhealthy tree with woodpecker damage, crown dieback or epicormic shoots.

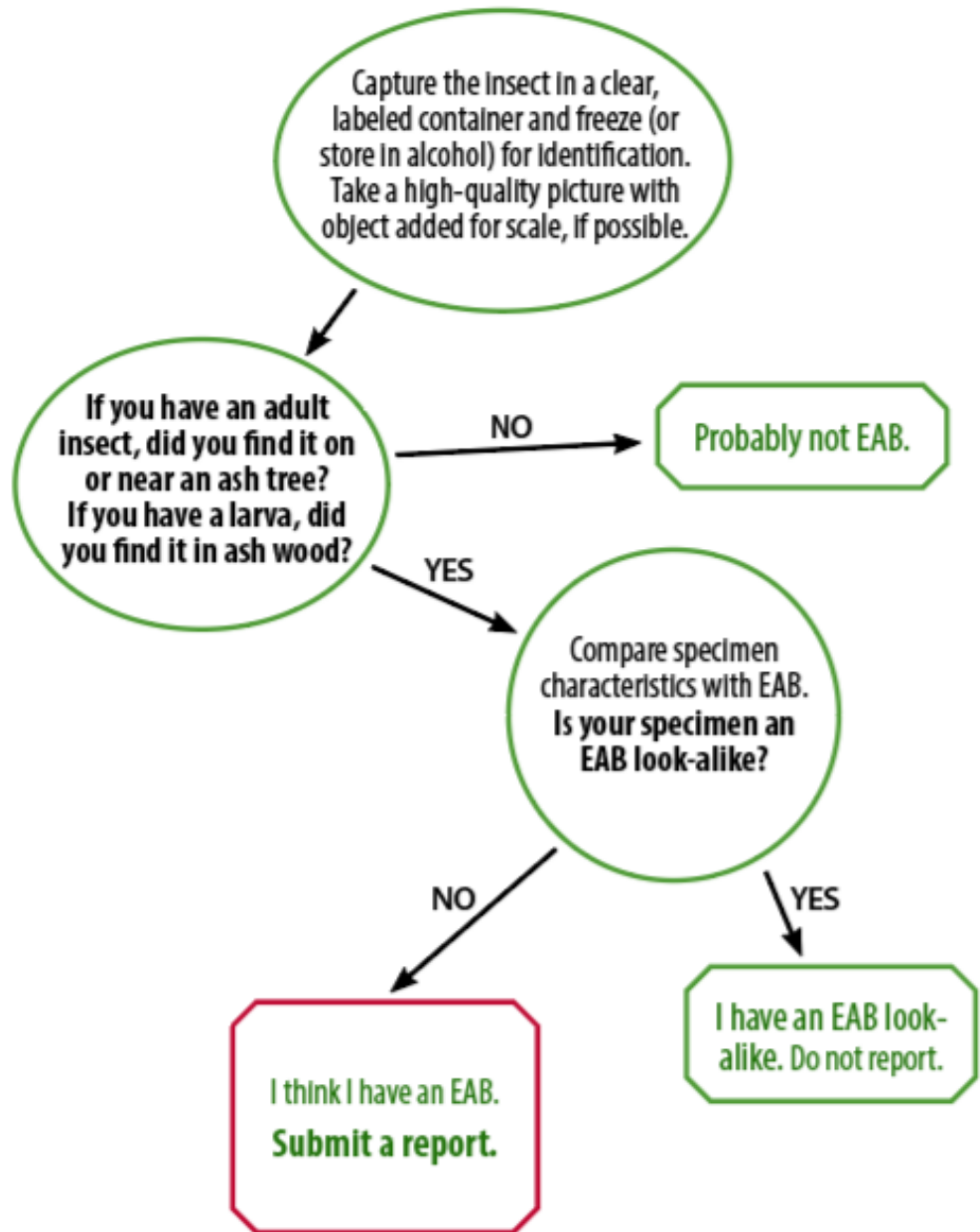


Submit a report of you see an ash tree in a natural area with damage or signs of disease and D-shaped exit holes or galleries.

Credit: © Oregon State University

EAB reporting decision tree No. 2

You see an insect that looks like EAB.



Check any insects found in or near ash trees against the reference chart above.

Credit: Oregon State University

Asian longhorned beetle, *Anoplophora glabripennis*

Quick facts

- Invasive wood-boring beetle
- From Asia; first reported in the United States in 1996 (Brooklyn, New York).
- Has been introduced to several other U.S. states and Canadian provinces.
- Attacks 12 genera of hardwood hosts, primarily maple (*Acer* spp.).
- Loss of 30% to 70% of tree canopy.
- Causes major damage to urban and natural forests.

ALB host species

Maple, *Acer* spp.

- Opposite branches.
- Simple, palmate leaf.
- Paired samaras.
- Includes boxelder.



Maple leaves.

Credit: Jan Samanek, State Phytosanitary Administration, Bugwood.org; CC BY 3.0



Maple samaras.

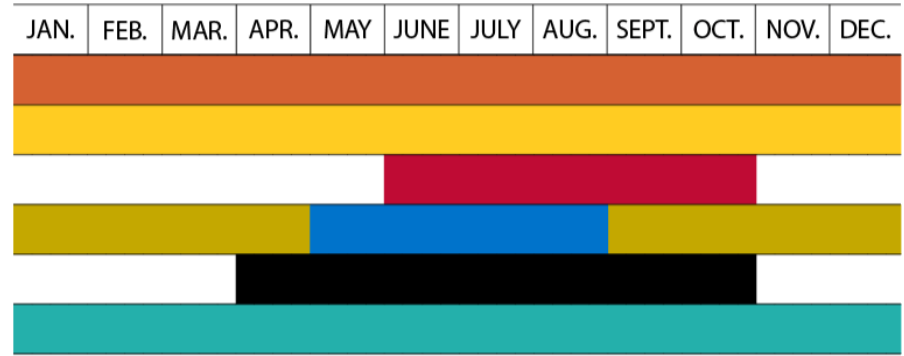
Credit: Jan Samanek, State Phytosanitary Administration, Bugwood.org; CC BY 3.0



Maple samara.

Credit: Rob Routledge, Sault College, Bugwood.org, CC BY 3.0

Quick-reference Oregon monitoring calendar



- Larvae
- Pupae
- Adults
- Check for **old** exit holes and egg sites
- Check for **old and fresh** exit holes and egg sites
- Look for host tree crown dieback
- Look for broken branches and frass around host trees

Adults are active June–October.

Credit: © Oregon State University

Birch, *Betula* spp.

- Alternate branches.
- Simple, serrate leaf.
- Deciduous catkin.
- Mature bark is often white or pink to gray to brown.



Birch leaves and cones.

Credit: Rob Routledge, Sault College, Bugwood.org, CC BY 3.0



Birch bark.

Credit: Rob Routledge, Sault College, Bugwood.org, CC BY 3.0



Birch bark.

Photo: Joseph O'Brien, USDA Forest Service, Bugwood.org, CC BY 3.0

Elm, *Ulmus* spp.

- Alternate branches.
- Simple, egg-shaped, serrate leaf.
- Round samara.
- Mature bark often deeply furrowed.



Elm leaves.

Credit: Rob Routledge, Sault College, Bugwood.org, CC BY 3.0



Elm samaras.

Credit: Rob Routledge, Sault College, Bugwood.org, CC BY 3.0

Willow, *Salix spp.*

- Alternate branches.
- Long, narrow leaf.
- Catkin with cotton-like seeds.



Willow leaves.

Credit: Paul Wray, Iowa State University,
Bugwood.org, CC BY-NC 3.0



Willow catkin.

Credit: Paul Wray, Iowa State University,
Bugwood.org, CC BY-NC 3.0



Willow twig.

Credit: Bill Cook, Michigan State University,
Bugwood.org, CC BY 3.0

Horse chestnut, *Aesculus hippocastanum*

- Opposite branches.
- Compound leaf with five to 11 leaflets.
- Green, spiny fruit.
- Mature bark smooth to flakey, sometimes plated.



Horse chestnut leaves and flowers.

Credit: The Dow Gardens Archive, Dow Gardens,
Bugwood.org, CC BY-NC 3.0



Horse chestnut fruit is covered in spines.

Credit: Bill Cook, Michigan State University,
Bugwood.org, CC BY 3.0



Horse chestnut fruit.

Credit: Paul Wray, Iowa State University,
Bugwood.org, CC BY-NC 3.0

Other hosts

- Ash (*Fraxinus*)
- Poplar (*Populus*)
- Sycamore (*Platanus*)
- Mountain-ash (*Sorbus*)
- Mimosa (*Albizia*)
- Katsura (*Cercidiphyllum*)
- Golden raintree (*Koelreuteria*)

Identifying ALB

- Shiny, black body with white spots,
- Long antennae with white bands,
- Six legs.
- 2 to 3⁴/₅ cm without antennae (about ¾ to 1½ inches).
- May have bluish feet.



ALB larvae.

Credit: Steven Katovich, USDA Forest Service, Bugwood.org; CC BY 3.0



Credit: Kenneth R. Law, USDA APHIS PPQ, Bugwood.org; CC BY 3.0

ALB galleries and tunnels

- Larvae tunnel deep into trunk and branches.
- Not immediately visible early in an infestation.



Photo: E. Richard Hoebeke, Cornell University, Bugwood.org; CC BY-NC 3.0



Asian longhorned beetle.

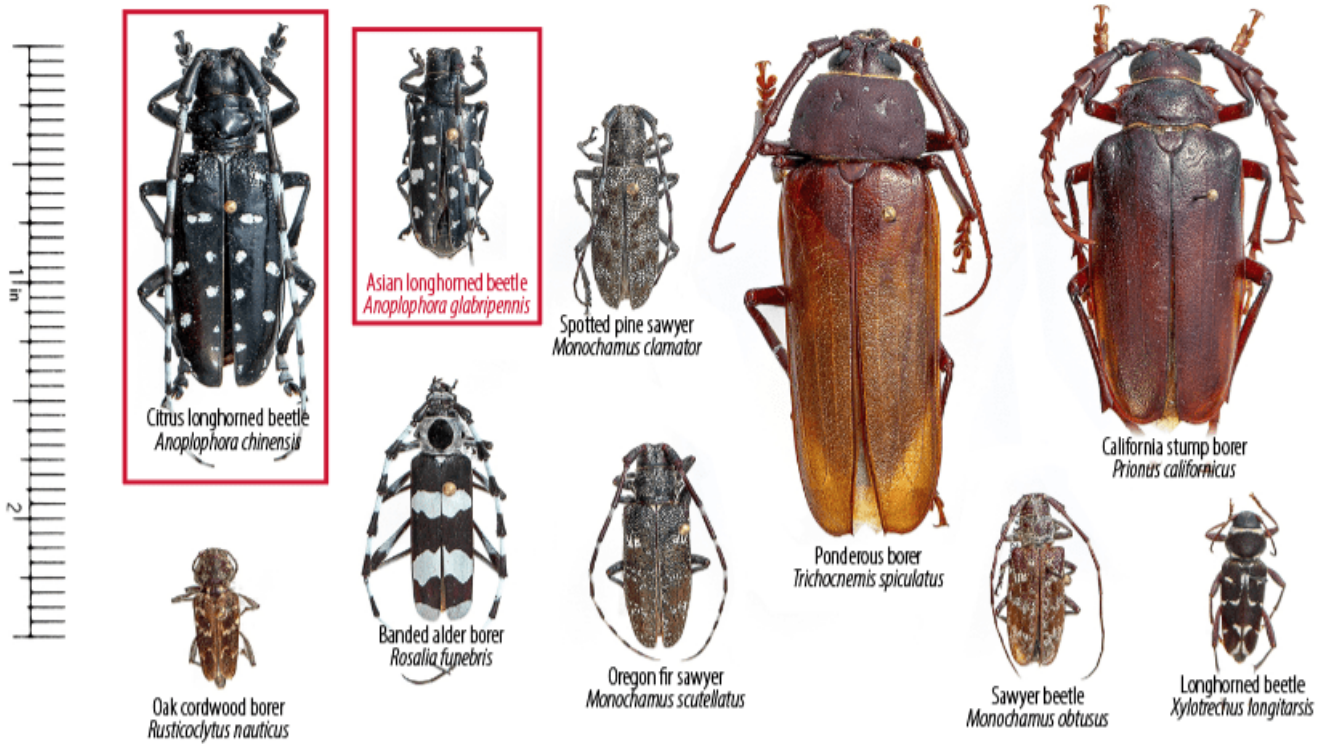
Credit: Pennsylvania Department of Conservation and Natural Resources–Forestry Archive, Bugwood.org, CC BY 3.0



ALB tunnels.

Credit: Pennsylvania DCNR Pennsylvania Department of Conservation and Natural Resources–Forestry Archive, Bugwood.org; CC BY 3.0

ALB look-alikes



Credit: Oregon Department of Agriculture

Carpenterworm moth larvae, *Prionoxystus robiniae*

- About 5 to 7½ cm long (2 to 3 inches).
- Have prolegs. (ALB does not.)
- Oval-shaped tunnels.
- Exit holes similar in size to ALB.



Carpenterworm moth larvae.

Credit: William H. Hoffard, USDA Forest Service, Bugwood.org; CC BY 3.0

Citrus longhorned beetle, *Anoplophora chinensis*

- Length: About 2 to 3½ cm (similar size to ALB).
- Hosts: 100-plus species; primary hosts include citrus (*Citrus*), apple (*Malus*), trifoliate orange (*Poncirus trifoliata*), poplar (*Populus*), willow (*Salix*), Australian pine (*Casuarina equisetifolia*).

Note: This is another high-priority invasive insect. If you think you have found a citrus longhorned beetle, please report it immediately.



Credit: Oregon Department of Agriculture

ALB signs and symptoms

ALB exit holes

- Round
- 1 cm ($\frac{2}{3}$ inch) across
- Found on branches, trunk, and above-ground roots



ALB exit hole.

Credit: Daniel Herms, The Ohio State University, Bugwood.org; CC BY 3.0

ALB egg scars

- Also referred to as oviposition sites or pits.
- Egg-laying site.
- 1 cm ($\frac{2}{3}$ inch) across.
- Sap can sometimes be seen weeping from egg scar.



ALB egg scar.

Photo: Dennis Haugen, USDA Forest Service, Bugwood.org; CC BY 3.0



ALB egg scar.

Credit: Dennis Haugen, USDA Forest Service, Bugwood.org; CC BY 3.0



ALB egg scar.

Credit: Kenneth R. Law, USDA APHIS PPQ, Bugwood.org, CC BY 3.0

Frass

This stringy sawdust substance (excrement) may be found on the ground, in tree branch unions or coming out of holes on living branches.



ALB frass.

Credit: Kenneth R. Law, USDA APHIS PPQ, Bugwood.org, CC BY 3.0

ALB frass.

Photo: Pennsylvania Department of Conservation and Natural Resources–Forestry Archive, Bugwood.org; CC BY 3.0

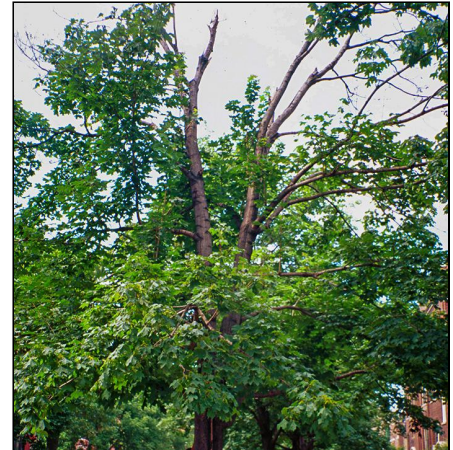
Crown dieback and broken branches

These symptoms may not be noticeable until tree is heavily infested.



ALB crown dieback.

Credit: Dennis Haugen, USDA Forest Service, Bugwood.org, CC BY 3.0

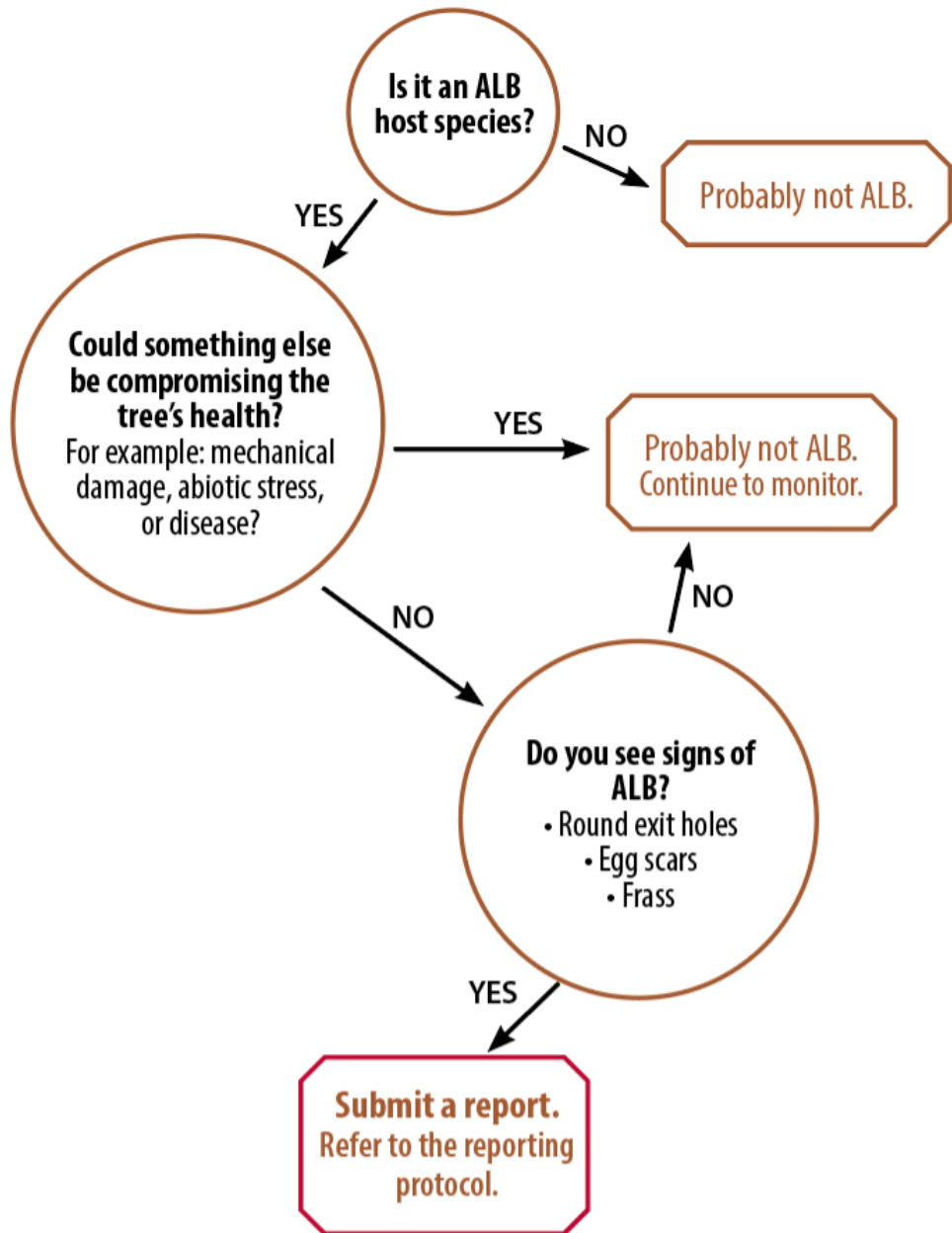


Broken branches in crown of tree.

Credit: Dennis Haugen, USDA Forest Service, Bugwood.org, CC BY 3.0

ALB reporting decision tree No. 1

You see a tree that seems unhealthy. It has holes in it, the crown is dying back and branches are breaking.

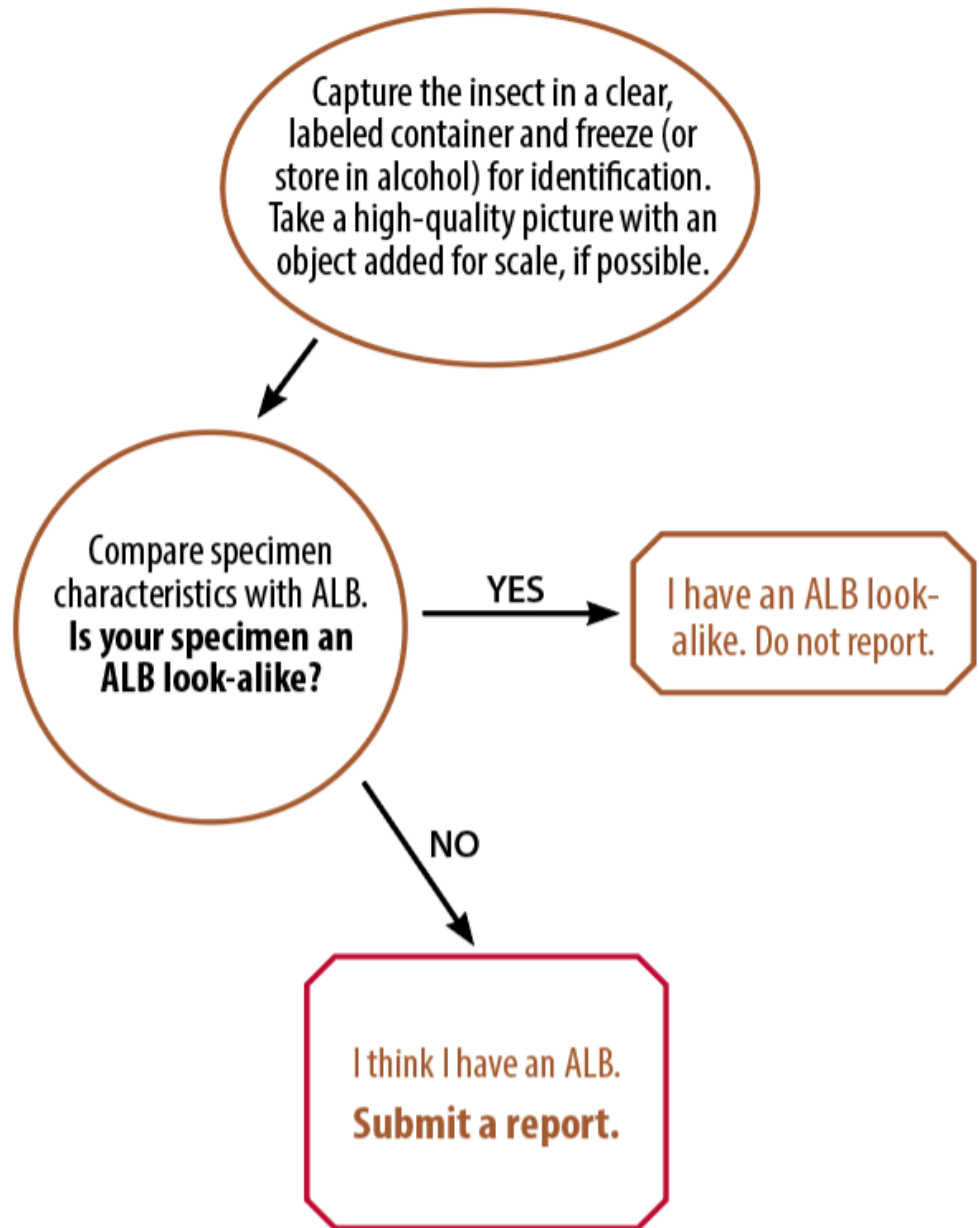


Determine whether the tree is an ALB host species and look for alternative causes before filing a report.

Credit: © Oregon State University

ALB reporting decision tree No. 2

Here's what to do if you see an insect that looks like the Asian longhorned beetle.



Capture the insect or take a photo with an object for scale.

Credit: © Oregon State University

Reporting protocol

1. Record the following:

- Site location and description (GPS coordinates or map, natural or urban area, public or private).
- Signs and symptoms observed (including host tree species).
- High-quality, well-lit photos of damage or insects. Include an object for scale.

2. Collect samples:

- Put wood or frass into a labelled plastic bag. Double-bag so nothing can chew out and escape in transit.
- Put insects into a clear, hard container (such as a glass vial or plastic food container). Preserve in a freezer or in rubbing alcohol.

3. Go to the [Oregon Invasive Species Hotline: \(http://oregoninvasiveshotline.org/\)](http://oregoninvasiveshotline.org/)

- Select [report now \(https://oregoninvasiveshotline.org/reports/create\)](https://oregoninvasiveshotline.org/reports/create) and complete a report.
- Be as detailed as possible.
- Provide your contact information so an expert can follow up.

Confidentiality agreement

If an ALB or EAB infestation is suspected, it must remain confidential until it is verified by professionals and the information is made public by the appropriate authority. Reports made to the Oregon Invasive Species Hotline will remain confidential. As an Oregon Forest Pest Detector, you must agree to protect information and suspected pest name, location and identity of any property owner or individual associated with the infestation until the proper authorities have released this information publicly.

Useful resources

- [Oregon Forest Pest Detector online course \(http://pestdetector.forestry.oregonstate.edu/\)](http://pestdetector.forestry.oregonstate.edu/)
- [Oregon Invasive Species Council \(http://www.oregoninvasivespeciescouncil.org/\)](http://www.oregoninvasivespeciescouncil.org/)
- EAB and ALB information and images
 - [Emerald ash borer \(http://www.emeraldashborer.info/\)](http://www.emeraldashborer.info/)
 - [Asian longhorned beetle \(http://www.asianlonghornedbeetle.com/\)](http://www.asianlonghornedbeetle.com/)
- [Don't Move Firewood \(http://www.dontmovefirewood.org/\)](http://www.dontmovefirewood.org/) campaign
- [Hungry Pests \(http://hungrypests.com/\)](http://hungrypests.com/)
- Oregon Department of Agriculture [Insect Pest Prevention and Management \(http://www.oregon.gov/ODA/programs/IPPM/Pages/Default.aspx\)](http://www.oregon.gov/ODA/programs/IPPM/Pages/Default.aspx)

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