



Forest Facts: Emerald Ash Borer (EAB)

Agrius planipennis Fairmaire



EAB adult. D. Cappaert.

Background

Emerald ash borer (*Agrius planipennis* Fairmaire), referred to as EAB, is a highly destructive invasive forest pest that has killed over 100 million ash trees in the eastern U.S. since its first detection near Detroit, Michigan, in 2002. Several North American ash species (*Fraxinus* spp.) are at risk, including the native Oregon ash (*Fraxinus latifolia*) and non-native ash species widely planted as landscape trees. **EAB was detected in Oregon on June 30, 2022, in Forest Grove.**

After its initial detection in the eastern U.S., EAB spread quickly beyond containment lines despite several aggressive eradication attempts. Only 20 years after its arrival in North America, five eastern U.S. ash species – green, white, black, blue and pumpkin ash – are already listed as “critically endangered” by the International Union for Conservation of Nature. In Oregon, efforts are underway to determine the extent and spread of EAB in and around Forest Grove as well as efforts to conserve native Oregon ash from the threat of EAB.

Wildland forest pest

Oregon ash is known from research trials to be highly susceptible to EAB. Oregon ash is a key part of riparian forests and wetlands west of the Cascades. It grows along streams, rivers and wetlands below 2,000' elevation, with 80 percent of the species occurring below 1,000' elevation. At the lowest elevations (below 500') it forms pockets of pure stands. EAB is

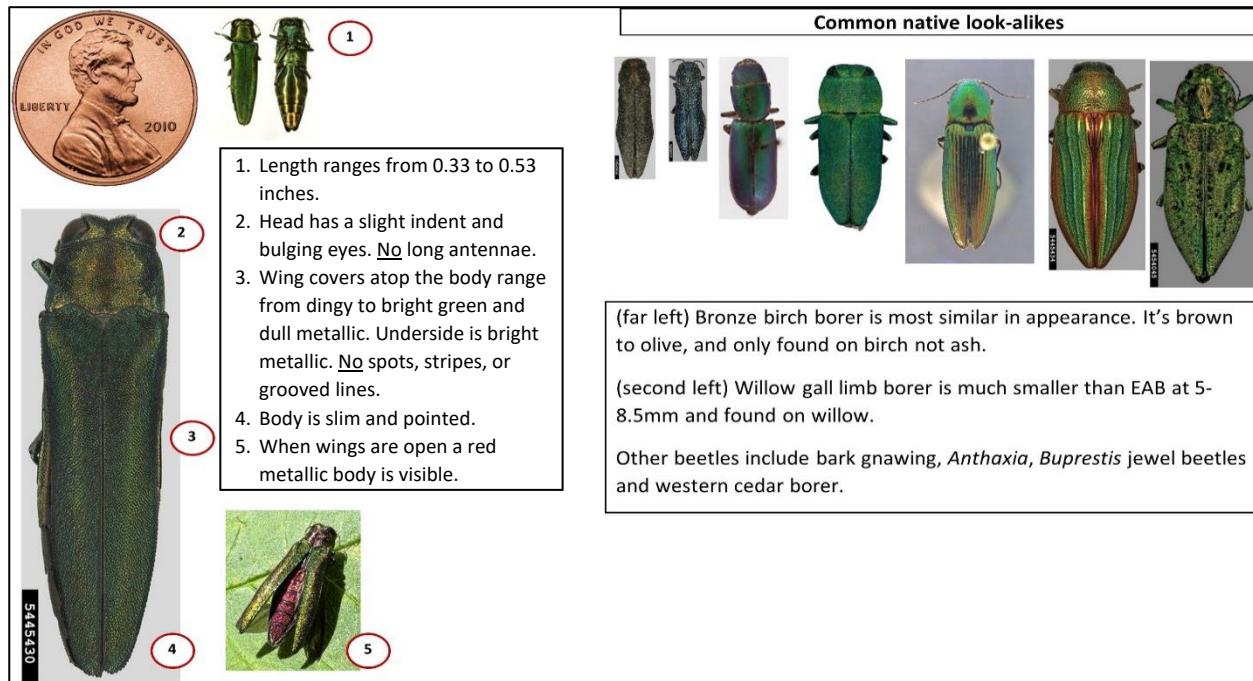


Oregon ash in a small riparian system near Marcola, Oregon. W. Williams.



Oregon ash (*F. latifolia*) with male flowers. W. Williams.

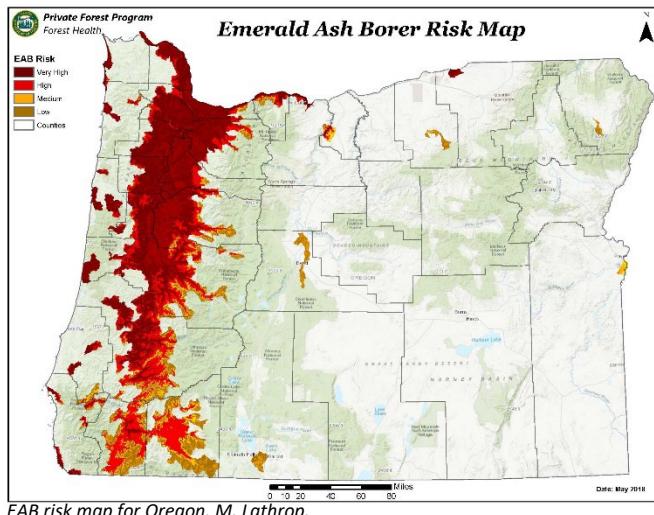
capable of killing entire stands of these ash. Oregon ash occurs on both lands zoned for forestry and for agriculture. Oregon ash is widely used for stream restoration plantings due to its ability to stabilize soil, control sediment, and moderate stream temperatures. It is assumed that widespread death of Oregon ash will lead to ecological changes in water quality, stream temperatures and riparian plant communities. Oregon ash has limited use in Oregon as a timber species. However, a number of small specialty mills process this hardwood for woodworking.



EAB and common Oregon look-alikes. C. Buhl.

Urban and community pest

Besides native Oregon ash, susceptible EAB hosts in Oregon include common landscape ash species: green, white, narrow-leaved (especially the cultivar 'Raywood'), and European ash. EAB is also known to feed on botanical relatives of ash, including white fringetree (*Chionanthus virginicus*) and cultivated olive (*Olea europaea*). In the eastern U.S., EAB has caused over \$2 billion in damages. Most of the costs are from losses in residential property values, tree removal and replanting in urban areas. EAB moves quickly; it can cause nearly complete mortality of ash trees within about 10 years after detection.



EAB risk map for Oregon. M. Lathrop.

Insect biology

EAB is native to eastern Asia, including far eastern Russia, China, Mongolia, Japan, Taiwan and the Korean Peninsula. It is only a minor pest of ash trees native to east Asia. In North America, however, it attacks both stressed and healthy trees. EAB was likely introduced to the Great Lakes area through international shipping of infested solid-wood material, such as wood pallets. Since 2002, EAB has spread to over 35 states and five Canadian provinces. The first detection on the West Coast of North America was in Forest Grove, Oregon on June 30, 2022. The next closest known EAB population is Boulder, Colorado.

EAB adults emerge May into July. Eggs are laid in crevices of bark. The larvae hatch and begin tunneling through and consuming the inner phloem, cambium and outer xylem, just beneath the bark. The feeding action of many hundreds or thousands of EAB girdles the tree, cutting off the flow of sugars produced in the leaves to the storage systems in the roots, effectively starving trees to death. There are four larval molts before the insect pupates and overwinters.

There are certain signs and symptoms that are characteristic of EAB, most of which are very long lasting, well after the insect has completed its development and left the tree. If the bark of affected trees are removed, one can observe the meandering "serpentine-shaped" galleries caused by hundreds and even thousands of larvae



Serpentine galleries caused by larval EAB feeding. W. Williams.

feeding on the vascular cambium. Second, the adults in this group of beetles leave a characteristic "D-shape" exit hole about an eighth of an inch wide when exiting the tree. Last, after about three or four years of repeated attack and feeding by EAB, ash trees show significant



"D-shaped" exit holes from EAB adults. C. Buhl.

canopy dieback. In an effort to stay alive, trees often produce shoots or suckers along the trunk. Other signs of EAB include woodpecker damage and loose bark. Typically, it can take three to four years before a tree will start to decline from EAB. This is well after the insect has bred and dispersed to other trees, making early detection difficult. Traps for EAB are only partially effective for attracting and monitoring EAB.

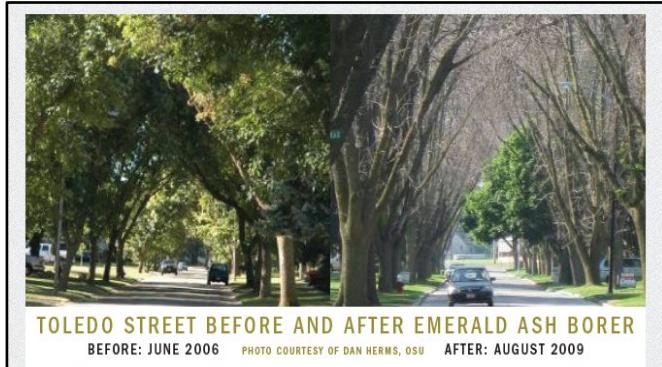
Detecting and reporting EAB

EAB is more often detected by keen eyes than by traps. In 2015, Oregon Department of Forestry, with financial aid from U.S. Forest Service and in conjunction with Oregon State University Extension, Oregon Department of Agriculture and the USDA Animal and Plant Health Inspection Service, developed a program to train over 500 of Oregon's natural resource specialists from local and state agencies on how to detect and report EAB and other invasive pests. Read



Dead canopy and epicormic shoots of tree with severe decline caused by EAB. D. Herms. Inset: Infested ash tree at the initial detection site in Forest Grove, Oregon. Note the thinning canopy. W. Williams.

about the Oregon Forest Pest Detector program at <https://extension.oregonstate.edu/ofpd>. Graduates of the Pest Detector program and any member of the public can report a suspected ash tree through the online reporting tool at <https://oregoninvasiveshotline.org/>.



Street trees, before and after EAB, Toledo, Ohio. EAB can move through an entire community in 3-10 years. D. Herms.

Treatments for EAB

First, make sure that the trees in question are true ash trees. Ash trees have compound leaves and opposite branching, and bark furrows become diamond shaped as trees age. Their seeds are paddle-shaped, hang in branches, and are present on female trees in late summer/early fall. Foliage turns from bright green to yellow in the fall, although some selections have purple or red fall color. Watch for any sign of initial canopy thinning, top dieback or other symptoms listed above.

There are no effective means of eradicating entire populations of EAB once the insect is established in an area. Individual trees can be protected before EAB arrives using stem-injected or soil-drenched systemic insecticides. Once a tree canopy has been thinned or reduced by 30% or more by EAB feeding activity, it is too late to protect it. Some of the systemic insecticides can only be applied by professional pesticide applicators, while others are available to the public. For a complete list of insecticides and their effectiveness, see the Oregon Statewide EAB Readiness and Response Plan, [www.oregneab.info](http://www.oregoneab.info).

For established populations of EAB, another method of management includes biological control – the practice of using an insect's natural enemies to control population growth. The USDA Animal and Plant Health Inspection Service has a biological control program for EAB in the eastern U.S. Releasing tiny parasitic wasps that specialize on EAB can help reduce, but not eliminate, population growth and spread of EAB. The Oregon Department of Agriculture Insect Pest Prevention and Management Program may be developing a similar biological control program for EAB in Oregon (<https://www.oregon.gov/oda/programs/ippm/pages/aboutippm.aspx>).

Other management options include pre-emptive removal of ash near an active infestation. Municipalities are encouraged to inventory ash trees and have a plan to spread the cost of ash tree removal over several years. Once removed, ash trees should be chipped to pieces one inch in dimension to stop the growth of EAB insects inside the tree. The chips should be covered with thick plastic or buried to stop the spread of EAB adults that may still emerge. Ash is a wonderful firewood but is also a prime pathway for the insect to move across the state. Therefore, ash firewood that is recently cut and split should also be covered by thick plastic for at least one year. Firewood should not be moved more than 30 miles from where it was harvested. See <https://www.dontmovefirewood.org/>.



Ash firewood should not be moved. Campers should buy kiln-dried firewood at campgrounds. Source: The Nature Conservancy.

Proactive preparations

Because the threat of EAB has been known for some time, Oregon has led the effort among states on the West Coast to prepare for this destructive pest. With financial assistance from the U.S. Forest Service State and Private Forestry program, ODF is collecting 1 million seeds of Oregon ash from across its range in Oregon. The seeds are being sent to researchers at USDA Genetic Resource Center near Cottage Grove, Oregon, as well as the USDA Seed Lab in Fort Collins, Colorado. Seeds were collected following a protocol that is designed to capture the genetic diversity of Oregon ash in the state. The hope is that one day there will be tree breeding programs to develop Oregon ash that is resistant to EAB and restore affected areas. The seed collection will provide genetic material to start the breeding program.



Stand of pure ash is home to elk and other wildlife species. Ankeny National Wildlife Refuge. W. Williams.

Since the introduction of EAB to North America, international regulations now require solid wood material used in international shipping to be debarked and heat treated to sanitize for tree-killing insects and disease. Within the United States, interstate spread of EAB occurs through the ash nursery trade and through the transportation of infested firewood. To protect our state from new pests, purchase locally sourced nursery stock and do not move firewood which could contain tree-killing insects and diseases.

Plant nursery companies and their customers should be on the lookout for ash saplings as small as 1" diameter infested with EAB. These should

be promptly destroyed. Firewood gatherers and producers should cover fresh-cut ash trees or kiln-dry wood (most effective method for killing EAB is 60 min at 140 degrees F). Cities and homeowners should start planning now for replacement tree species used in restoration projects, street tree programs and other urban landscapes while choosing native and climate-adapted tree species above others. See details on preparing your community for EAB at [www.oregneab.info](http://www.oregoneab.info).

Resources and further reading

Emerald Ash Borer Readiness and Response Plan for Oregon: www.oregneab.info

Oregon Forest Pest Detector program, Oregon State University Extension.

<https://extension.oregonstate.edu/ofpd>

Oregon Forest Pest Detector Field Guide, Oregon State University Extension.

<https://catalog.extension.oregonstate.edu/em9127>

Oregon Invasive Species Council Online Hotline for reporting EAB:

<https://oregoninvasiveshotline.org/>

Ash Genetic Conservation Program, US Forest Service:

https://www.fs.usda.gov/nsl/GeneticConservation_Ash.html

Emerald ash borer information network:
<http://www.emeraldashborer.info/>

Emerald Ash Borer fact sheet, USDA Animal and Plant Health Inspection Service:

<https://www.aphis.usda.gov/aphis/ourfocus/plant-health/plant-pest-and-disease-programs/pests-and-diseases/emerald-ash-borer>

USDA Emerald Ash Borer Fact sheet:

<https://www.ars.usda.gov/ARSUserFiles/80620520/EABfactsheet.pdf>

Oregon Department of Agriculture Insect Pest Prevention and Management Program:

<https://www.oregon.gov/oda/programs/ippm/pages/aboutippm.aspx>

Trees to know in Oregon:

<https://extension.oregonstate.edu/trees-know-oregon-washington>