Oregon Ash: Insects, Pathogens and Tree Health

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A stand of Oregon ash in the Willamette Valley. This riparian tree provides important habitat for wildlife.

Credit: David Shaw, © Oregon State University

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EM 9380 | January 2023

View online: https://extension.oregonstate.edu/pub/em-9380

Oregon ash (*Fraxinus latifolia* [Benth]) is a wetland and riparian tree of great importance, providing habitat for wildlife, understory plants, lichens and mosses. In July 2022, the emerald ash borer (*Agrilus planipennis* [Fairmaire]), or EAB, was discovered in Oregon. This insect has the potential to destroy ash trees in Oregon.

This guide helps those interested in Oregon ash distinguish the effects of emerald ash borer from those of typical ash pests. Oregon ash is poorly studied, and the insects, pathogens and abiotic issues that affect tree health are not well-documented. This report summarizes current understanding of the pests affecting Oregon ash.

Oregon ash is native to the West Coast, ranging from central and western Washington through western Oregon to northwestern California and the Sierra Nevada mountains (Figure 1). The tree can occur in mixed forests with other riparian trees. Ash also grows in pure stands in seasonal wetlands and along river drainages, such as the Columbia River west of Portland.

Oregon ash often looks unhealthy due to dead tops or partial crown dieback (Figure 2). These symptoms may be caused by drought, heat, stem and twig diseases, and animals browsing on foliage. In some areas, foliage diseases turn leaves brown in late August and September. In addition, local die-off of stands or parts of stands has been observed in some areas. These are thought to be related to changes in the water table and inundation flooding.

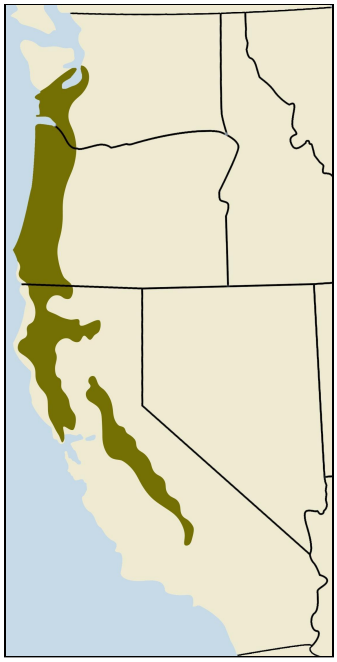

Figure 1. The range of Oregon ash extends from Puget Sound, through western Washington and Oregon, and into the mountains of northern and central California.

Credit: Alan Dennis, © Oregon State University

While many issues affect the health of Oregon ash, the introduction of the emerald ash borer to the Pacific Northwest makes correct diagnosis critical. Carefully examine trees showing disease symptoms to rule out this destructive pest.

Insects and diseases that affect the foliage appear to be the most important and well-known pests of ash, but a host of other animal and plant life has been documented on Oregon ash.

Related resources

- Oregon Forest Pest Detector Pest Watch — Emerald Ash Borer (https://catalog.extension.oregonstate.edu/em9160)
- Recognizing ash trees in Oregon, Washington and Northern California (https://extension.oregonstate.edu/gallery/recognizing-ash-trees-oregon-washington-northern-california)
- Emerald ash borer look-alikes (https://www.oregon.gov/oda/programs/IPPM/SurveyTreatment/Documents/EABLookAlikes.pdf?fbclid=IwAR28OWwIWxolOiBb9DlDXP8cLDLJbhgbCZumtmAHsXlLji_wQPCT1I5F_VA)

Figure 2A. Crown and branch dieback of Oregon ash.

Credit: Dave Shaw, © Oregon State University

Figure 2B. Scientists don't know why the crowns and branches of Oregon ash die back.

Credit: Jay Pscheidt, © Oregon State University

Insects and mites

Insects and mites feed on all the parts of Oregon ash, but we mostly know about a few foliage feeders and a bark beetle (Table 1).

Table 1. Insect foliage feeders, bark beetles and wood borers of Oregon ash

Insect species or group	Tree part	Importance
Seed weevil: *Thysanocnemis (Lignyodes)* species (336)	Seed	Unknown. Reported to destroy up to 60% of a seed crop. Present over the entire range of Oregon ash.
Eriophyid mite (not an insect), *Eriophyes fraxinivorus*	Flowers, inflorescence	Forms galls on flowers/inflorescence
Lace bug, *Leptophya minor*	Foliage	Unknown
Plant bug, *Tropidosteptes pacificus*	Foliage	Unknown

Insect species or group	Tree part	Importance
Tree cricket, *Oecanthus fultoni*	Foliage	Unknown
Zelleria species (possibly *Z. pyri*)	Foliage	A micromoth that scrapes the underside of the leaf. Known from outbreaks in the Coos Bay, Oregon, area.
Fall webworm, *Hyphantria cunea*	Foliage	Cyclic defoliator. May cause significant defoliation in some years.
Western oak looper, *Lambdina fiscellaria somniaria*	Foliage	Can be locally common in ash, but is mostly an oak defoliator.
Oregon ash bark beetle, *Hylesinus (Leperisinus) oregonus*	Under bark; trunk and large branches	Unknown
Emerald ash borer, *Agrilus planipennis*	Under bark; trunk and large branches. Does not bore into wood deeply. Adult feeds on foliage.	Extremely important. Could cause major regional mortality of Oregon ash.

From *Western Forest Insects* by R.L. Furniss and V.M. Carolin, 1977, and observations in the field.

Additional reports from the OSU Plant Clinic (1954–2017) indicate that leafhoppers, leaf blister mite (not an insect) and woolly aphid feed on horticultural ash.

Emerald ash borer

The emerald ash borer is a non-native, invasive wood-boring beetle that does not significantly bore into the wood. The larvae feed in the inner bark and slightly etch the outer sapwood. They leave distinct S-shaped galleries under the bark (Figure 3) and "D"-shaped exit holes on the outer bark (Figures 4A, 4B). In spring the larvae burrow into the sapwood to pupate just below the surface of the wood. They may pupate in the bark of trees with thick bark. As beetle feeding intensifies throughout the tree, the tree becomes girdled and dies. This may take several years.

All North American ash (*Fraxinus* species) are susceptible to the emerald ash borer. The insect has killed millions of trees since it was first discovered in Michigan in 2002.

Adult beetles are 7.5–13.5 mm (0.3–0.5 inches) long, slender and metallic olive to emerald green (Figure 5). The adults are active from June through July and August. They can be confused with other green insects (Figure 6). Larvae are 2.6–3.2 cm (1–1.3 inches) long, creamy white, with bell-shaped segments (Figure 7). Larvae may be found under the bark throughout the year. EAB may have a life cycle of one or two years, based on observations in eastern North America.

Figure 3. "S"-shaped galleries under the bark are characteristic signs of emerald ash borer larvae feeding.

Credit: Art Wagner, Bugwood.org

Fig 4A. D-shaped exit holes from emerald ash borer measure about 3 mm across.

Credit: Kenneth R. Law, Bugwood.com

Figure 4B. Exit holes are fairly small. Compare this to the size of the holes left by the red-breasted sapsucker, Figures 36 and 37.

Credit: Wyatt Williams, Oregon Department of Forestry

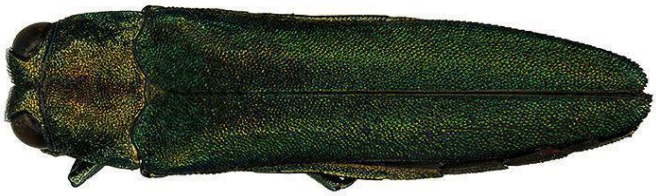

Figure 5. Emerald ash borer adults measure 7.5–13.5 mm (0.3–0.5 inches) long.

Credit: Oregon Department of Agriculture

Figure 7. Emerald ash borer larvae.

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

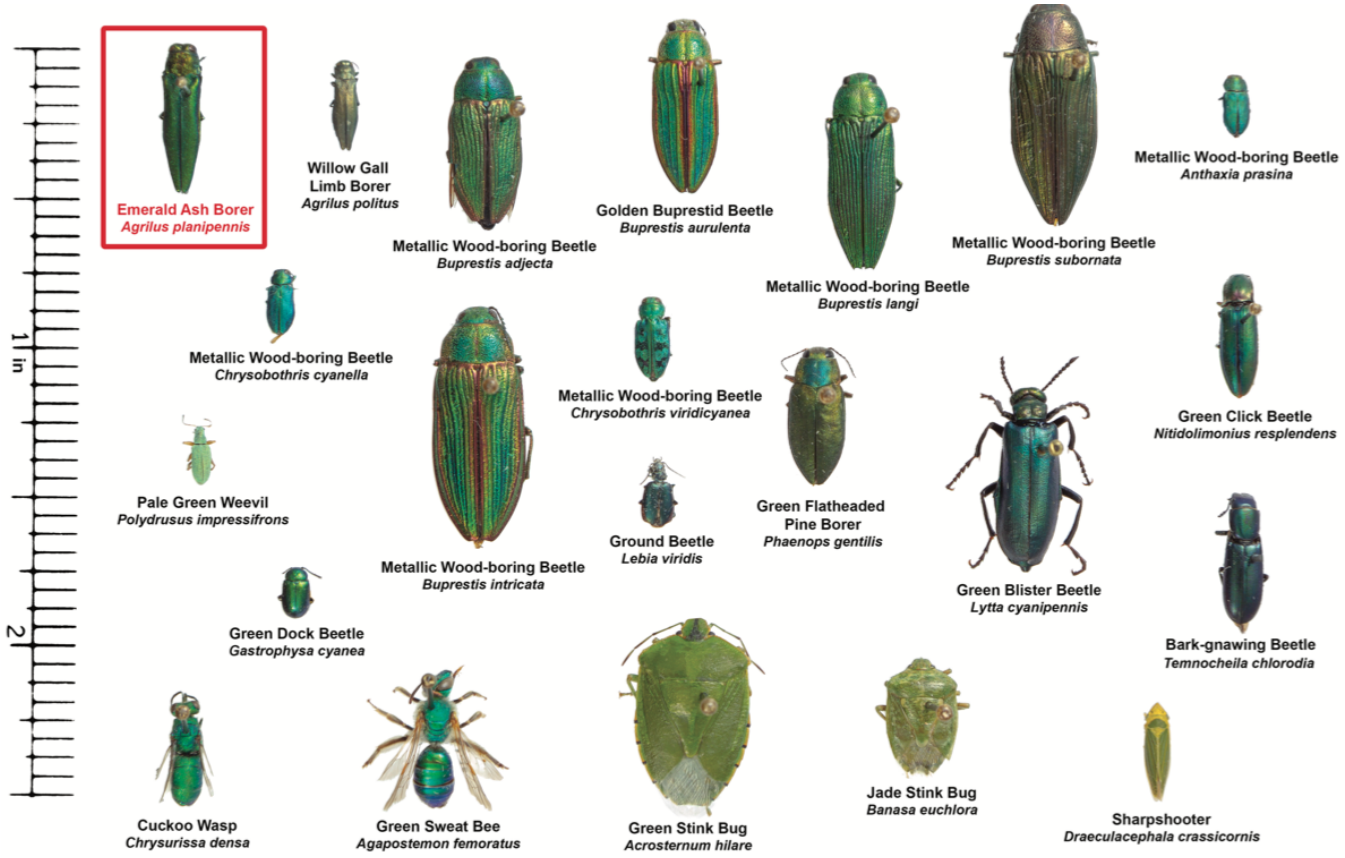

Figure 6. Several insects may resemble emerald ash borer in color and shape.

Credit: Oregon Department of Agriculture

Visible tree symptoms can be confusing in the early stages of an attack. The tree may take two to four years, or longer, to die. A declining crown, with dead branches in the upper crown, can be a sign of an EAB attack (Figure 8A, 8B, 8C). Other factors can also cause issues in Oregon ash, so look for D-shaped exit holes and S-shaped galleries under the bark to confirm a finding.

Other signs of tree decline due to EAB are the formation of secondary branches from dormant buds (known as epicormic branches) and sprouts from the base (Figure 9).

In other regions of the country, woodpecker activity is often an indication of EAB infestation. The woodpeckers flake the bark from the tree and change the general color of the tree bark in a patchy fashion (Figure 10).

Figure 8A. A large infested Oregon ash tree in Forest Grove, Oregon, shows crown thinning.

Credit: Wyatt Williams, Oregon Department of Forestry

Figure 8B. A small infested horticultural ash with purple sticky trap.

Credit: Wyatt Williams, Oregon Department of Forestry

Figure 8C. A row of infested horticultural ash trees in a parking lot.

Credit: Wyatt Williams, Oregon Department of Forestry

Figure 9. A branch sprouting from the base of an Oregon ash tree.

Credit: David Shaw, © Oregon State University

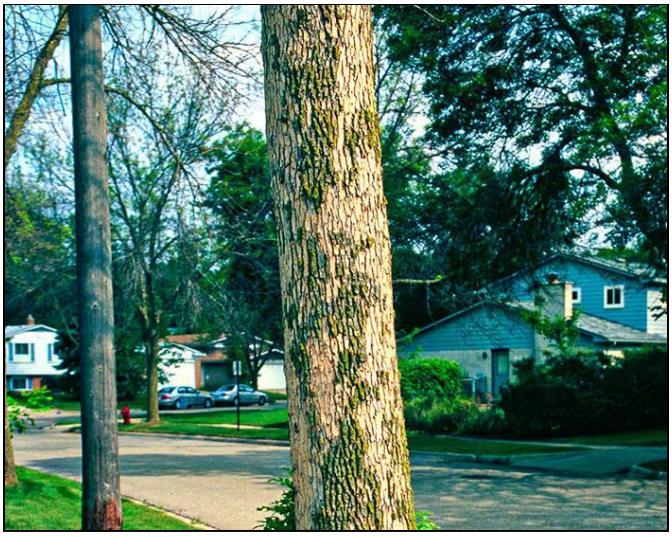

Figure 10. In their search for EAB larvae, woodpeckers flake the bark of ash trees. Flaky bark is one sign of possible infestation.

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

Figure 11. Adult western ash borer, *Neoclytus conjunctus*.

Credit: John Davis, bugguide.net

Other wood-boring insects

There is little documentation of other wood-boring beetles in Oregon ash. The western ash borer, *Neoclytus conjunctus* (Coleoptera: Cerambycidae), is known to utilize dead ash, oak (*Quercus* species) and madrone (*Arbutus menziesii*) from British Columbia to southern California. That insect is not considered a threat to tree health. Western ash borer adults are black with bold white or yellow “O”-shaped markings at the base of the elytra. They measure 7–18 mm long (Figure 11). The insect is attracted to freshly cut wood and may arrive while the chain saws are still working. The larvae can riddle the sapwood of freshly cut, bark-covered, unseasoned wood. Adults can emerge from firewood stored inside houses up to two or more years after cutting. Our native wood-boring insects may be opportunistic feeders of stressed trees but do not significantly contribute to tree mortality.

Figure 12. Larva of flatheaded wood borer (top) and roundheaded wood borer (bottom).

Credit: Christine Buhl, Oregon Department of Forestry

There are two major groups of wood-boring beetles:

- Long-horned beetles (family Cerambycidae). Their larvae are called roundheaded wood borers (Figure 12, bottom). The western ash borer is in this family.
- Metallic wood borers (family Buprestidae). The larvae are called flatheaded wood borers (Figure 12, top). This family includes the emerald ash borer.

It's likely that other kinds of wood borers use Oregon ash, but documented evidence is lacking.

Bark beetles

The Oregon ash bark beetle, *Hylesinus (Leperisinus) oregonus* (Coleoptera: Curculionidae: Scolytinae) (Figure 13) is known to attack weak and declining Oregon ash. The closely related western ash bark beetle (*L. californicus*) may also occur on Oregon ash. The Oregon ash bark beetle leaves a characteristic gallery pattern under the bark. It feeds on the inner bark and slightly etches the outer sapwood (Figures 14A, 14B). The egg galleries are horizontal, and the larval galleries are perpendicular up and down from the egg gallery. *L. oregonus* is thought to have one generation per year.

Figure 13. Oregon ash bark beetle (*Leperisinus (Hylesinus) oregonus*) adult female.

Credit: T.H. Atkinson, Smithsonian Institution

Figure 14A. Ash bark beetle (*Hylesinus* (*Leperisinus*) species, possible *H. oreganus*) galleries on ash in the Willamette Valley. Note the horizontal lines; these are egg galleries made by the adults.

Credit: Amanda Rau, © Oregon State University

Figure 14B. Female ash bark beetles lay eggs in the horizontal galleries. The grubs, or larvae, make vertical lines as they mine up or down.

Credit: Wyatt Williams, Oregon Department of Forestry

Seed insects

Seed weevils (*Thysanocnemis (Lignyodes)* species) (Coleoptera: Curculionidae) are known to feed on ash seeds, although this is poorly studied. The weevil has a classic look with a distinct "snout." Adults are about 2.5–4 mm long (Figure 15). The females puncture young seeds and lay an egg in the wound. Small, white, legless larvae feed within the seed. In fall, the larvae leave the seed and pupate in the ground.

The weevils destroy up to 60% of Oregon ash seed. Weevils have been reared from Oregon ash in California, Oregon and Washington. Seed viability is often low in Oregon ash, according to Richard Sneizko of the U.S. Forest Service Dorena Genetics Resource Center. Sneizko has been collaborating with an Oregon ash seed collection project. He reports that only about 25% of Oregon ash seed is viable.

Figure 15. An ash seed weevil (*Lignyodes horridulus*). We don't know which species of weevil are most common in Oregon ash.

Credit: Chris Joll, bugguide.net

Foliage feeders

Lace bugs, aphids, plant bugs and a tree cricket (Table 1) are all known to feed on Oregon ash. The fall webworm, *Hyphantria cunea* (Lepidoptera: Erebidae), defoliates many hardwood species. This insect occurs throughout North America and is invasive in Europe. It is common on Oregon ash, cottonwood, madrone and other hardwoods along the Pacific coast. It rarely causes major problems for Oregon ash but may be common in some years. Fall webworms form a distinctive tent made of caterpillar webbing. These can become large and obvious in midsummer (Figure 16). The caterpillars are hairy and tend to feed within the tent, growing to about 30–35 mm long (Figure 17). They pupate in early fall. The adults are white moths with yellow markings on the underside.

Figure 16. Fall webworm tents in ash.

Credit: Beth Willhite

Figure 17. Fall webworm caterpillar in a late instar stage.

Credit: James B. Hanson, U.S. Forest Service

Figure 18. Oregon ash defoliated by an oak looper.

Credit: David Shaw, © Oregon State University

The western oak looper, *Lambdina fiscellaria somniaria* (Lepidoptera: Geometridae), is a cyclic defoliator of Oregon white oak. It has been observed defoliating Oregon ash forests in the Willamette Valley (Figure 18). One population of western oak looper persisted in defoliating ash stands for several seasons, even after defoliation in the oak had ceased. However, scientists say this insect is not a big threat to Oregon ash stands. The caterpillars are classic "inchworms" that feed on leaves (Figure 19) and hang from the tree on silken threads. The adult moth has a wingspan of 3.3 cm. Its angular wings are cream to light brown with fine brown stripes (Figure 20).

Figure 19. Western oak looper caterpillar, also known as an inchworm.

Credit: David Shaw, © Oregon State University

Figure 20. Western oak looper adult moth.

Credit: David Shaw, © Oregon State University

Micromoths (or microlepidoptera) are small moths with a wingspan of less than 20 mm, or 0.8 inch. The caterpillars are also very small. Outbreaks of a *Zelleria* species have been identified in the Coos Bay, Oregon, area. Richard Worth of the Oregon Department of Agriculture said those insects were probably *Z. pyri* (Lepidoptera: Yponomeutidae). The moths are difficult to identify (Figure 21). The caterpillars feed by skeletonizing or scraping the underside of the leaf, leaving distinct streaks of webbing (Figure 22).

Figure 21. *Zelleria* species of micromoth.

Credit: Richard Worth, Oregon Department of Agriculture

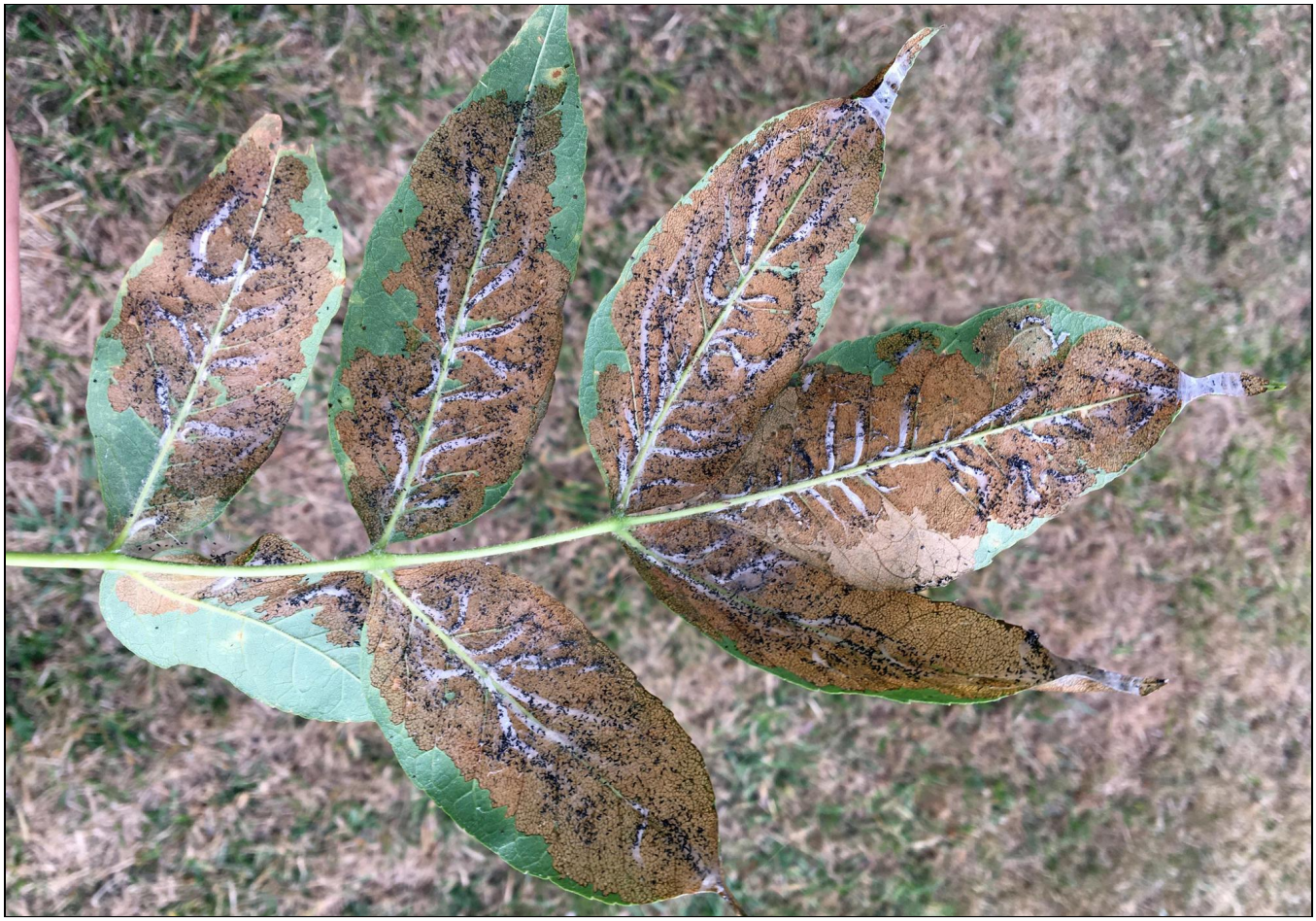

Figure 22. Feeding damage caused by *Zelleria* species. Note the underside of the leaf is scraped. The black dots are frass left after feeding, while the whitish streaks along the midribs are webbing.

Credit: Norma Kline, © Oregon State University

Pathogens

Many of the pathogens we know about on ash occur on non-native ash landscape trees. These pathogens are better known due to their importance in nurseries and landscape settings (Table 2).

Table 2. Pathogens of Oregon ash

This list may be biased toward horticultural ash.

Pathogen species	Plant part	Importance
Foliage disease — leaf spot, *Mycosphaerella effigurata*	Foliage	Important in late summer and fall foliage loss
Foliage disease — leaf spot, *Mycosphaerella fraxinicola*	Foliage	Important in late summer and fall foliage loss
Foliage disease — leaf spot, *Pseudocercosporella fraxini*	Foliage	Unknown
Foliage disease — leaf spot, *Marssonina fraxini*	Foliage	Unknown
Foliage disease — leaf spot, *Phyllosticta innumera*	Foliage	Unknown
Foliage disease — Anthracnose, *Plagiostoma fraxini*	Foliage	Common after wet spring weather, especially if rain persists into June (most common submission to the OSU Plant Clinic)
Powdery mildew, *Phyllactinia guttata*	Foliage	Unknown
Coin canker of ash, *Neofabraea vagabunda*	Main stem/trunk	May be more important in non-native landscape ash trees
Twig canker fungi, *Hysterographium fraxini*	Twigs, branches	Unknown
Twig canker fungi, *Cytospora ambiens*	Twigs, branches	Unknown
Twig canker fungi, *Nectria cinnabarina*	Twigs, branches	Unknown
Verticillium wilt, *Verticillium dahliae*	Roots, stem and branches	Most important in non-native landscape ash trees (commonly submitted to OSU Plant Clinic)
White mottled rot, ash heart rot, *Perenniporia fraxinophila*	Roots and butt, trunk heart rot	Reported as a heart rot of Oregon ash that attacks older trees and may cause extensive cull.

Pathogen species	Plant part	Importance
Ganoderma species	Trunk rot, possible root and butt rot	Observed on old Oregon ash stumps.
Phytophthora canker, *Phytophthora syringae*	Cankers can occur anywhere on the stem of young plants but primarily on lower stem and tree base.	Unknown; may be more important in landscape trees. Also a problem in bareroot nursery production.

From *Pacific Northwest Plant Disease Management Handbook* and reports from the OSU Plant Clinic, 1954–2017.

Additional observations from the OSU Plant Clinic 1954–2017, mostly from horticultural ash, include:

- Canker, *Fusarium lateritium*
- Canker, *Botryosphareria* species
- Canker and leaf spot, *Phomopisis* species
- Leaf spot, *Phleospora* species
- Leaf spot, *Cylindrosporium* species
- Bacterial blight, *Pseudomonas* species
- Root and butt rot (conk), *Phaeolus schweinitzii*

Dieback of ash in Europe caused by *Hymenoscyphus fraxineus*

A non-native, invasive canker disease caused by *Hymenoscyphus fraxineus* is damaging and killing ash trees in the plantations and woodlands of central Europe. The disease is not known in North America. It causes necrotic lesions on stems and branches. These lesions enlarge and form perennial cankers that can kill the tree. Young trees are particularly vulnerable. Scientists have found that Oregon ash is susceptible to this disease, if it were present in North America. It would be a significant threat if introduced.

Figure 23. Brown-looking Oregon ash plantation with severe leaf spot fungi in late summer.

Credit: David Shaw, © Oregon State University

Foliage pathogens

Foliage pathogens are common on Oregon ash and may cause defoliation in spring or late summer to early fall. Stands can look brown in early- to midfall, especially if rains occur in late summer (Figure 23). It appears these pathogens have little effect on growth.

Anthracnose is a common name applied to a group of related fungal diseases that can cause dark lesions on leaves. Scientists think *Plagiostoma fraxini* (Figure 24) causes the common foliage anthracnose disease of Oregon ash. It is associated with wet spring weather that persists into June and July. Spread stops in hot, dry weather. Leaves, petioles and twigs are infected. Young developing shoots and leaves are most susceptible, as the fungus overwinters on the blighted twigs and petioles. Small, water-soaked spots on young tissues coalesce rapidly in spring. Young lesions may be greenish brown to dark brown (Figure 25). Discrete brown or tan blotches develop on distorted leaves. If you look at affected tissue with a hand lens, you will see elliptical to round reproductive structures known as acervuli. Severe infections can cause some defoliation or dieback in the lower limbs. Most ashes are susceptible, but green ash is relatively resistant.

Figure 24. Necrotic (dead) spots on leaves are caused by *Plagiostoma fraxini* (ash anthracnose).

Credit: Jay W. Pscheidt, © Oregon State University

Figure 25. Ash anthracnose on Oregon ash. Note the discrete brown or tan blotches on distorted leaves.

Credit: Neil Bell, © Oregon State University

Leaf spots

Several fungi cause leaf spots on Oregon ash (Table 2). These can be associated with wet spring and early summer weather, or wet late summer and early fall weather. See the Pacific Northwest Plant Disease Management Handbook for more details about the suite of foliage disease fungi.

Perhaps the most important late summer/early fall foliage disease (leaf spot) of Oregon ash is *Mycosphaerella fraxinicola* (Figure 26), and the closely related species *M. effigurata*. *Mycosphaerella* causes brown spots with yellow borders. *M. fraxinicola* spots are 5–15 mm, while those caused by *M. effigurata* are smaller (3 mm). Numerous spots may coalesce into large necrotic areas (Figure 27a). Black-fruiting bodies can run together to form black crusts on the undersurface of the leaves (Figure 27b). The result of heavy infection is premature defoliation. In the Willamette Valley, leaf browning from *Mycoshaerella* may be particularly severe in late summer and fall, giving the ash forests a brown look (Figure 23).

Figure 26. Leaf spot of Oregon ash caused by *Mycosphaerella fraxinicola*.

Credit: © Oregon State University Plant Clinic

Figure 27A. Heavy infection and coalescing leaf spots on Oregon ash.

Credit: David Shaw, © Oregon State University

Figure 27B. Underside of *Mycosphaerella*-infected leaf (Figure 27A) with black fruiting bodies.

Credit: David Shaw, © Oregon State University

Figure 28. Leaves can turn brown in August due to foliage diseases.

Credit: David Shaw, © Oregon State University

Cankers

A canker is a localized dead area of bark. Several canker-causing fungi affect the twigs and branches of ash, but their occurrence on Oregon ash is poorly documented. Coin canker of ash, caused by *Neofabraea vagabunda*, may also

cause cankers on apple (bull's-eye rot and canker of apple). This fungi may be common in the Pacific Northwest. Cankers occur on the main stem or trunk of trees. Cankers are smooth, round, brownish yellow and range from 0.1 to 0.6 cm in diameter (Figure 29). On smaller trees, cankers will grow together in blotches. The margins on larger cankers are distinctly reddish and have cracked margins. Cankers are annual and will not individually girdle a tree. Once they coalesce and increase in number, the damage can be serious.

Figure 29. Coin canker of ash on horticultural species of ash. Cankers are smooth, round and brownish-yellow. They range from 0.5 to 1.5 inches in diameter.

Credit: Linnea Skoglund

Wilt

Verticillium wilt, caused by *Verticillium dahlia*, a soilborne fungus, is common in planted, horticultural varieties of ash. However, scientists don't know where this disease impacts native trees, or how important it is to Oregon ash.

In horticultural ash, the foliage turns light green and chlorotic, followed by leaf scorch and premature defoliation (Figure 30). Older leaves seem to defoliate first, and upper branches die back in a random or one-sided distribution. Unlike maple, there is no streaking discoloration of the wood in the limbs.

Figure 30. Symptoms of Verticillium wilt on white ash.

Credit: Rich Regan, © Oregon State University

Live wood decays

White mottled rot or ash heart rot, caused by *Perenniporia fraxinophila*, is thought to affect ash throughout North America. Although it is poorly described, it may be the most important decay of live Oregon ash.

Most information is from eastern North American ash trees. The fungus forms classic hoof-shaped conks. The conks are hard and woody and can range up to 40 cm across and 25 cm deep. The upper surface of the conks is dark (reddish-brown, gray-brown or black). The surface can become cracked and furrowed (Figure 31). The pore surface is white or brownish and does not bruise like a G*anoderma* conk.

Not all conks formed by white mottled rot are perfectly hoof-shaped, and the decay can sometimes appear as a folded-over edge above a spreading pore surface. It can also overlap conks. *P. fraxinophila* conks can appear anywhere on the tree trunk, and often high up on the trunk. The decay is a white rot that may be initially brownish with white spots. Later, the wood becomes straw-colored or white, soft and crumbly. It can cause significant white heart rot of live trees, especially of trees injured by breaking branches or sunburn. Conks may be single, or multiple conks can grow together. Reports say *P. fraxinophila* has caused extensive decay in Oregon ash.

Ganoderma species have also been found on old ash stumps, but formal reports are lacking (Figure 32).

Figure 31. Conk (spore-producing structure) of ash heart rot (*Perenniporia fraxinophila*) on eastern ash. These can occur anywhere along the trunk or in large branches of ash trees.

Credit: Steven Katovich, Bugwood.org

Figure 32. *Ganoderma applanatum* at the base of an oak tree.

Credit: Alan Kanaskie

Root rots

Scientists don't know much about root diseases of Oregon ash. The root rot fungus *Armillaria* may likely occur on Oregon ash, but the seasonal wetlands that ash often occupies may limit the ability of below-ground fungi to access the roots. *Ganoderma* species may be a root and butt rot of ash (Figure 33).

Phytophthoras

Phytophthoras are water molds and are not true fungi. They are poorly studied in Oregon ash. Phytophthora syringae is known to cause stem cankers on ash (Figure 34), but scientists don't know if it occurs in native Oregon ash stands.

Figure 34. Stem canker (dead bark) caused by *Phytophthora syringae* on a horticultural ash tree.

Credit: Rich Regan, © Oregon State University

Figure 33. Butt rot of Oregon ash, cause unknown.

Credit: Jay W. Pscheidt, © Oregon State University

Parasitic plants

Phoradendron macrophyllum (big-leaf mistletoe) parasitizes Oregon ash (Figure 35) in California, south of Redding. *P. villosum* (western oak mistletoe) may rarely parasitize Oregon ash in Oregon and California. Big-leaf mistletoe is a perennial shrub that attaches to the branch and connects to the sapwood and inner bark to get water and nutrients. If the tree has multiple infections, it can cause crown decline.

Figure 35. Big-leaf mistletoe on Oregon ash in California.

Credit: David Shaw, © Oregon State University

Figure 36. Red-breasted sapsucker and sap wells. The woodpecker creates sap wells by excavating small holes in the bark. These can be confused with EAB exit holes, but tend to occur in rows.

Credit: Greg Gilson, Macaulay Library, All About Birds

Animal damage

The most commonly observed animal damage to bark of Oregon ash is caused by a woodpecker — the red-breasted sapsucker (Figure 36). The sapsucker creates small excavations in the bark, called wells, to cause the tree to bleed into the wells. The woodpecker may eat the sap, or it may eat the insects attracted to the sap. The wells resemble exit holes of the emerald ash borer but usually occur in characteristic rows (Figure 37).

Deer and elk also browse Oregon ash, and birds and squirrels eat its seeds.

Figure 37. Red-breasted sapsucker sap wells in Oregon ash tree. The oval holes appear in a line. They are also larger than the D-shaped exit hole of EAB.

Credit: Jay W. Pscheidt, © Oregon State University

Abiotic factors

Abiotic factors such as herbicides, flooding, drought, frost and snow all impact ash (Table 3). But we have few documented descriptions of these impacts. Most of the *Fraxinus* species submissions to the OSU Plant Clinic from 1954 to 2017 were due to abiotic issues.

Anecdotal observations suggest that entire stands or parts of stands of Oregon ash can die due to changes in the water table or some other factor associated with flooding (Figures 39, 40). Although Oregon ash can tolerate a high water table and seasonal flooding, trees in standing water generally can't develop deep root systems. If the summer drought typical across the range of Oregon ash results in dry soils, these shallow root systems can't provide the water necessary to sustain foliage throughout the growing season. In addition, ice storms and heavy, wet snow can severely damage Oregon ash by breaking branches.

Figure 38. Oregon ash die-off associated with changes in the water table and flooding.

Credit: Jay W. Pscheidt, © Oregon State University

Figure 39. Dieback of Oregon ash associated with changes in the water table.

Credit: Wyatt Williams, Oregon Department of Forestry

Table 3. Abiotic factors that may affect ash

Factor	Plant part	Importance
Herbicides	Entire tree, foliage	Unknown
Flooding	Entire tree	Changes in the water table and excessive flooding can kill Oregon ash stands.
Drought	Whole tree, partial crown	Unknown
Ice or snow damage	Stem and top breakage	Anecdotal observations suggest that ice damage can be severe.
Sun or heat scorch	Foliage and twigs, bole	Unknown

Figure 40. Oregon ash in the Willamette Valley, Oregon.

Credit: Wyatt Williams, Oregon Department of Forestry

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Acknowledgments

Thanks to Christine Buhl, Wyatt Williams, Gabriela Ritokova, Erica Rudolph, Norma Kline, Richard Sniezko, Beth Willhite, Joey Hulbert and Gary Chastagner.

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