

Homeowner Guide to Managing Bronze Birch Borer

An insect killing birches in the PNW



Photo: Ian Kennedy, CC BY-NC 2.0

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Introduction

Birch trees in the PNW are dying from damage caused by a beetle that spends most of its life inside the tree. Often by the time beetle infestation is recognized, it is too late to save the tree. The purpose of this document is to assist homeowners in identifying damage from this beetle, the Bronze birch borer (BBB) and deciding how to handle it.

Identification

Bronze birch borer (*Agrilus anxius*) is a beetle in the Buprestidae family. It is olive to brown with a coppery metallic sheen. (Figure 1) Adult males are about a half-inch long, with females slightly larger. Males and females have slightly different head color. Larvae, the immature and most destructive form of the pest, are creamy white, about an inch long when fully developed and have a distinct flat head (Figure 2). Both larvae and adults are difficult to find. Signs and symptoms of BBB damage are easier to detect than the actual insects, which spend most of their lives inside the tree. Wilted leaves near the tree's top are often the first identifiable sign of BBB, followed by twig and branch dieback.

Life stages and damage

After hatching from eggs laid on the birch tree surface, BBB larvae bore into branches or the tree trunk. Larvae feed in the cambium layer of the tree. The cambium is between the bark and wood of the tree (Figure 3) and is the location of the tree's nutrient and water transport systems. Extensive feeding by BBB larvae disrupts the flow of water and nutrients in the tree. This feeding kills individual roots and branches and eventually the entire tree. Because it is inside the tree,



Photo: J.A. Davidson, Univ. Md, College Pk, Bugwood.org

Figure 1. Adult bronze birch borer

larval feeding damage can only be seen when the bark has been removed (Figure 4).

“Rumpled” or wrinkled-looking bark is one symptom of BBB infestation. It is caused by the bark separating from the wood where larvae have been feeding. Wrinkled bark is most often on the trunks of young trees. On large trees, look for wrinkled bark at large branch bases, where they meet the trunk, then outward away from it. (Figure 5) Wrinkled bark is sometimes accompanied by yellow to brown staining on the bark. BBB feeding at branch bases cuts off water and nutrients to the branch, causing the individual branch to die

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Figure 2. Bronze birch borer larva



Figure 3. Bronze birch borer pupa in tree cambria

back. Individual branch dieback is one sign that BBB is present. All of these symptoms of BBB can be difficult to see and might result from other tree health issues.

Larval development takes 1 to 2 years, depending on the climate (temperature, humidity, drought, etc.) and the length of the growing season. After growing to about one inch in length, larvae pupate inside the tree (Figure 3).

Adults emerge from the tree, leaving a hole in the tree like a sideways capital “D”. Adults feed on birch leaves. Because the adult stage only lasts a few weeks, little damage is caused by adult feeding. The D-shaped exit hole made by the adult emerging from the tree is a sign of BBB infestation (Figure 6); it is sometimes accompanied by brown bark staining. In mature trees, the D-shaped emergence holes are usually found in the top third of the tree, making them challenging to see from the base of a mature tree. The small holes often go undetected until canopy damage is obvious. While other signs like a dead branch or stained bark can be attributed to other causes, a D-shaped exit hole is a certain indicator of Buprestid beetles like BBB, indicating that feeding has been going on inside the tree for at least a year (two years identified in the Klamath Basin and other areas with short growing seasons).

What homeowners can do

Assessing damage levels

An illustrated scale can help assess tree damage levels and whether treatment is likely to help. The scale ranges from 1 (healthy tree) to 5 (dead/dying tree) (Figure 7). Trees can be preserved only if the damage is caught and treated early. Trees with level-1 to level-3 damage have a good chance of recovery. With level-4 damage saving the tree is unlikely, but possible under ideal (i.e, abundant water) conditions. A tree with level-5 damage is dead and needs to be removed. Landscape practitioners report that recovery is possible if treatment is applied while trees are actively growing and less than 40% of the tree canopy is affected. Once more than 50% of the tree canopy is affected, no treatments will save birch trees infested with BBB.

Cultural practices

Different birch species vary in susceptibility to BBB. For future plantings of birch in areas where BBB is present, select a resistant type. See the US Forest Service’s “Forest Insect & Disease Leaflet 111” <https://www.fs.usda.gov/foresthealth/docs/fjdl/FIDL-111-BronzeBirchBorer.pdf> for more detailed information on species susceptibility to BBB. Native birch species are the most resistant to this insect. Most susceptible species include Jacquemontii birch, White barked Himalayan birch (*Betula jacquemontii*) and European white weeping birch, (*B. pendula*), and ornamental cutleaf varieties of birch. In dry areas such as eastern Oregon, birch species are no longer recommended for most landscape uses.

The transport of firewood is one way BBB is moved to new locations. Purchasing locally sourced firewood can reduce the possibility of introducing BBB into a non-infested area. Burn infested wood locally.

BBB cannot kill healthy trees and is most likely to attack old, stressed, or drought-stricken trees. While watering mature trees is not a typical concern in rainy areas, adequate watering is a key strategy for preventing BBB damage in dry areas. Birch trees tend to be shallow-rooted and respond well to watering. Don’t prune birches when adults are likely to be active in your area. Adult beetles may be attracted to the tree by pruning stress and lay eggs. Adults are active for a few weeks in summer- the exact few weeks are dependent on the geographic area and the local temperature and precipitation over the course of spring. OSU provides a model (linked below) to predict adult activity. Either use the model or avoid pruning over the entire summer.

Removing trees too damaged to recover disrupts the BBB life cycle and can slow the spread of the pest. Removal is the only option for trees with level-5 damage. The success of your treatment plan may be affected by the actions or inactions of your neighbors regarding the control of this pest.

If you find that BBB is a problem in your landscape, proactive treatment is beneficial not only to your trees but also to trees in your neighborhood. Once an

Photo: Steven Katovich, USDA Forest Service, Bugwood.org



Figure 5. “Zig-zig” raised areas of bark are evidence of larval feeding

individual tree has been killed, adults will move to a new tree to lay eggs.

Chemical practices

Insecticides can be effective tools to control BBB. Effectiveness depends on timing and the amount of damage before treatment. Some products are only effective for 2-3 weeks of the year.

Depending on the application method and product, you may have to hire a licensed pesticide applicator. Tree injection products are only available to professional applicators. Read the pesticide label before purchasing a product to ensure it is intended for use on ornamental trees, including birch. Similar products with the same active ingredients but not formulated for trees could damage your tree further.

Carbaryl is a topical (contact) insecticide applied for this pest as a spray to the trunk and lower limbs of trees; it should be applied while BBB adults are active. Carbaryl and other contact products are only useful when they come into contact with BBB eggs and newly hatched larvae. These treatments must be precisely timed to adult emergence, typically a 2-3-week window that varies yearly due to weather and temperature fluctuation. To determine when adult emergence is most likely, a predictive model has been developed by OSU: https://uspest.org/dd/model_app?spp=bbb. Enter the parameters for your area in the model to determine when adults are most likely active. For instance, in Klamath Falls, OR, adult emergence is usually about the first week of July: a spray would be effective at that time. The contact spray approach is impractical for large, mature trees where surface coverage of the branches

and canopy isn't possible. Using a contact insecticide such as Carbaryl will only be effective during this short window of adult activity. Once eggs have hatched and larvae have burrowed under the bark, or any other time of year, these short-lived insecticides will not affect BBB. Contact insecticides can impact other insects. Carbaryl is highly toxic to bees: see the section on pollinator protection for more information.

Systemic insecticides, such as Imidacloprid or Dinotefuran, come in numerous forms and can be applied as a tree injection, soil injection or soil drench. When purchasing these products, use a systemic formula specifically for trees and shrubs. Formulas designed for spraying on leaves may have the same active ingredient but will not work for BBB. Systemic insecticides are absorbed by the tree and are expressed in the plant's tissues. Systemic pesticides affect only insects that ingest plant parts, like BBB feeding inside the tree. Always follow the label exactly.

Systemic insecticides effectively control larvae feeding inside the tree when: 1) adequate water is applied regularly throughout the growing season and 2) the tree is treated early in the infestation cycle. Adequate water helps move active chemical ingredients throughout the tree. For information on calculating a tree's water needs, this guide is helpful: https://ucanr.edu/sites/UrbanHort/Water_Use_of_Turfgrass_and_Landscape_Plant_Materials/Estimating_Water_Requirements_of_Landscape_Trees/. Because larvae can feed up to two years before damage is visible on the tree, insecticides are often applied too late, and the tree ultimately dies. If BBB presence is indicated by the decline of birches nearby, treatment of trees that appear healthy is worth considering, especially for large, mature trees that would be expensive to remove.

Proper timing of the systemic application is critical: apply early in the growing season. In Klamath Basin, for instance, systemic treatments are best applied May–July.



Figure 6. Exit hole made by adult bronze birch borer emerging from the tree

Photo: Robin Rosetta, © Oregon State University

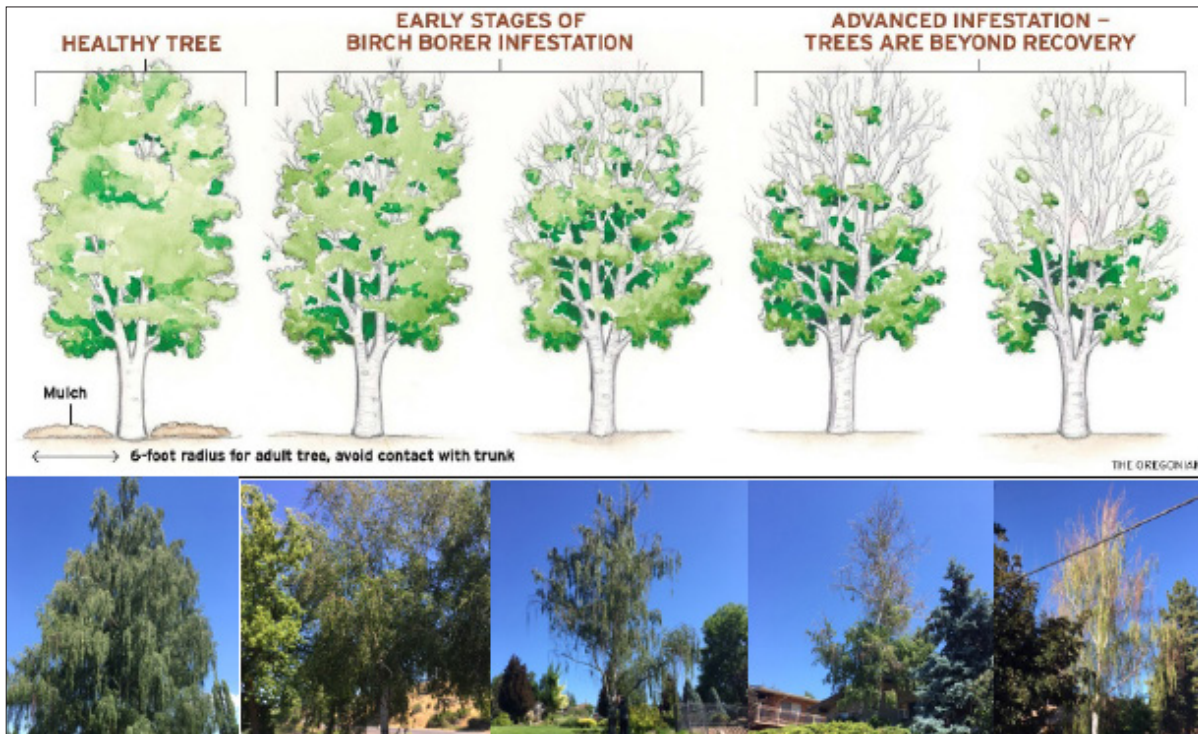


Figure 7. Scale of damage from bronze birch borer, ranging from a healthy tree (level-1 damage, on the left) to a tree that has to be removed (level-5 damage, on the right)

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BBB damage in mature trees is most apparent in late summer when affected branches are permanently wilted or lose leaves early. A late summer systemic treatment is far less effective than an early one because trees are approaching dormancy and aren't taking up water (or the insecticide in the soil) like when they are actively growing. A fall application of systemic insecticide to a tree approaching winter dormancy is practically useless.

Standard, commercial practice for BBB in European Birch (the birch species most affected in the Klamath Basin) is trunk injection of emamectin benzoate every three years, or trunk injection or soil drench of imidacloprid every year. Injections are performed by licensed pesticide applicators. Trees treated via injection should likewise be watered regularly — it takes multiple months for the product to be fully drawn into a large tree. In areas with no summer rains, watering is necessary to move the pesticide through the tree.

Notes on pollinator conservation

Carbaryl and Pyrethrin, two insecticides for surface treatment of limbs and bark of birch trees, are contact insecticides. These are harmful to beneficial insects like pollinators and the predators and parasitoids that eat other insects that we consider pests. Contact pesticides should not be used next to blooming plants where spray drift might contact flowers. These products break down quickly on leaves and trunks — precise timing of the application is crucial to any control of BBB.

Birch trees are wind pollinated. However, pollen from birch catkins may attract bees, and bees have been

observed visiting birch catkins (flowers). Best practice for systemic insecticides puts application only after flowering has occurred in the spring to reduce possible bee exposure. Also, do not apply systemic insecticides (spray, soil drench) when flowers attractive to bees bloom close by. Take these precautions to reduce the possibility of pollinators and other beneficial insects contacting the pesticide. Always follow pesticide label instructions. The label is the law.

It is not known at this time how much pesticide is found in birch pollen following the application of various systemic pesticides. Depending on the application timing, method and rate, imidacloprid and certain other pesticides may persist into the following year. Dinotefuran usually does not persist in trees as long as imidacloprid and may be less likely to be expressed in pollen the following spring. A potential benefit of the more expensive dinotefuran may be reduced longevity in the tree when contact with insects other than BBB is a concern.

BBB is a native insect that is increasing its range. Since about 2000, far more research on pesticide interactions and side effects has been conducted on the Emerald Ash Borer, a closely related Buprestid beetle recently detected in Oregon (<https://extension.oregonstate.edu/eab>). Emerald ash borer destroys ash trees in a manner very similar to BBB in birch. Those considering whether to use a pesticide or seeking to understand potential side effects may find this information on Emerald Ash Borer helpful; <https://extension.entm.purdue.edu/EAB/PDF/PotentialSideEffectsofEABInsecticidesFAQ.pdf>.

Upper Klamath Basin case study: BBB in Klamath Falls

Bronze birch borer was first detected in Oregon in 2003, appearing first in Portland and spreading in the years since. BBB was first detected in Klamath Falls in 2017 (six adult beetles were captured). The beetles have been present since at least 2015 because the larvae take two years to develop inside the tree.

In 2017, the BBB infestation was seemingly confined to two Klamath Falls neighborhoods. About 30% of trees in those two neighborhoods showed BBB damage. Trees in irrigated yards appeared healthier than trees that did not receive regular watering.

A vigorous campaign to inform residents about BBB was undertaken in 2017-18. Efforts included multiple newspaper articles, radio announcements, flyers, and a display in the county library. In 2019, a driving survey of birches was conducted. We found:

- 40% of the birch trees in the original affected neighborhoods had reached level 4 or 5 damage.
- In a third neighborhood, 75% of birch trees showed some level of BBB damage.
- Trees scattered throughout town were starting to show symptoms.

By summer 2022, a healthy birch tree in Klamath Falls was a rarity. More than 90% of trees throughout the city showed signs of BBB presence in an August 2022 driving survey (sample size = 312 birch trees). Using the rating system described in this document, we found:

- 91.64% of all birch trees showed some signs of BBB damage.
- 51.5% rated a 4 or 5, beyond saving.
- 37.4% of trees rated a 5, near or completely dead.

The spread of BBB in Klamath Falls has resulted in hundreds of inquiries to the County Extension

office regarding “sick” birch trees from Klamath County and beyond. Our experience has been that clients are often reluctant to treat for BBB, leading to tree death and client dissatisfaction. Discussions with clients and with professionals called upon to inject infested trees have identified the following factors that lead to delay in treatment for BBB:

- Inability to see the actual insect or exit hole that is absolute confirmation of BBB presence.
- Cost associated with the application of pesticide yearly or bi-yearly (and cost of needed water through the growing season in a drought).
- Concerns about the use of any pesticides.
- Concerns about neonicotinoids and their effects on beneficial insects.
- Most inquiries happen in August and September, when treatment is ineffective and must be delayed to the following spring.
- Clients unsure/ unwilling to ensure trees were watered regularly during the growing season (due to drought or watering restrictions).

In the five years since BBB was detected in Klamath Falls, a few clients have been successful in maintaining birch trees that still appear healthy with chemical treatments and regular watering (follow the guidelines above). More frequently, clients choose not to invest water and repeated chemical treatments in trees that are ill-suited for the Klamath Basin. European birches were a popular landscape choice in the area 50-60 years ago, when precipitation was perhaps more abundant. They are no longer a sustainable choice for landscape trees in the Klamath Basin due to drought, higher temperatures, and less available moisture.

While losing a valuable shade tree is difficult, removing the birch and replanting with a tree more appropriate for the climate is an increasingly popular choice in the Klamath Basin.

For more information

For more information or guidance on managing BBB in your area, contact the horticulture faculty in your local Extension office. Listed below are some useful publications.

OSU Extension publications

- Pacific Northwest Insect Management Handbook: <https://pnwhandbooks.org/insect/hort/landscape/hosts-pests-landscape-plants/birch-betula-bronze-birch-borer>
- How to Reduce Bee Poisoning from Pesticides: <https://catalog.extension.oregonstate.edu/sites/catalog/files/project/pdf/pnw591.pdf>

Additional resources

- US Forest Service Forest Insect & Disease Leaflet 111, Bronze Birch Borer: https://www.fs.usda.gov/Internet/FSE_DOCUMENTS/fsbdev2_043665.pdf
- OSU IPM Bronze Birch Borer Page: <https://agsci.oregonstate.edu/nurspest/insects/bronze-birch-borer>
- University of Minnesota Insect Page: <https://extension.umn.edu/tree-and-shrub-insects/metallic-wood-boring-beetles>

Use pesticides safely! Wear protective clothing and safety devices as recommended on the label. Bathe or shower after each use. Read the pesticide label—even if you’ve used the pesticide before. Follow closely the instructions on the label (and any other directions you have). Be cautious when you apply pesticides. Know your legal responsibility as a pesticide applicator. You may be liable for injury or damage resulting from pesticide use.

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Published March 2018, revised July 2023