

FIR ENGRAVER DAMAGE IN WESTERN WASHINGTON



The fir engraver beetle (*Scolytus ventralis*) (Figure 1) can cause significant damage and mortality to conifers in the *Abies* genus in western Washington. This small insect bores below the bark of trees (Figure 2) and feeds on the sugar-rich phloem. In the process, they also cause severe damage to the cambium, the tissue responsible for annual diameter growth. If enough beetles feed on the tree, they will eventually girdle its circumference, cutting off nutrient flow and causing the tree to die. In the lowlands and foothills of western Washington, the fir engraver highly prefers true firs like grand fir (*Abies grandis*) and noble fir (*Abies procera*) greater than four inches in diameter but can also attack Douglas-fir (*Pseudotsuga menziesii*) during outbreak conditions (Randall 2006).

While this beetle is capable of killing trees, in western Washington it behaves as a secondary agent. This means it typically can only establish itself in trees dealing with a preexisting stressor, such as drought or a root disease. In optimal conditions, trees can defend themselves from beetles by pitching, the process by which trees flush a thick resinous liquid through beetle entry holes in order to expel them. Sometimes, trees are also able to “close off” a wounded area in its interior tissues, preventing further damage from the beetle. When trees are under significant stress, they are less able to defend themselves. Because of this, severe drought conditions in western Washington often correlate with a spike in fir engraver beetle populations. Since climate models predict hotter, drier summers in the coastal northwest, fir engraver damage and mortality may become more commonplace in the years to come (Mote and Salathé 2009).

Life Cycle

The life cycle of the fir engraver starts beneath the bark of the tree. Adult beetles enter the tree, mate, and females go on to feed on the phloem in a single line, laying eggs in the excavated “egg gallery.” When a beetle successfully bores into a tree, it can emit a pheromone that attracts other fir engraver beetles, causing greater damage. Eggs hatch roughly two weeks after being laid, and larvae feed while forming larval galleries in lines



Figure 1. Adult fir engraver beetle (*Scolytus ventralis*). Photo: Donald Owen, California Department of Forestry and Fire Protection, Bugwood.org.



Figure 2. Trees can sometimes isolate beetles below bark to prevent further damage. (Photo: Patrick Shults.)

perpendicular to the egg gallery. Roughly a month later, pupation is complete, and larvae are able to emerge as adult beetles, which are typically four millimeters long and shiny black (Ferrell 1986). Each of these cycles is considered a generation. In a given summer, fir engraver beetles often have one and one-half generations, meaning in the second cycle beetles will overwinter as larvae and emerge as adults in the following spring or summer. Peak populations of flying adults often extend into July.

Symptoms and Signs

Symptoms of the fir engraver beetle are similar to most other bark beetles. The first step, however, is identifying the species of tree you are dealing with. Once you know you have damage on a true fir (*Abies*), look for the below symptoms:

- Pitching—One of the first signs of beetle damage you may see is pitching, which is the extirpation of beetles by flushing a sticky, resinous defense compound through holes in the bark created by beetles. This is not necessarily a bad sign. It means the tree is attempting to defend itself, possibly successfully.
- Boring holes and frass—Small holes in the bark (Figure 3) can indicate the entrance or exit of an adult beetle. However, not all holes in tree bark are made by bark beetles. Fir engraver holes are small, only two millimeters in diameter. In rough bark, they are often found in the crevices and can be difficult to see. You may also see red or cream-colored boring dust, also called frass, near the holes (Figure 4). The cream-colored boring dust means the beetles have successfully bored below the bark and into the phloem and cambium.
- Red foliage/sudden death—When fir engraver beetles cause the death of a tree, this leads to the foliage turning red rather suddenly. Occasionally, trees killed at the end of a summer will not flush red until the following spring as trees come out of dormancy and attempt to photosynthesize. Generally, by the time you are seeing this in a tree, all of the beetles have left, and it does not pose a risk of further bark beetle spread. These trees can be kept to provide valuable wildlife habitat, provided they do not pose a risk to structures.
- Egg galleries—Previously mentioned symptoms are indicators of multiple kinds of bark beetle. While identifying the species of tree can help determine whether or not you are dealing with fir engraver, the only way to be certain is to look below the bark at the egg galleries (Figure 5). The fir engraver is unique in that it has a horizontal egg gallery and vertical larval galleries, whereas many other beetles, like the Douglas-fir beetle (*Dendroctonus pseudotsugae*), have the opposite (Figure 6). The larval galleries are also arranged directly opposite of each other across the egg gallery, while Douglas-fir beetle larval galleries alternate.

Looking below the bark can be easily done on smaller trees with a hatchet. Older trees with thicker bark can be more difficult. It is best to choose a recently dead or infested living tree to look for egg galleries. Once a tree dies many

saprophytic insects (insects that feed on dead material) will move in, and it can be difficult to discern between the different insect damage.



Figure 3. Small boring holes are demonstrated. (Photo: Patrick Shults.)



Figure 4. Red boring dust can indicate the exit or entry of beetles. (Photo: Patrick Shults.)

Management

Often when people find out they have beetle damage, they want to turn to chemical treatments. However, once beetles have successfully infested a tree, insecticides are not going to be effective. Furthermore, treating multiple trees in a forest is not a practical solution.

There are, however, some silvicultural options for control. First, it is important to remember that fir engraver is native to western Washington and has evolved alongside these trees to be a secondary pest, meaning it only kills weak or stressed trees. In doing so, it serves an ecological function of reducing stand density while ultimately improving the tree species' gene pool. Because it is a secondary pest, beetle outbreaks in coastal Washington forests tend to be significantly less severe compared to interior forests of eastern Washington and Oregon, Colorado, Montana, etc. With that in mind, the first and greatest tool at a landowner's disposal to prevent bark beetle damage of any kind is maintaining vigorous tree growth. This means actively managing stand density to ensure trees have proper resources to

grow and avoiding overstocked conditions, which are very stressful for trees (Figure 7). To learn more about managing stand density, see the WSU Extension Forestry publication [Silviculture for Washington Family Forests](#) (Hanley and Baumgartner 2005). However, as climate change continues and Pacific Northwest summers become hotter and drier, it may result in greater damage from the fir engraver. In this scenario, some simple management methods can be effective at mitigating the damage.

Once fir engraver beetles are confirmed on your property, reducing the threat requires managing the food source, which is the fresh, defenseless interior tissue of the tree. For instance, recently downed or topped trees (e.g., damage from a windstorm) should be managed promptly. To avoid providing habitat for bark beetles, these trees can be cut into firewood lengths (12–18 inches) to allow the inner layers to dry out. Debarking the tree is the best way to ensure the interior dries but may not be feasible on a large scale. Left unmanaged, the interior tissue can serve as a food source for fir engraver for up to two springs, so this form of management is only effective within that window.



Figure 5. Looking below the bark of a tree may reveal signs of beetles that can be key to identifying the species responsible. (Photo: Patrick Shults.)

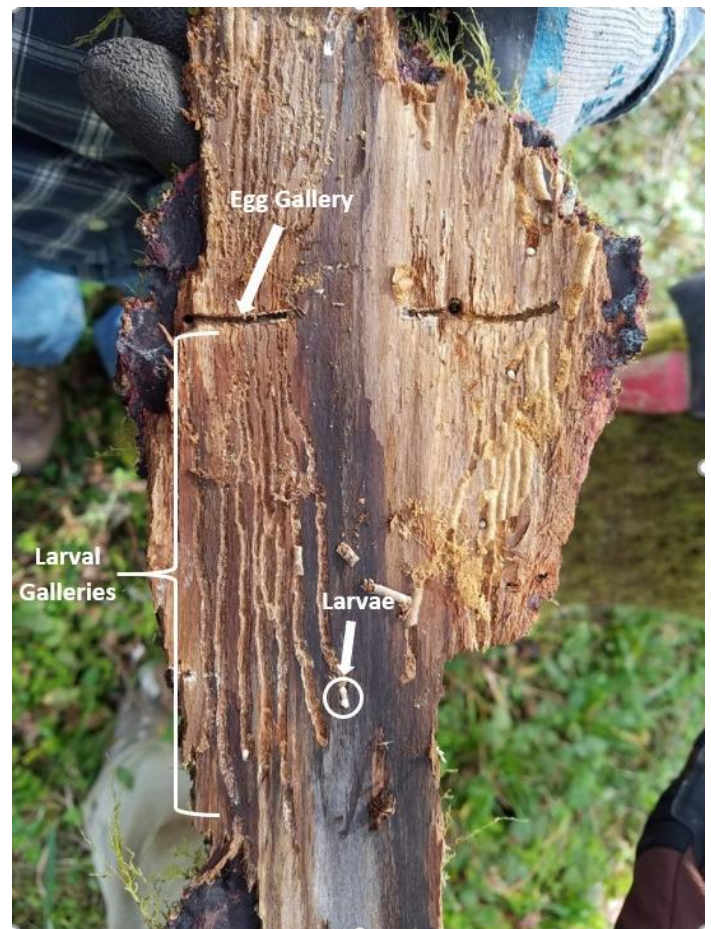


Figure 6. The fir engraver has a distinctive horizontal egg gallery. (Photo: Patrick Shults.)



Figure 7. Forests become overstocked when they have too many trees for the available resources like water, sunlight, and nutrients. Ensuring forest stands do not become overstocked can prevent many forest health issues, including bark beetles. (Photo: Patrick Shults.)

Infested living trees that are not successfully defending themselves should be felled and treated similarly. Determining whether a tree is successfully defending itself can be difficult but, generally speaking, if there are exit or entry holes with cream-colored boring dust or multiple (more than ten) pitch streams on the main bole of the tree, it is not likely to survive.

While actively removing the food source can help diminish fir engraver populations or reduce risk of establishment, you may only be able to reduce or slow damage with this method. Under optimal conditions, a fir engraver outbreak might result in around 5–15 dead trees at a given site. However, damage can be much greater following periods of drought. This is why ensuring trees are healthy and vigorous to start is critical. Removing dead and infested trees in a stand that is severely overstocked and facing significant drought stress will have minimal impact in the end. In this situation, an ounce of proactive stand management is worth a pound of cure.

It should be noted that actively managing fir engraver damage does not mean you should reduce the amount of susceptible species (*Abies* spp.) on your property in advance of seeing any symptoms. As previously mentioned, healthy firs can often weather fir engraver damage just fine. However, if you find that damage is widespread in your forest, managing away from the most affected species, noble and grand fir, may be a good idea. For instance, it would not be recommended to plant these species near a heavily damaged area, despite the fact that young trees (four-inch diameter or less) are typically not affected. Often these beetles are more problematic on sites with poor growing conditions to begin with, such as on excessively dry or shallow soils. As the climate continues to shift, we may find that noble and grand fir will no longer grow on these sites.

For more information or assistance with fir engraver damage on your property, reach out to your local Extension office to get in touch with your region's forester.

References

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