



Western Spruce Budworm

Forest Health Fact Sheet

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Western spruce budworm larva

Western spruce budworm (*Choristoneura freemani*) is the most destructive defoliator of conifers in central and northeastern Oregon. Major outbreaks can last for more than a decade and impact millions of acres of forests. The five types of tree damage associated with budworm defoliation are growth loss, top-kill, crown deformity, reduced seed production and tree mortality. Host trees that survive major budworm outbreaks in a weakened condition are often killed later by bark beetles. Despite the name, Western spruce budworm found in Oregon primarily feeds on Douglas-fir, western larch and also white, grand and subalpine firs.

Hosts

- Major: Douglas-fir; white, grand and subalpine fir; western larch
- Minor: Engelmann spruce, pacific silver fir, western and mountain hemlock and pines

Western spruce budworm occurs in much of western North America. There are a number of distinct species and subspecies within the *Choristoneura* genus, which also includes eastern budworm, that are distributed across parts of North America.



Ladd Livingston, Bugwood.org

Western spruce budworm adult

Biology

Adults are orange to gray-brown and wings are 1” wide with a conspicuous white dot on each forewing margin. Adults lay eggs in July and August. Larvae hatch from

eggs within a couple of weeks and seek shelter on trees to spin silk tents called ‘hibernacula’ to overwinter in. The following May - June, larvae emerge to feed on new needles and mine into buds. Shoots become stuck together with frass and silk and appear stunted or twisted. Larvae have 6 molts. Late-stage larvae have brown bodies with whitish spots and brownish heads that may have black patterns. Larvae pupate after about a month or more of feeding. Pupation occurs under a cover of silk and lasts less than 2 weeks.



Ken Gibson, USFS, Bugwood.org

Shoots stuck together with budworm silk and frass

Damage

Feeding causes branch tips to turn reddish-brown, and upper crowns become sparse as more and more needles are devoured. Missing needles on year-old shoots can indicate budworm-feeding activity during the previous

year. Larvae will consume older needles if new needles are not available, consumption of older foliage usually signals a declining budworm population.

It usually takes 3-5 years of defoliation to cause top kill, reduced radial growth or tree mortality. Smaller diameter hosts (5 - 8" dbh) and seedlings are more likely to suffer severe from damage. Near the end of a budworm outbreak, bark beetle infestations are common in larger trees weakened by defoliation.

Management

Natural

Ants and birds are the major predators of budworm larvae. Leaving woody debris on the ground for ants, and snags as nesting sites for birds, may increase predator abundance but these agents are insufficient to control large populations.

Silvicultural

Silvicultural practices that reduce budworm damage are best applied during the years between major outbreaks.

- Keep stocking levels of budworm host trees to <30% of the stand to reduce the intensity of damage from outbreaks. Stocking levels of budworm hosts seem to be a good indicator of how stands might be damaged during an outbreak, which is a strong argument for maintaining species diversity in stands.
- Convert stands back to pine or larch where fire suppression and logging practices have allowed Douglas-fir and true fir to become dominant. Although larch is considered a budworm host, it usually suffers little damage from defoliation because it loses its needles naturally each year.
- Do not thin stands during or immediately after an outbreak. There is no way to identify which trees will fully recover from defoliation and escape bark beetle attack. Also, opening up stands may reduce shade tolerant foliage, further weakening the remaining trees.
- Reduce number of canopy layers and crown closure to inhibit larval travel from tree to tree.

Predicting Defoliation

There are occasions when knowing the future course of stand defoliation will aid in management decisions. This is particularly true whenever an insecticide treatment is under consideration. Information on a system that relates the number of moths caught in pheromone baited traps to

Management highlights

- Retain ant and bird habitat for natural control (insufficient for large budworm populations)
- Reduce budworm host trees species to <30% of the stand, encourage stand species diversity
- Convert Douglas-fir and true fir-dominated stands back to pine and larch where appropriate
- Reduce canopy layers and crown closure to reduce ability of larvae to travel from tree to tree.
- Utilize pheromone-baited traps to predict future damage levels

stand defoliation the next year is available from Oregon Department of Forestry Forest Health.



Defoliation from western spruce budworm

William Ciesla, For. Health Mgt. Int., Bugwood.org

Insecticides

Insecticides are most effective in early summer when most budworm larvae are in the fourth instar (approximately 3/4" long). As a result of this late application timing, little foliage may be saved in the year of treatment. Large scale applications of insecticides proved ineffective during the last major budworm outbreak in Oregon, due to reinvasion from surrounding areas. Therefore, only small scale treatments over targeted areas are recommended, with the focus on retaining foliage until harvest or other stand management activities can be completed. Pesticides registered for use on western spruce budworm can be found in the [Pesticide Center Online \(PICOL\) database](#).

When using pesticides, always read and follow the label

More information:

Oregon Dept. of Forestry, Forest Health
<http://tinyurl.com/odf-foresthealth>
2600 State St. Bldg. D, Salem, OR 97310
503-945-7200

Other references:

USFS Forest Health Protection
www.fs.usda.gov/goto/fhp/fidls

OSU Forestry Extension
<http://extensionweb.forestry.oregonstate.edu/>