



UI Extension Forestry Information Series II

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Western Spruce Budworm

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Pests have long been the source of epidemic outbreaks of both insects and diseases of forest trees. Over the years the trees of North America have been besieged by white pine blister rust, gypsy moth, Dutch elm disease, chestnut blight, balsam woolly adelgid, and various bark beetles. Another pest that has long caused problems in Idaho and the western United States is the western spruce budworm (*Choristoneura occidentalis* Freeman).

Western spruce budworm (WSB) is native insect and is the most widely distributed and destructive forest defoliator in western North America. Susceptible tree species include Douglas-fir, true firs and spruces. Larvae will also feed on pines and other conifers when insect populations reach outbreak levels. Buds, current year foliage, and developing cones are fed on voraciously. Larvae initially feed on new needles throughout late spring and early summer causing a red-halo appearance on outer portions of infested branches.

Damage from defoliation can result in reduced vigor, growth loss, and increased susceptibility

to attack from other insects and diseases. Direct mortality from repeated and heavy defoliation rarely exceeds about five percent of large mature trees, and is typically confined to smaller, suppressed and pole-sized trees. Outbreaks of bud-



Western spruce budworm damage.
Larval feeding causes foliage to turn red.
Photo: by Tom Eckberg, Idaho Department of Lands.

worm can be prolonged, and defoliation can be more severe during periods of drought. Bark beetle attacks may be higher during periods of drought. Drier forests of Idaho such as the Salmon-Challis, Payette, and Boise National Forests are currently experiencing WSB outbreaks and associated Douglas-fir beetle mortality. The Coeur d'Alene National Forest is currently experiencing widespread, light defoliation.

Heavy budworm defoliation can also lead to increased fire risk over the short term and can impact the aesthetics of the forest, especially along scenic corridors and homes in and around forested areas. Although large numbers of trees with red needles can increase short term risk of wildfire, small tree mortality resulting from heavy budworm infestation can result in fire hazard over the long term.

WSB adults are normally small, mottled, rusty



Western spruce budworm adult.
Photo: University of Georgia archives.

brown moths, but color can vary from tan to almost black. WSB go through four distinct life cycles – egg, larva, pupa, and adult. After mating, females lay eggs on the undersides of needles. Eggs are oval shaped, consist of masses of 25-40 eggs that overlap like shingles, and typically hatch in about 10 days. Young larvae do not feed, but move to crevices under bark scales or lichens where they spin silky shelters termed hiberniculae. They remain dormant in the silken shelters until the following spring. In later spring (April to May, depending on temperature) the larvae will exit the hiberniculae and migrate to the foliage, where they begin to mine the old foliage or feed on host flowers. After a week or two, they will enter developing buds, hence the activity or process that gives them their name. As new needles lengthen, the rapidly growing larvae continue to feed. They will web the foliage together and feed inside this web. It is at this point that most damage occurs. After approximately 40 days of feeding, the larvae pupate inside the webs, with adults emerging about one week afterwards and the cycle is complete. There is only one generation per year.

WSB are important since they can eat all of the new growth produced by the host species. The new foliage/needles are the primary source of food, so the immediate effect of defoliation is a reduction in growth. To the landowner, the defoliation is mainly a loss in aesthetic value. If defoliation continues, more significant im-

pacts will follow, such as death of branch tips and terminals. Seed production can also be impacted, which in turn can reduce regeneration (we are currently seeing this in eastern Idaho). If the outbreak persists over multiple years, tree deformity, top kill, and tree mortality can occur. Non-fatal attacks, on the other hand, may predispose the trees to attack from bark beetles such as Douglas-fir beetle and fir engraver, which in turn, can lead to tree mortality.



Western spruce budworm larvae.
Photo: Tom Eckberg, Idaho Department of Lands.

WSB like stands that are dense, and dominated by host tree species that have been predisposed to stress conditions. Populations are generally kept low by a combination of predators, parasites, adverse climatic conditions, or inadequate food source. Spiders, insects, and birds are important, natural predators. However, silvicultural or management practices that thin forest stands, convert stands to non-host species, or limit host species to one size may help prevent serious damage. Multiple storied stands with host trees in the understory are especially vulnerable. In landscape situations (near homes), cultural practices such as fertilizing, thinning, or watering that promotes tree vigor can reduce susceptibility and aid the trees in surviving multiple attacks.

Chemical control over large areas may not be economically feasible, but can be used to protect high value trees from defoliation and associated

damage. The materials listed for chemical control in Idaho are carbaryl, cyfluthrin, and spinosad (several trade names). For proper application timing, always read and follow the recommendations on the label.

Another management control option is *Bacillus thuringiensis* (BT), a microbial insecticide which is registered for use against WSB. BT is a naturally occurring, relatively host specific pathogen that affects only the larvae of moths and butterflies. It can be used in sensitive areas along streams, lakes, and rivers.

Chemical or BT applications can be conducted from the ground or aerially for short term protection. Users should consult State or Federal Forest Health Specialists regarding formulations, dosage, and treatment timing.

Some observations suggest that historically, low intensity budworm outbreaks repeatedly thinned shade tolerant trees in the understory. In combination with more frequent surface fires, these less severe outbreaks probably reduced the likelihood of catastrophic, stand replacing fires or high intensity insect outbreaks. Decades of fire suppression and selective harvesting of non-host species may have modified forest conditions leading to more severe budworm outbreaks. Maintain-

ing a healthy forest is the best way to prevent or reduce WSB outbreak severity. Stands that have been thinned (reducing tree to tree competition) are generally healthier stands. Dense stands can lead to reduced resources for individual trees, and subsequent stress, which may ultimately lead to increased insect and disease outbreaks.

For more information on western spruce budworm, see page 106 at http://www.idl.idaho.gov/bureau/ForestAssist/insect_disease/InsectAndDiseaseFieldGuide.pdf

Or go to <http://www.fs.fed.us/r6/nr/fid/fidls/fidl-53.pdf> for Forest Insect and Disease Leaflets (FIDLs)

US Forest Service management recommendations can be found at: https://fs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb5186684.pdf.

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Swarm of western spruce budworm adults on cars in Salmon, ID, in 2006.
Photo: Tom Eckberg, Idaho Department of Lands.