



## THE BODWORMS ARE BACK!

Summary of a Western Spruce Budworm Presentation

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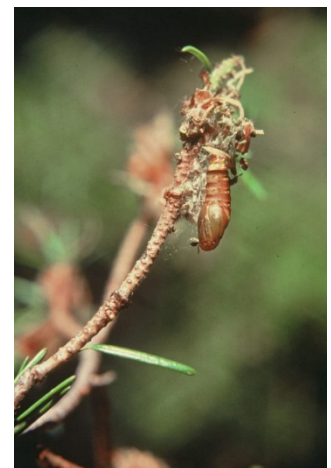
### INTRODUCTION

Western spruce budworms (*Choristoneura freemani*) are native insects that defoliate spruce and fir trees in Colorado. Trees impacted by a defoliator can look ragged, and heavy defoliation over an extended period of time reduces tree vigor, eventually causing branch and/or top dieback. This lack of vigor also makes a tree more inviting to bark beetles.

Despite their name, spruce budworms prefer to feed on Douglas-fir and white fir trees. Engelmann spruce and blue spruce are occasional hosts, however.

### LIFE CYCLE

Adult budworms are small, non-descript moths that are gray or brown in color. Most often, the moths emerge from pupal cases in July. They do not feed on host trees, but lay green egg masses on the underside of needles. The eggs hatch in about 10 days. Each tiny larva spins a *hibernacula* (cocoon) around itself and remains in a bark crevice or tucked into lichen on the tree until the following spring. In April or May, the larvae (caterpillars) become active and begin to feed by "mining" older needles or tunneling into closed buds and flowers. After the tree buds open, the larvae produce webbing to loosely hold the new needle tips together while feeding on the base of the needles inside this makeshift shelter. As new needles are consumed, the caterpillars rappel down from the tree on webbing they produce to reach more needles. If few new needles remain, the larvae transition to feeding on older needles. In July, the life cycle is repeated when the larvae pupate on branch tips amidst dying needles and twigs held together by webbing.



## VISUAL IMPACTS

Western spruce budworms can cause aesthetic impacts to large areas of forest. During an outbreak, partially consumed Douglas-fir needles turn reddish-brown, often with webbing visible among the needles. The trees can have a scorched look, with green needles remaining in the interior but branch tips farther from the trunk showing more discoloration.



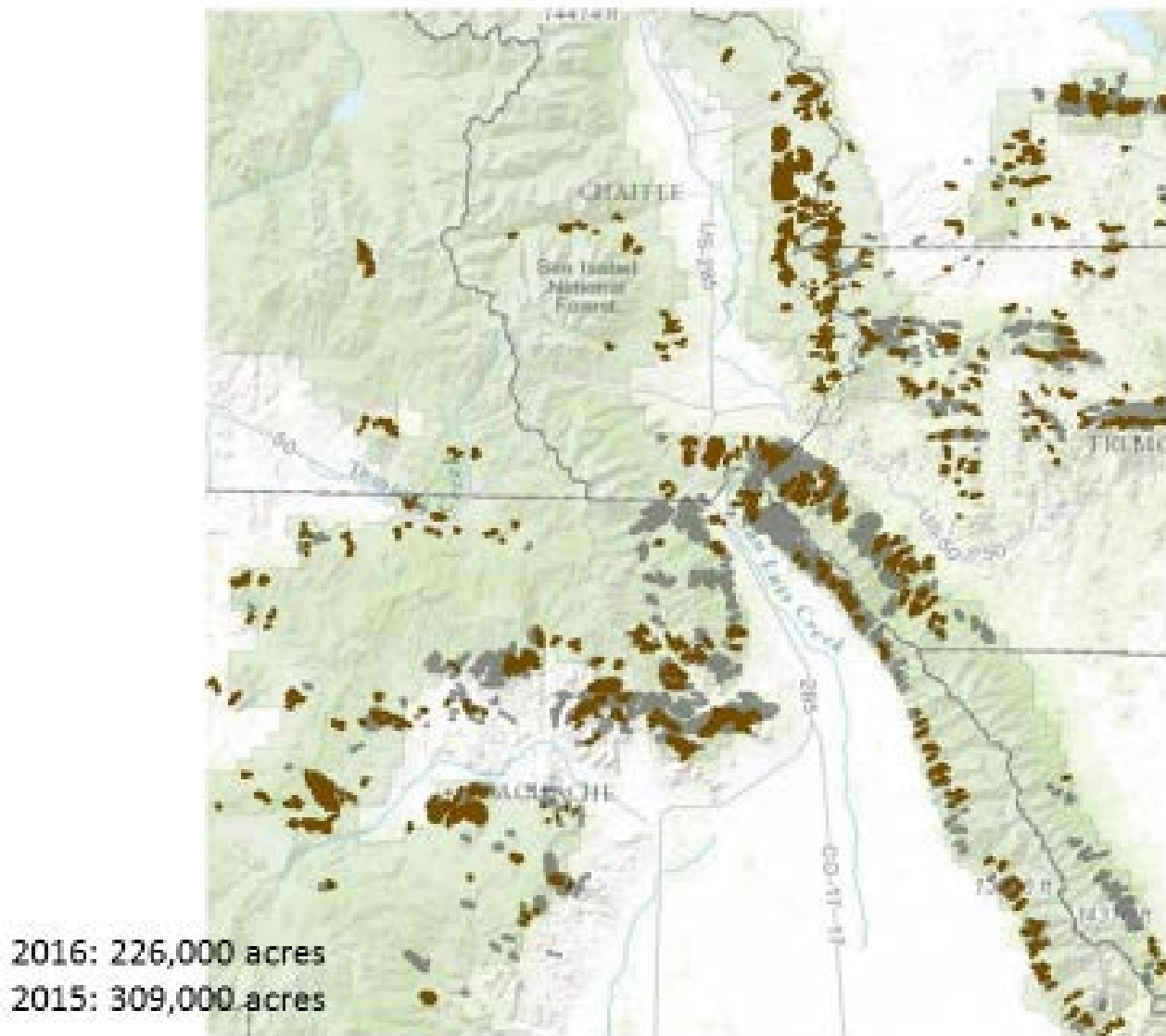
## TREE DECLINE

After multiple years of defoliation, a tree impacted by this insect will lose vigor, particularly if the surrounding forest is dense. Loss of vigor becomes visible when the foliage in the top of the tree thins, and after a few more years of infestation, the very top of the tree dies. If the budworm population remains high, the tree gradually dies from the top down. Also, if and when the dead portion of the tree exceeds the live portion, the tree will probably not recover and will succumb to bark beetles.

Bark beetle species that will take advantage of struggling trees include the Douglas-fir beetle (*Dendroctonus pinediscedens*), which prefers mature trees, and Douglas-fir pole beetle (*Pseudohylesinus nebulosus*) and Douglas-fir engraver beetle (*Scolytus unispinosus*), which will attack smaller-diameter trees.



## Western Spruce Budworm Defoliation - 2016



**Western spruce budworm impacts in south-central Colorado, 2015-2016.** Brown areas represent defoliation observed in 2016 aerial surveys; gray areas represent defoliation in 2015.

### **CONTROL STRATEGIES**

Because this is a native insect, nature does provide some natural controls of the population. Parasitizing wasps and flies may attack the eggs, larvae or pupa, and some birds eat larvae and adults. However, when the spruce budworm population blossoms, it takes some time for populations of these natural controls to correspondingly increase in numbers. Even then, the percentage of spruce budworms killed by predators is small. Weather can also take a toll on spruce budworm populations, such as during a late-spring freeze or due to high winds that dislodge and displace hibernacula.

The structure of the forest can work in favor or against western spruce budworms. Because the budworm's feeding strategy is to move down through the forest canopy, populations flourish in dense forests of Douglas-fir/white fir with variable tree heights. The budworm prefers the older trees, but eventually drops down into the younger trees growing underneath.

A less-hospitable environment for western spruce budworm is an open forest setting, where tree crowns do not touch and the height of the tree canopy is fairly uniform. The less Douglas-fir/white fir understory available between the ground and the top of the tallest trees, the more likely the budworm larvae will drop all the way to the ground and have a more arduous journey back up into the trees.

This preference for dense, unbroken forest presents an opportunity to control populations of western spruce budworm by thinning forests and removing some of the trees. A good rule of thumb for ideal tree spacing is to multiply tree diameter in inches by 1.5 to determine the desired number of feet between tree trunks. (Thus a 12-inch diameter tree should be at least 18 feet away from the trunk of the nearest tree.)

Spruce budworms do not feed on pine trees (i.e., lodgepole, ponderosa, bristlecone, limber, pinyon) or aspen trees, so having a variety of tree species in the forest also makes a positive difference in controlling spruce budworm populations.

### **OTHER CONTROL EFFORTS**

Western spruce budworm is a native insect in Colorado and therefore has “been in business” for a very long time. Douglas-fir and white fir are still a part of the native forest, so a spruce budworm outbreak is not the end of the world. On the other hand, watching these defoliators feed on trees for multiple years can be hard to watch, particularly if it’s happening in your own yard.

Use of a control product (i.e., insecticide sprays) may be warranted after 3-4 consecutive years of significant defoliation of high-value trees. Significant defoliation means the budworms are feeding on the new growth **and** older needles of a tree. The reason it is wise to wait so long to spray is that anything used to kill the budworm will also kill other insects that are considered beneficial. Over-spraying also can lead to different insect problems in the future.

Consider this: To effectively control spruce budworms feeding on a tree, nearly all the foliage needs to be covered with the insecticide. But broadly spraying to achieve this means much of the spray also is going somewhere other than on needles, and contacting more than just spruce budworms. If there’s any breeze, the product will be carried elsewhere. Note that most products used for this budworm also cannot safely be used near lakes, streams and other bodies of water.

**With insecticide treatments, timing is everything.** The products require direct contact with the caterpillars, so the time to spray is just after the bud caps come off the tree tips and the new tips and needles begin to expand. Depending on elevation and aspect, this generally occurs in Colorado during the first half of May, and the opportune time to spray lasts about two weeks. **If you miss this window, you are wasting your time and money and mostly killing non-target insects.**

Read the labels on insecticides carefully before purchasing and applying them, to learn where and how to use the product and what insects and other creatures the product kills.

## Products for Ground-Based Application

### Permethrin (e.g., Astro, Onyx)

- Attacks the neurological system of insects, paralyzing them on contact or through ingestion.
- Breaks down relatively quickly in the environment when exposed to UV light; must be applied annually for effective treatment.
- Highly toxic to bees, fish and aquatic invertebrates during the application process. Impacts a broad range of insects in addition to Douglas-fir tussock moth or other *Lepidoptera* species (butterflies and moths).
- At least 24 hours without precipitation is necessary after application to allow the product to adhere to foliage and not run into surface water/drainage systems.

### Carbaryl (e.g., Sevin, Sevinmol)

- Neurotoxin that kills insects through ingestion or on contact.
- Persists in the environment longer than permethrin, being less affected by UV light.
- Extremely toxic to aquatic organisms and bees; water sources and blooming plants must be protected when applying this pesticide.
- Impacts a broad range of insects besides Douglas-fir tussock moth or other *Lepidoptera* species.
- May leave a white residue on applied surfaces.
- At least 24 hours without precipitation is necessary after application to allow the product to adhere to foliage and not run into surface water/drainage systems.

### *Bacillus thuringiensis* var. *kurstaki* (e.g., Dipel, Foray)

- Bacterium that kills caterpillars shortly after ingestion by rupturing internal organs.
- Most effective when timed with early caterpillar stages.
- Persists in the environment only for a few days to a week, so applying while larvae are small and feeding is important to ensure effectiveness; a second application may be necessary, depending pest population levels.
- Specific to *Lepidoptera* species, therefore non-target species impacted by this insecticide will be limited to *Lepidoptera*.

### Tebufenozide (e.g., Confirm, Mimic)

- Insect growth regulator that specifically targets the caterpillars of butterflies and moths and induces premature molting once ingested, causing death shortly thereafter. Will cause death to non-target butterfly and moth species.
- Persists in the environment longer than biological insecticides (i.e., Btk), which may increase efficacy.
- Application timing should target small caterpillars, early in the season.
- At least six precipitation-free hours necessary after application to allow the product to adhere to foliage.
- Toxic to aquatic invertebrates, and has a potential via runoff or drift to enter surface water supplies for months after application.

Note: All photos and figures in this synopsis were part of Dr. West's presentation.

The CSFS Quick Guide to Western Spruce Budworm can be found online at:

[http://csfs.colostate.edu/media/sites/22/2014/02/Western\\_Spruce\\_Budworm\\_QG\\_10May2016.pdf](http://csfs.colostate.edu/media/sites/22/2014/02/Western_Spruce_Budworm_QG_10May2016.pdf)