



## Signs of Western Spruce Budworm Damage

Western spruce budworm (WSBW) consumes the needles of Douglas-fir, grand fir, pacific silver fir, and Engelmann spruce and to a lesser extent other tree species as well. WSBW larvae feed primarily on new foliage during May and June. By July, a browning of the needles and sparse foliage, especially in the upper portions of the canopy, is observable.



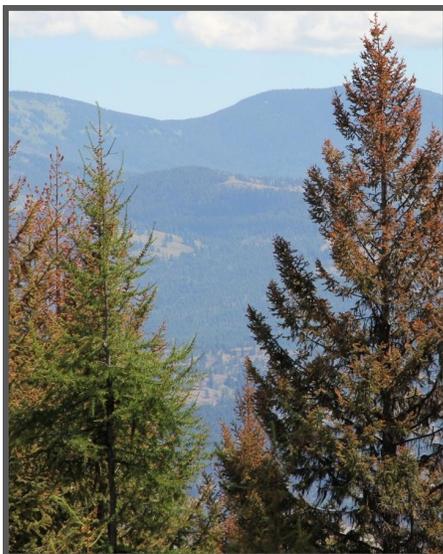
Browning of foliage in the upper canopy caused by western spruce budworm defoliation.



Budworm larvae feeding on needles.



Douglas-fir saplings defoliated for two years by the western spruce budworm



Characteristic browning of needles caused by budworm defoliation.

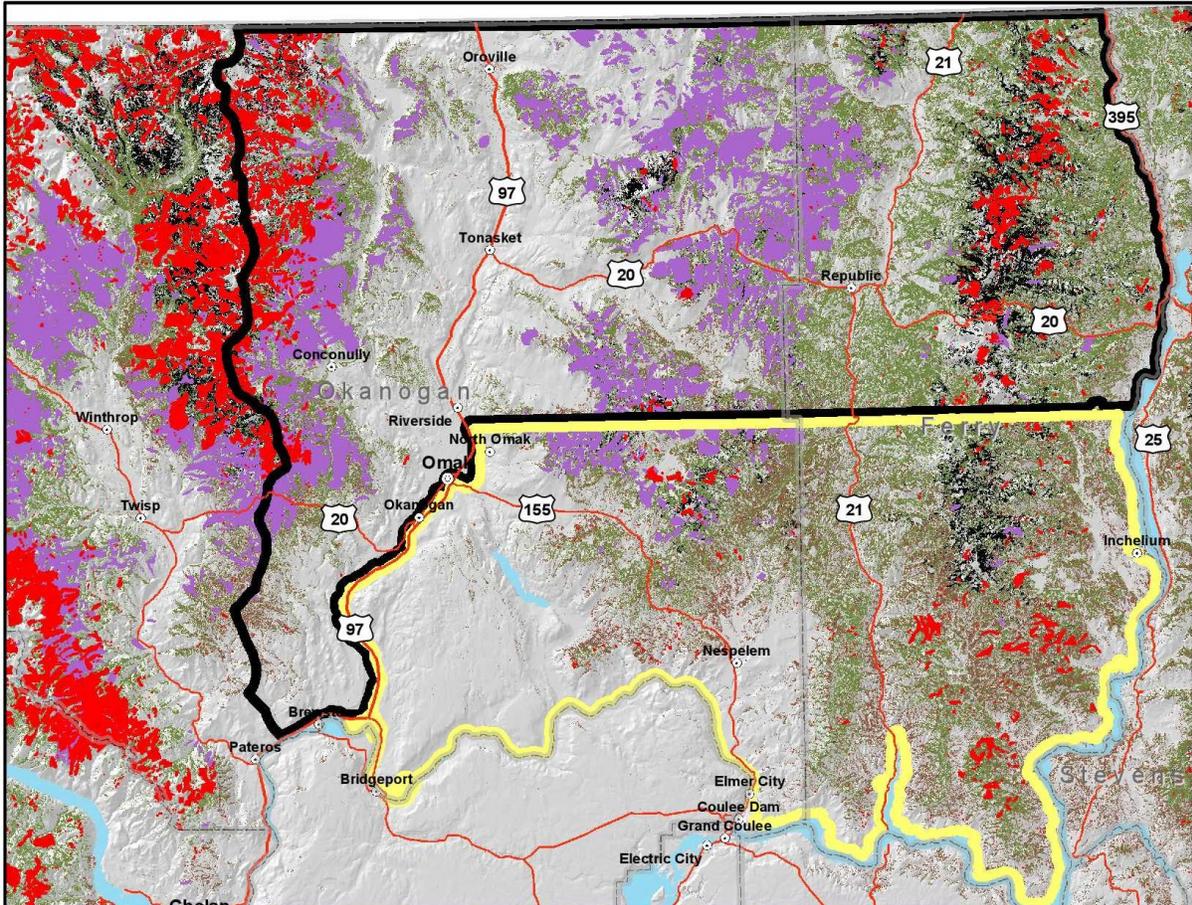
Damage is particularly severe on young fir trees less than 20 feet tall. After three or more years of defoliation, there is usually extensive top-kill as well as mortality in young trees. Damage in mature trees, those greater than 12 inches in diameter, is usually limited to decreased growth and some top-kill. If defoliation lasts for more than five years, there can be significant mortality of mature trees, either from the budworm itself or secondary pests such as the Douglas-fir beetle.



Close-up budworm damage to Douglas-fir tree foliage.

## Map of Western Spruce Budworm Outbreak in Ferry and Okanogan Counties

Currently (summer of 2012), there is a large western spruce budworm outbreak occurring in Okanogan and Ferry counties. Landowners within the Forest Health Hazard Warning area for Okanogan and Ferry counties that have host tree species present on their property are most likely experiencing some level of defoliation from western spruce budworm. The outbreak has lasted for two to three years in portions of eastern Okanogan County and western Ferry County. The outbreak is expected to continue for several more years in portions of both counties. Extent of recent defoliation is in purple on the map below.

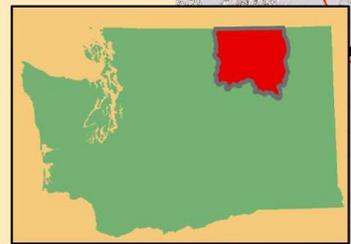


### Recent Forest Damage in the Forest Health Hazard Warning Area

-  DNR Forest Health Hazard Warning Area Boundary
-  Joint DNR/Colville Tribal Forest Health Hazard Warning Area Boundary
-  Pine bark beetle mortality 2006 - 2010
-  Western spruce budworm defoliation 2007 - 2011
-  Ponderosa pine suitable host areas for bark beetles
-  Lodgepole pine suitable host areas for bark beetles
-  Suitable host areas for western spruce budworm
-  County Boundaries



0 5 10 20 Miles



WASHINGTON STATE DEPARTMENT OF  
**Natural Resources**  
Peter Goldmark - Commissioner of Public Lands

#### Data sources:

Suitable host area for WSBW created from a query of GNN layer m1\_spsz00; downloaded from LEMMA.  
Query of GNN layer based on the following attributes:  
-FIR\_BA\_PCT >= 40% (ABGR, ABLA and PSME)  
-JMAP\_LAYERS >= 2  
-BAA\_GE\_3 >= 11.14 sq m (120 sq ft)  
Suitable host area for pine bark beetles created from GNN layer m1\_spsz00; downloaded from LEMMA.  
-Lodgepole or ponderosa pine comprised 30% or more of total stand basal area.  
-Quadratic mean diameter of 8 inches or greater.  
-Total stand basal area of 120 square feet or greater.

Pine bark beetle mortality represents areas where five trees per acre or greater were observed dead from 2006-2010.

Budworm defoliation represents areas with at least one year of defoliation from 2007 to 2011.

US Forest Service and WA DNR Aerial Insect and Disease Survey.



## Signs of Ponderosa Pine Bark Beetle Damage



Western pine bark beetle, about the size of a grain of rice. Pest and Diseases Image Library, Bugwood.org.

### Pitch Tubes and Frass

The first notable sign of bark beetles in your forest are pitch tubes,  $\frac{1}{4}$  to  $\frac{1}{2}$  inch in diameter, formed around entry holes made by attacking female beetles. Relatively few, widely scattered white pitch tubes, 1 inch or larger in diameter, usually indicate that the trees were healthy enough to resist the attack. Small, reddish-brown pitch tubes and dry, reddish brown boring dust in the bark crevices usually indicates that the attack was successful.

Frass, which is the boring dust that looks like sawdust and is created by the beetles as they bore into the tree, can be found at the base of the tree and in bark crevices and is a sign that bark beetles are active in your forest.



Frass at the base of the tree. Ryan Ludlow, BoulderCounty.org

Ponderosa pine is the most common pine tree found on private forestlands in eastern Washington. There are three major bark beetles that attack ponderosa pine: mountain pine beetle, western pine beetle and *Ips pini* (pine engraver). These bark beetles feed in the phloem and inner bark of the tree and they also promote the spread of a fungus which blocks the conductive vessels that move water in the tree.

These bark beetles are native insects and are usually present at low levels in most forests where ponderosa pine are present. Healthy trees can resist attacks when bark beetle populations are low by producing pitch that thwarts the beetle attack. Trees are susceptible to bark beetles when they are stressed, damaged or weakened. Drought and/or dense forest stand conditions can weaken trees so that normally healthy trees cannot produce enough pitch to resist the bark beetles.



Tree with multiple pitch tubes. Ryan Ludlow, BoulderCounty.org



Frass caught in bark crevice. Ryan Ludlow, BoulderCounty.org



Small pitch tubes on the bark of ponderosa pine indicate points of western pine beetle attack. Kenneth E. Gibson, USDA Forest Service, Bugwood.org.



## Signs of Ponderosa Pine Bark Beetle Damage

### Woodpecker Flaked Bark

Another sign of bark beetle infestation in your forest is woodpecker activity on ponderosa pine. Woodpeckers flake off the outer layer of bark exposing the bright orange inner bark as they search and feed on bark beetle larvae.



Woodpecker flaked bark, exposing the orange inner bark, on a ponderosa pine.

### Fading Needles

Needles on successfully attacked trees begin to change color, known as fading, several months up to a year after the initial beetle infestation. The needles will first fade to a pale green, then to yellow, and, finally, the foliage may turn red brown.



Bark beetle attacked ponderosa pine with faded needles.



Western pine beetle galleries under the bark. Ladd Livingston, Idaho Department of Lands, Bugwood.org.