



Douglas-fir tussock moth (*Orgyia pseudotsugata*): Outbreak status of a conifer defoliating caterpillar

Importance. The Douglas-fir tussock moth (DFTM) is a defoliating caterpillar that can severely damage Douglas-fir, true fir, and spruce trees in the western United States. In eastern Washington, outbreaks are cyclical and may cause top kill, growth loss, and may kill up to 40% of host trees in an infested stand. Hairs from the caterpillars and cocoons can cause an allergic reaction in some people.

Hosts. Douglas-fir, grand fir, Engelmann spruce, and sub-alpine fir in forest environments. Blue spruce in ornamental plantings may also be defoliated. Ponderosa pine and western larch may be damaged, but are not likely to die from DFTM damage.

Impacts. In a severe outbreak, as much as 40% of host trees in a stand may be killed. Surviving trees may have top-kill and suffer growth loss. The trees most vulnerable to mortality are those with the least foliage, such as young trees and those growing in dense stands (Fig. 1). Defoliated trees are more susceptible to mortality from bark beetle attacks. The hairs of DFTM caterpillars are skin irritants to many people, which can limit use of and access to forested areas during severe outbreaks. The last outbreak in Washington occurred during 2000 to 2002, leaving more than 45,000 acres defoliated. Over 800,000 acres were affected by a huge outbreak in Washington, Oregon and Idaho in the early 1970s.



Figure 1. Top down defoliation damage caused by Douglas-fir tussock moth. *Photo: William M. Ciesla, Forest Health Management International.*

Monitoring. The USDA Forest Service (USFS) and Washington Department of Natural Resources (DNR) conduct annual monitoring of DFTM activity in Washington State using a combination of aerial survey, ground surveys and a network of 260 “Early Warning System” pheromone-baited trap locations on federal, state and private land. When the number of moths caught in traps increases significantly, the DNR conducts ground surveys near trap locations to identify specific areas at risk of defoliation. The annual aerial survey for detection of insect and disease activity also records acres and severity of DFTM defoliation seen from the air.

Current DFTM status.

Spokane County and north Idaho: Pheromone monitoring traps in eastern Spokane County indicated increasing DFTM populations in 2008 which have remained high through 2011. In the summer of 2011, the Idaho State Department of Lands (IDL) aerial survey mapped approximately 68,000 acres with defoliation in Kootenai, Benewah and Latah Counties in Idaho; a significant increase from the 8,500 acres mapped in 2010. The USFS and Washington DNR cooperative aerial survey recorded just over 1,600 acres with defoliation in eastern Spokane County; an increase from 570 acres in 2010 (Fig. 2). In Washington, damage has primarily affected grand fir and Douglas-fir on Mica Peak, Tekoa Mountain and Gelbert Mountain. Defoliation has been moderate, with more heavy defoliation in the upper third of tree crowns. Low numbers of new egg masses and evidence of virus-killed caterpillars suggest the outbreak in Spokane County is collapsing and there isn’t likely to be much more defoliation in 2012. In spring 2012, an analysis of egg masses collected throughout the affected areas in both states will be used to identify locations where there may be enough virus to cause a collapse of the caterpillar population.

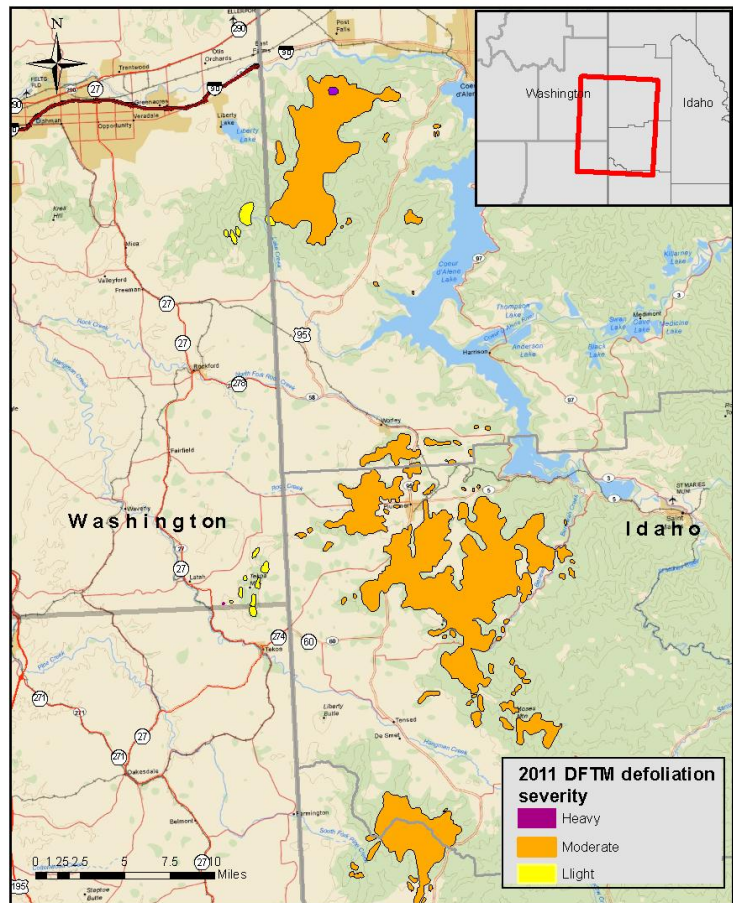


Figure 2. 2011 Douglas-fir tussock moth activity in Spokane County (WA) and Kootenai, Benewah and Latah Counties (ID). Map: Aleksandar Dozic, Washington DNR.

Concerned landowners near the affected areas should look for DFTM egg masses on branches and structures during fall and winter 2011-2012. The amount of egg masses may indicate an increase or decrease in DFTM populations.

Blue Mountains:

In 2011, approximately 7,800 acres of new DFTM defoliation was mapped in the Umatilla National Forest in the Blue Mountains of Washington and an additional 1,200 acres in northeast Oregon (Fig. 3). In 2010 a very small area of light defoliation was noted by USFS entomologists. Defoliation primarily affected grand fir, subalpine fir and to a lesser extent Douglas-fir and spruce in the wilderness area in Columbia and

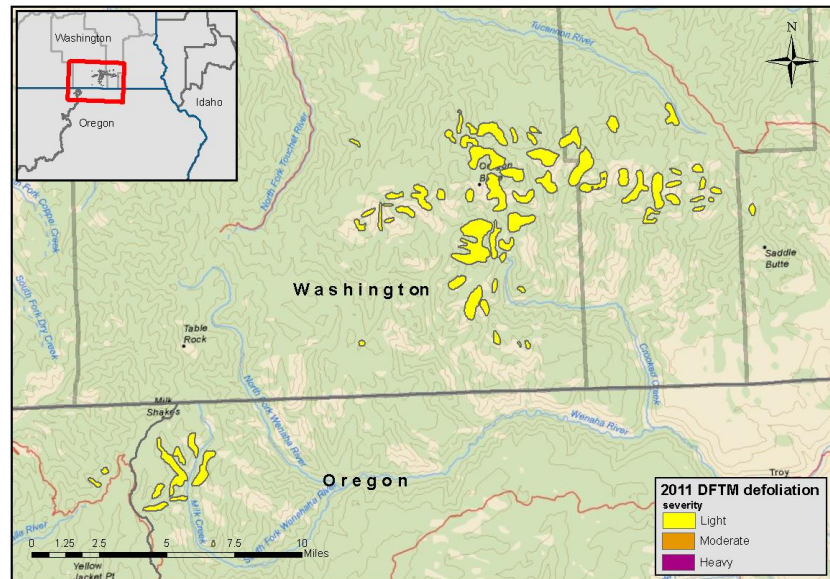


Figure 3. 2011 Douglas-fir tussock moth activity in Columbia and Garfield Counties (WA) and northeast Oregon. *Map: Aleksandar Dozic, Washington DNR.*

Garfield Counties. Damage is typically light, with the top third of the crown most heavily defoliated. Defoliation may expand in area and intensity in 2012.

Okanogan County: No DFTM defoliation was recorded in Okanogan County in 2011. The 2008-2010 outbreak in Okanogan County peaked in 2009, when more than 3,500 acres had defoliation, primarily east and west of Oroville near the British Columbia border. In 2010, the affected area decreased to approximately 650 acres including small areas of new defoliation in the Methow Valley. In summer 2010, a DFTM suppression project was conducted using a naturally occurring virus (TM Biocontrol) on 13,000 acres of Forest Service land in the Methow Valley area. Also, 965 acres of private land in the upper Methow Valley were aerially sprayed with the bacterial insecticide Btk, *Bacillus thuringiensis* var. *kurstaki* (Foray 48B). The number of adult moths collected in DFTM monitoring traps throughout Okanogan County returned to normal levels in 2010 and remains low.

Signs and symptoms to look for. DFTM egg masses can be found on the underside of branches and on structures through the winter. Egg masses are about one inch across, round, grey, hairy, with white eggs (Fig. 4). Mature caterpillars with distinctive tight tufts of hair, called “tussocks,” can be seen from June through early August (Fig. 5). The cocoons are about one inch long, tan, and felt-like (Fig. 6). They can be seen throughout the year on branches and structures, but only contain live pupae in July and August.

Adult male DFTM are brownish grey with feathery antennae and a wingspan of about 1 ¼ inches. Female adults are grey to brown, about ¾ inch long with a wide abdomen, and are flightless, so wings are not noticeable (Fig. 4).

Caterpillars feed on both new and old foliage and defoliation can be most severe in the top crown (Fig. 1). Sometimes webbing can be seen in the tops of tussock moth infested trees. Feeding by DFTM in June and July may completely remove needles from branches or may cause new foliage to turn brown. This damage can be confused with defoliation caused by the western spruce budworm. Defoliated ornamental spruce trees in non-forested areas are known as “sentinel trees” because their damage often precedes forest defoliation. There is no direct, predictable relationship between the location of sentinel trees and locations where forest areas will be defoliated.

Life cycle. DFTM completes one generation per year. In late May or early June, eggs hatch shortly after host trees flush new needles in spring. New caterpillars spin silk webbing and can disperse by wind. This webbing can



Figure 4. Adult female Douglas-fir tussock moth (left) and egg mass (right) on Douglas-fir. *Photo: Glenn Kohler, Washington*



Figure 5. Mature Douglas-fir tussock moth caterpillar on grand fir. *Photo: Glenn Kohler, Washington DNR.*



Figure 6. Douglas-fir tussock moth cocoon. *Photo: Glenn Kohler, Washington DNR.*

sometimes be seen in the tops of trees. Caterpillars begin by feeding on new needles, turning them brown, and then they feed on older needles. When mature in late July or early August, caterpillars will spin a tan cocoon of silk mixed with body hairs attached to the underside of branches or on nearby structures. In late July through November, adults emerge and mate. The females are flightless and cling to their cocoons where they deposit pearly-white eggs in a grey mass of body hairs bonded together with saliva. The eggs overwinter attached to the cocoon.

Infestation cycle.

DFTM populations are normally kept low by natural controls that include disease, predators, food supply, and weather. Periodically, DFTM populations are able to escape these controls and outbreaks occur. Outbreaks typically collapse within two to four years due to a combination of build-up

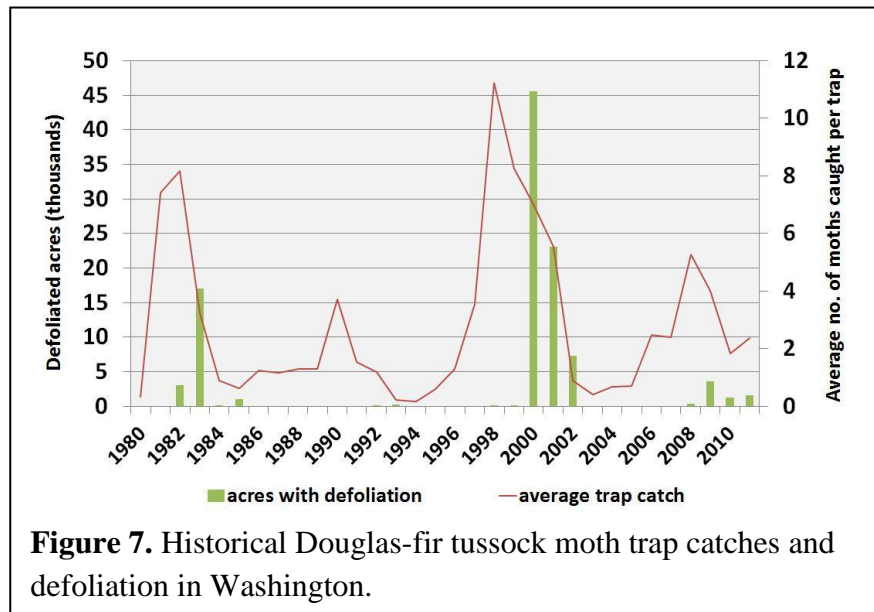


Figure 7. Historical Douglas-fir tussock moth trap catches and defoliation in Washington.

in natural enemies and/or starvation (Fig. 7). Early in the outbreak, egg masses can be analyzed to determine the level of virus and parasitism. This information can be used to predict the duration and possibly predict severity of the outbreak.

Control. If no actions are taken to manage or prevent DFTM damage, the outbreak will subside in two to four years due to a build-up of natural controls. Management options are available to protect host trees valued for timber, recreation, or aesthetics.

Natural. After the first two years of defoliation, any combination of virus, parasites, predators, disease, or starvation will cause the DFTM population to collapse by the fourth year.

Silvicultural. DFTM may damage ponderosa pines and western larch, but is unlikely to kill them. If timed before an outbreak, thinning the forest to reduce the proportion of Douglas-fir and true fir can reduce DFTM damage. Dense understory trees are more vulnerable to damage because they have fewer needles and DFTM caterpillars drop on them from taller trees. In an even-aged stand with widely spaced trees, caterpillars are less likely to land on host trees. After an outbreak, killed trees can be salvaged as timber or left standing. Selection of trees for removal should be done in spring following bud

break because some trees that appear dead may produce new growth. High numbers of standing dead trees may create wildfire or falling hazards. Some dead trees can provide value as wildlife habitat.

Insecticides. For immediate reduction of defoliation, insecticides can be sprayed on host trees soon after most caterpillars have emerged and begun feeding. Conventional and biological insecticides are effective against DFTM. Biological insecticides include a bacterial insecticide, Foray or 'Bt' (*Bacillus thuringiensis* var. *kurstaki*), and a naturally occurring virus, 'TM Biocontrol'. TM Biocontrol is only available through the USDA Forest Service. Please contact the Washington State Department of Agriculture for current pesticide information. When using pesticides, always read and follow the label. It is a violation of state and federal law to apply a pesticide in a manner not described on the label.

Mating disruption (experimental). Forest Service studies suggest that mating disruption can be used to reduce DFTM populations. Adult female DFTM produce a pheromone (communication chemical) to attract males. In mating disruption, a synthetic version of this pheromone is distributed at high concentrations to confuse males so they are unable to locate a mate. Because this strategy targets adult moths, it does not reduce defoliation in the year of treatment. However, it can reduce the number of eggs laid in the fall. In 2009, Forest Service researchers evaluated the effectiveness of mating disruption at some locations in Okanogan County.

For more information:

If you have questions about this information or want to report Douglas-fir tussock moth activity, please contact Glenn Kohler, Forest Entomologist with Washington DNR (360-902-1342; glenn.kohler@dnr.wa.gov). Idaho landowners should contact Tom Eckberg, Forest Entomologist with Idaho Department of Lands (208-666-8625; teckberg@idl.idaho.gov). Oregon landowners should contact Rob Flowers, Forest Entomologist with the Oregon Department of Forestry (503-945-7396; rflowers@odf.state.or.us).

The USDA Forest Service's Forest Health Protection website has detailed information on DFTM biology, management, and monitoring at: <http://www.fs.fed.us/r6/nr/fid/dftmweb/index.shtml>.