

DOUGLAS-FIR TUSSOCK MOTH IN THE BLUE MOUNTAINS

Compiled by David C. Powell

June 2008



Douglas-fir tussock moth larvae on the bark of a tree

Douglas-fir tussock moth is a native insect of the Blue Mountains; it was not introduced from somewhere else like larch casebearer or white pine blister rust. Tussock moth defoliates true firs (grand fir primarily) and Douglas-fir from the top down, killing trees outright or setting them up for future attack by bark beetles such as Douglas-fir beetle or fir engraver.

Unlike western spruce budworm, another major defoliator causing widespread tree damage in the Blue Mountains from 1944 to 1958 and 1980 to 1992, the tussock moth can consume all of a tree's foliage in a hurry – infested trees begin to turn reddish-brown in June and could be entirely defoliated (all of the needles are gone) by mid-July.

Tussock moth populations are cyclic, rising on average about every 9 years in the western United States. Not every population peak results in an outbreak – in northeastern Oregon, it appears that an outbreak happens to coincide with every second or third population peak. Outbreaks were recorded for the Blue Mountains in 1928-1929, 1937-1939, 1946-1948, 1963-1965, 1972-1974, 1992-1993, and 2000-2001.

Dendrochronology studies found that tussock moth has been active in the Blues for as long as their mixed-conifer forest habitat has been available (note that dendrochronology is the interpretation of tree cores to infer climatic cycles, fire cycles, insect outbreaks, etc.). Dendrochronology analysis indicates that tussock moth might have defoliated mixed-conifer stands in the Drumhill Ridge area (Walla Walla Ranger District) during 1843-1845, 1852-1854, and in 1875.

The Umatilla National Forest has maps and written records for two of the early Douglas-fir tussock moth outbreaks. The first one was discovered on August 20, 1946 when a pine beetle survey crew was cruising a check plot near Troy, Oregon. After the survey crew reported the out-

break, an entomologist was dispatched from the Forest Insect Laboratory in Portland to examine the situation.

When entomologist Walter J. Buckhorn visited the Troy area on September 18 and 19, 1946, he found that 10,000 to 12,000 acres of mixed-conifer forest had been defoliated by tussock moth, with complete tree mortality occurring on some 500 to 600 acres in patches ranging up to 50 acres in size. Local residents told him that 1946 was the second year of the outbreak. Heavy egg deposits indicated that tussock moth populations were still increasing, and that many trees would probably be killed in 1947.

Buckhorn was particularly interested in the Troy-area infestation because it coincided with a much larger tussock moth outbreak in central Idaho and northeastern Washington. Extensive control operations were already being planned for the Washington and Idaho outbreak areas. He decided that the Troy infestation was close enough to the central Idaho outbreak to coordinate a control program with one already planned for that area.

Buckhorn and the Walla Walla District Ranger (Willis W. Ward) completed an aerial survey of the Troy outbreak on March 24 and 25, 1947 by using a Stinson Voyager airplane on loan from the Forest Service's Division of Fire Control. On the first day, they flew about 1,000 to 1,800 feet above the tree tops and at a speed of 110 miles per hour, which was deemed to be a little too fast for best results.

As soon as the survey began, they realized it was going to be difficult to distinguish the undamaged tree tops of western larch, which looked gray because they had not yet leafed out, from the gray tops of grand firs and Douglas-firs that had been defoliated by tussock moth.

On the second day, Buckhorn decided to fly closer to the tree tops (only 200 feet above the canopy) in an attempt to separate western larch from the other species. But this strategy proved to offer no advantage because the trees passed by too quickly, and were too close at hand, to permit accurate determination of species.

Buckhorn's final sketch map showed that 56,065 acres were infested with tussock moth at some level of severity, and that heavy defoliation occurred on 1,265 acres, moderate defoliation on 23,890 acres, and light defoliation on the remainder (30,910 acres).

Between June 24 and July 1 of 1947, 14,000 acres of the Troy tussock moth outbreak were sprayed with insecticide. A C-47 airplane carrying 1,000 gallons of spray solution per trip was used for the project; it operated from the Moscow, Idaho airport located about 65 miles from the Troy area.

The spray was a solution of DDT in fuel oil applied at the rate of one pound of insecticide (DDT) in one gallon of diluent (fuel oil) per acre. The results were "phenomenal" with practically 100 percent reduction in tussock moth numbers.

On the unsprayed areas, a polyhedral virus disease appeared near the end of the feeding period and caused widespread mortality of tussock-moth larvae and pupae. On four small areas

to the north and east of Troy, the virus in combination with natural predators virtually wiped out the tussock moth population, and no spraying was necessary.

Later in the season, however, tussock moth developed to a greater extent than anticipated in certain untreated areas and caused extensive damage there; the same thing happened in another location about eight miles south of the project area near Promise, Oregon.

During 1947, many reports came in about tussock moth damage, but they ultimately turned out to be western spruce budworm defoliation. In order to help sort out this confusing situation, it was finally decided to make an aerial survey of the 7,755,000 timbered acres of the Blue Mountain region and to install supplementary ground surveys.

This survey turned out to be the first aerial reconnaissance to determine the extent and severity of insect damage for the national forests of Oregon and Washington. An aerial survey has been conducted every summer since then, and the annual sketch maps get frequent use today.

A localized tussock-moth outbreak occurred in the mid 1960s on the southern half of the Malheur National Forest and a small portion of the adjoining Ochoco National Forest. Mixed-conifer stands in the Silver Springs (Snow Mountain), Gold Hill, King Mountain, Antelope Mountain, and Vance Creek areas were defoliated between 1963 and 1965. The outbreak collapsed after 65,945 acres were sprayed with DDT between June 10 and July 1, 1965.

The next broad-scale tussock moth outbreak affecting the northern Blue Mountains occurred in the early 1970s. The first damage was noticed as 2,400 acres of defoliation in the Okanogan Valley of north-central Washington in 1971. In 1972, over 197,000 acres were defoliated in Oregon and Washington.

Perhaps some of the worst tussock moth damage occurred on the northern half of the Umatilla National Forest. By 1974, 44% of defoliated acreage in the outbreak area (including state, private, and other federal ownerships) was on the Umatilla National Forest – 353,850 acres out of a total outbreak area of 800,000 acres!

How did the Umatilla National Forest respond to the 1970s outbreak? The Forest Service acted quickly and decisively to tussock-moth damage, and the political aspects of that story are fascinating.

DDT, the powerful chemical insecticide used in the 1947 spray project near Troy, and for experimental control of western spruce budworm populations on the Heppner Ranger District and adjacent Kinzua Pine Mills lands, was found to affect many other organisms beyond insects that defoliate trees. Due to its environmental persistence and the broad spectrum of organisms affected by it, William Ruckelshaus, director of the Environmental Protection Agency, banned DDT on June 14, 1972.

From the perspective of the 1970s tussock moth outbreak, the EPA's ban couldn't have come at a worse time. Banning DDT removed the most effective weapon against tussock moth during the first year of what would turn out to be the largest and most severe outbreak ever recorded.

Following the DDT ban, the Forest Service immediately began testing other potential insecticides. Testing included Zectran, carbaryl (Sevin), Pyrethroid, and Dylox, all of which were chemical compounds, and two possible biological control agents – *Bacillus thuringiensis* (a bacteria) and a natural virus.

After a Forest Service petition requesting emergency use of DDT was denied by EPA in June 1973, 32,000 acres of the Walla Walla watershed was sprayed immediately with Zectran as a test project.

On Thursday, August 16, 1973, when United States Senator Bob Packwood was reviewing tussock moth damage near La Grande, Oregon, a forest fire broke out near Perry and burned nearly 6,000 acres in a short period of time, including an area damaged by tussock moth. This Rooster Peak fire directly threatened La Grande, burning several homes at its edge and coming within yards of others.

Over 1,500 people fought the Rooster Peak fire, and many of them were local residents of La Grande. The National Guard was activated to help evacuate homeowners from foothill areas. Shortly after this fire event, an area-wide fire closure was implemented because of high fire danger from tussock moth damage and an on-going drought.

Initially, Senator Bob Packwood had no official position regarding EPA's ban on the use of DDT. Following the Rooster Peak fire and after examining thousands of acres of tussock-moth damage from both the air and the ground, Senator Packwood eventually expressed this opinion regarding the DDT ban: "But, now I'm convinced their decision was wrong" (referring to EPA's decision not to authorize use of DDT for tussock moth control).

Following Packwood's visit and the Rooster Peak fire, petitions began circulating in northeastern Oregon requesting that the EPA's ban be lifted so that DDT could be used against tussock moth. On August 31st of 1973, Secretary of Agriculture Earl Butz visited the Blue Mountains to view tussock moth damage firsthand.

In January 1974, the EPA held hearings in Portland to consider possible DDT use against tussock moth. On January 30, 1974, the Tussock Moth Control Association of La Grande, Oregon presented petitions containing 57,000 signatures to Vice President Gerald Ford; the petitions requested that DDT be allowed for emergency use against tussock moth. On February 26, 1974, EPA director Russell Train authorized emergency use of DDT against tussock moth only.

After a Johnny Appleseed clean-up weekend in early June 1974, when 2,000 four-wheel drive club volunteers performed clean-up work in tussock moth damaged areas, a tri-Region, tri-State DDT spray project began on June 9, 1974 on the Colville Indian Reservation. By June 22, DDT spraying was underway in the Blue Mountains, eventually concluding on July 25, 1974.

A total of 426,559 acres were sprayed to reduce tussock moth population levels in 1974, including 32,706 acres on the Umatilla National Forest and 72,717 acres on the Wallowa-Whitman National Forest.

Although applying an insecticide was the primary Forest Service response to tussock moth defoliation, salvage sales to harvest damaged and dead timber were also completed. The first Umatilla National Forest salvage sale was sold on November 28, 1972. The last of 40 tussock-moth salvage sales was awarded on September 3, 1974.

Many old harvest units in places like Ruckel Ridge, Phillips Creek, and upper Tiger Canyon date from the tussock-moth salvage program of the early 1970s.

The following notes, which were prepared by Paul Bouchard (retired forester), describe how the Pendleton Ranger District responded to the tussock moth outbreak (note: this portion of the Umatilla National Forest had more impact from tussock moth than other ranger districts).

“The 1973 aerial sketch map showing tussock moth defoliation became the planning map for the salvage timber harvest program. The heavy infestation and damage areas were used to rough out potential timber sale area boundaries. By estimating the potential treatment area and timber volume by damage classes, a rough estimate of total sale acreage and salvage volume was then available for program management purposes (personnel, supplies, funding needs, etc.).

It was estimated that the tussock moth salvage program could involve as much as 210 million board feet of timber volume from a gross analysis-area acreage of 66,000 acres, of which 38,000 was forested. All of the potential treatment areas were reconnoitered from the air and sale area boundaries then established on 4-inch-to-the-mile aerial photographs enlarged from a 1970 high-altitude reconnaissance flight. Areas more than 800 feet below the ridgelines and areas with small-diameter, dead white fir (usually in the headwaters of intermittent drainages) were eliminated from timber sale consideration.

Three potential silvicultural treatments were mapped from the aerial reconnaissance: clearcutting (completely dead areas); shelterwood cutting (mostly dead areas); and partial cutting (areas with intermixed mortality). Nearly pure inclusions of non-host tree species and light damage of host species were also mapped. Due to time and personnel limitations, a very extensive and limited ground check and plot cruise was made (plot locations were noted on aerial photographs). The cruise amounted to about a 2/10 of 1% sample.

By correlating plot data with experienced estimates, a salvage timber harvest program was developed for 128 million board feet covering 55,000 gross acres and 23,000 net acres. Approximately 137 million board feet was cut and removed under 13 timber sale contracts (105% of the appraised amount).”

Another Forest Service reaction to the tussock-moth outbreak was to develop an early-warning system utilizing pheromone traps to monitor tussock moth population levels (pheromones are biochemicals whose odor is used to attract insects). This early-warning system was implemented West-wide in 1980 as one way to help predict tussock moth outbreaks, and it is still in use today.

Since tussock moth develops rapidly, the early-warning system was designed to predict population increases with enough lead-time to implement a treatment program before serious tree damage could occur. Beginning in 1998, this early-warning system indicated that the northern Blue Mountains were facing another tussock-moth outbreak.

An outbreak actually began in the spring of 2000, and 39,392 acres on the Umatilla and Wallowa-Whitman national forests were sprayed with TM-BioControl, a natural virus affecting tussock moth only, during June and July of 2000. The objective of this spray project was to minimize tussock-moth damage in specific areas of high concern, such as old-growth stands and bull-trout habitat.

Sources

- Buckhorn, W.J. 1947.** Second memorandum on the Douglas fir tussock moth outbreak near Troy, Oregon. Unpublished Typescript Report. Portland, OR: U.S. Department of Agriculture, Bureau of Entomology and Plant Quarantine, Forest Insect Laboratory. 8 p.
<http://www.fs.fed.us/r6/uma/publications/history/Defoliator2.pdf>
- Buckhorn, W.J. 1948.** Defoliator situation in the fir stands of eastern Oregon and Washington. Unpublished Typescript Report. Portland, OR: U.S. Department of Agriculture, Forest Insect Laboratory. 21 p.
<http://www.fs.fed.us/r6/uma/publications/history/Defoliator1.pdf>
- Brookes, M.H.; Campbell, R.W., eds. 1978.** The Douglas-fir tussock moth: a synthesis. Technical Bulletin 1585. Washington, DC: U.S. Department of Agriculture, Forest Service, Science and Education Agency. 331 p.
- Eaton, C.B.; Beal, J.A.; Furniss, R.L.; Speers, C.F. 1949.** Airplane and helicopter spraying with DDT for spruce budworm control. *Journal of Forestry*. 47: 823-827.
<http://www.fs.fed.us/r6/uma/publications/history/Eaton.pdf>
- Graham, D.A.; Mounts, J.; Almas, D. 1975.** 1974 cooperative Douglas-fir tussock moth control project; Oregon, Washington, Idaho. Unnumbered Report. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Region. 74 p.
- Ragenovich, I. [2000.]** 1999 Douglas-fir tussock moth early warning system trapping summary for Oregon and Washington. Unnumbered Report. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Region, Forest Insects and Diseases/Natural Resources. 36 p.
- Swetnam, T.W.; Wickman, B.E.; Paul, H.G.; Baisan, C. 1995.** Historical patterns of western spruce budworm and Douglas-fir tussock moth outbreaks in the northern Blue Mountains, Oregon, since A.D. 1700. Research Paper PNW-RP-484. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 27 p.
- U.S. Department of Agriculture, Forest Service. 1972.** Douglas-fir tussock moth situation. Unpublished Typescript Report. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Region. 18 p.
- U.S. Department of Agriculture, Forest Service. 1974.** Douglas-fir tussock moth salvage sales. Pendleton, OR: U.S. Department of Agriculture, Forest Service, Umatilla National Forest. 1:126,720; projection unknown; 38" × 43"; colored thematic map.
- U.S. Department of Agriculture, Forest Service. 1976-1979.** Douglas-fir tussock moth timber sales. Unpublished Typescript Memoranda. Pendleton, OR: U.S. Department of Agriculture, Forest Service, Umatilla National Forest. 15 p.

- U.S. Department of Agriculture, Forest Service. 1978?** DFTM chronological sequence of events. Unpublished Typescript Report. [Place of publication unknown]: [Publisher unknown]. 3 p.
- U.S. Department of Agriculture, Forest Service. 2000.** Douglas-fir tussock moth: final environmental impact statement. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Region. Irregular pagination.
- Wickman, B.E.; Mason, R.R.; Swetnam, T.W. 1994.** Searching for long-term patterns of forest insect outbreaks. In: Leather, S.R.; Walters, K.F.A. [and others], editors. Individuals, populations and patterns in ecology. Andover, Hampshire, United Kingdom: Intercept Ltd: 251-261.
- Williams, J.T. 1978.** Management implications from a timber type evaluation of Oregon and Washington tussock moth outbreak areas. Master of Science thesis. Seattle, WA: University of Washington. 69 p.