Summary of Aerial Overview Surveys in the Southern Interior Forest Region - 2008

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2008 Overview of Forest Health in the Southern Interior Forest Region

Introduction

The 2008 Aerial Overview Surveys were carried out between July 11 and August 16, 2008. A total of 336.2 hours of fixed-wing flying, over 56 days, were required for 100% coverage of the Region. As in past years, three separate survey crews conducted the surveys for the Southern Interior Region which included the Quesnel, Central Cariboo, Chilcotin, 100 Mile House, Kamloops, Cascades, Okanagan Shuswap, Headwaters, Columbia, Arrow Boundary, Kootenay Lake, and Rocky Mountain Districts. Of the total, approximately 20 hours (4 days) were spent covering portions of the Coast Forest Region, and an additional 34.4 hours (6 days) were spent completing portions of the Northern Interior Forest Region in October.

Surveys were carried out using the standardised Provincial Aerial Overview Survey protocols (http://www.for.gov.bc.ca/hfp/health/overview/methods.htm), and documented mortality and/or damage resulting from bark beetles, defoliators, and any other visible forest health factors, such as foliar diseases and abiotic damage. Table 1 describes severity ratings used in the surveys.

Overall, weather conditions and visibility were satisfactory. Wildfire activity was very low in most areas this year; however, smoke from fires in the U.S. caused a few visibility concerns in early August.

The most damaging pest in the Southern Interior Region continued to be mountain pine beetle (4,812,045 ha); other pests causing large scale damage were western spruce budworm (766,224 ha), western balsam bark beetle (184,829 ha), Douglas-fir beetle (93,652 ha), two-year cycle spruce budworm (54,136 ha) and spruce beetle (20,528 ha).

Table 1. Severity ratings used in the aerial overview surveys.

Mortality severity class	Current mortality	Defoliation severity class	Attributes
Trace*	< 1%	Light	some branch tip and upper crown defoliation, barely visible from the air
Light	1-10%		
		Moderate	thin foliage, top third of many trees severely defoliated, some completely stripped
Moderate	11-29%		
Severe	30-49%	Severe	bare branch tips and completely defoliated tops, most trees sustaining >50% total defoliation
Very Severe*	50% +		

* Trace and Very Severe categories used for bark beetles and other mortality agents only.

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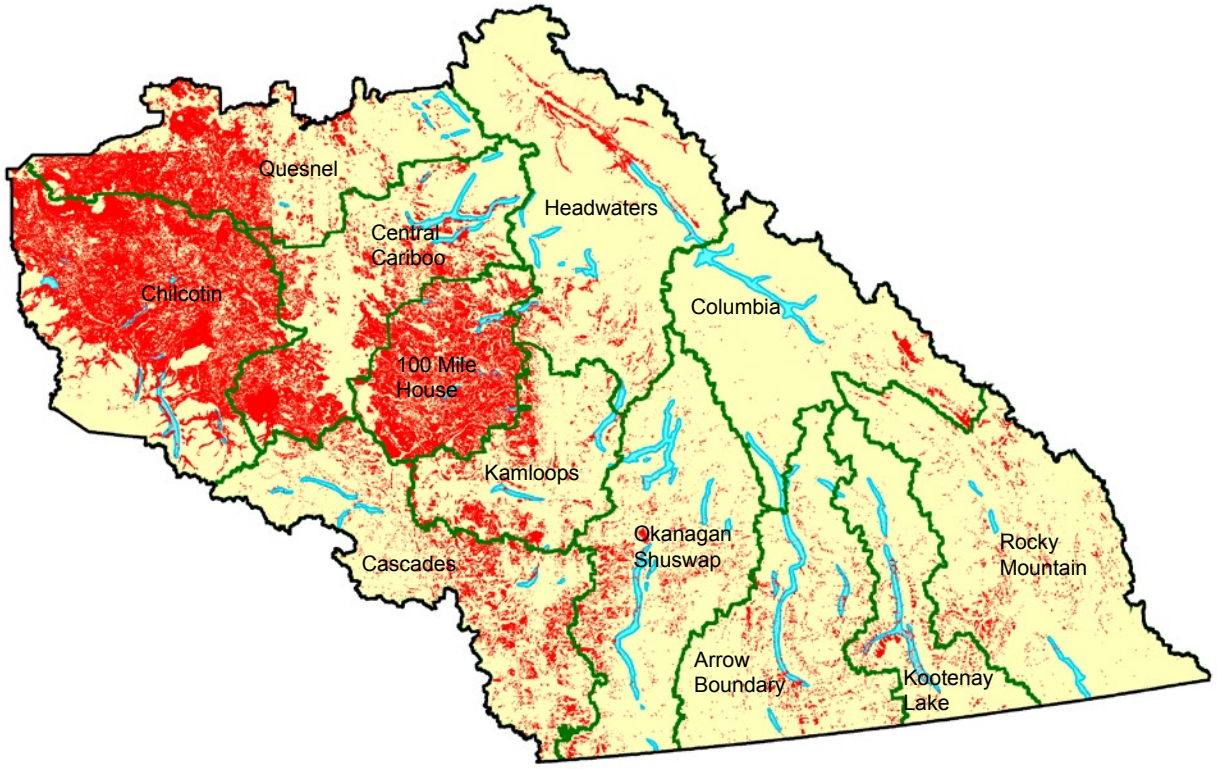

Figure 1. Mountain pine beetle infestations in the Southern Interior Forest Region in 2008.

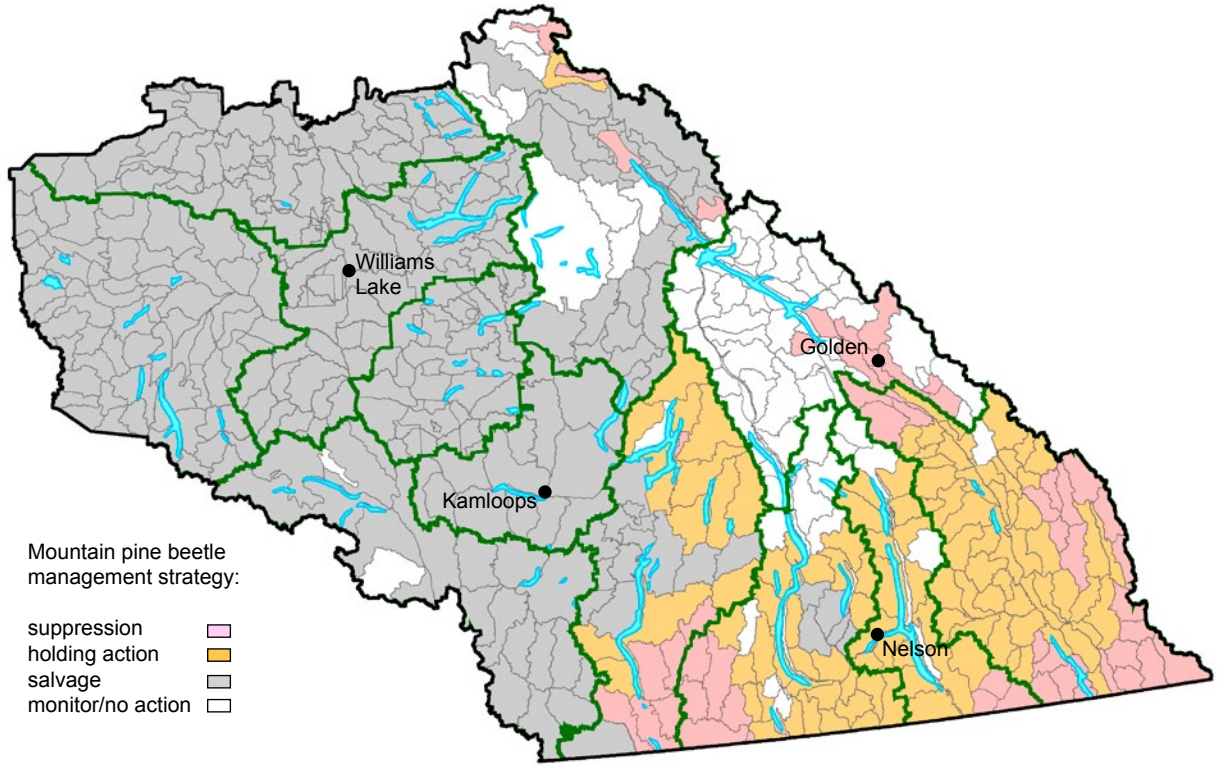

Figure 2. Beetle Management Unit (BMU) boundaries, and associated mountain pine beetle strategies, as of December 2008.

Table 2. Area summaries for forest health factors mapped during the 2008 aerial overview surveys

Forest District and Damaging Agent	Area of Infestation (ha)					
	Trace	Light	Moderate	Severe	Very Severe	Total
Mountain Pine Beetle						
Chilcotin	315,238.0	1,068,607.2	140,745.8	7,953.5	0.0	1,532,544.4
100 Mile House	322,494.9	219,515.8	131,106.3	40,439.9	28,519.2	742,076.0
Quesnel	349,577.6	230,295.1	104,580.0	27,945.4	329.0	712,727.1
Central Cariboo	289,846.4	206,922.2	88,885.5	13,148.9	3,419.7	602,222.8
Cascades	47,839.1	191,503.9	105,835.4	22,666.0	3,026.3	370,870.6
Kamloops	60,576.2	108,315.3	50,958.5	10,907.6	1,511.0	232,268.6
Okanagan Shuswap	30,418.2	98,953.7	32,281.2	7,878.2	1,543.3	171,074.5
Headwaters	73,172.3	48,795.5	31,132.2	7,985.1	3,378.8	164,463.9
Rocky Mountain	14,967.4	33,390.3	28,584.9	14,830.1	7,636.2	99,408.8
Arrow Boundary	19,110.2	36,855.6	21,233.0	8,968.4	1,998.7	88,165.9
Kootenay Lake	6,556.9	18,873.8	12,742.0	7,684.3	9,281.9	55,138.9
Columbia	6,950.1	8,214.8	8,022.0	6,030.8	11,865.8	41,083.6
Total	**1,536,747.5**	**2,270,243.1**	**756,106.8**	**176,438.0**	**72,509.9**	**4,812,045.2**
Western Balsam Bark Beetle						
Okanagan Shuswap	54,469.0	4,526.0	34.1	0.0	0.0	59,029.1
Headwaters	22,785.8	1,241.4	0.0	0.0	0.0	24,027.2
Central Cariboo	20,367.3	436.9	171.8	0.0	0.0	20,976.0
Chilcotin	13,444.0	6,215.4	24.1	0.0	0.0	19,683.5
100 Mile House	9,538.2	1,100.8	0.0	0.0	0.0	10,639.0
Arrow Boundary	8,296.8	2,206.2	35.6	0.0	0.0	10,538.6
Kamloops	8,821.9	920.3	0.0	0.0	0.0	9,742.2
Cascades	8,345.6	185.8	49.5	0.0	0.0	8,580.8
Rocky Mountain	6,767.4	764.1	468.3	0.0	0.0	7,999.8
Quesnel	5,339.5	637.3	0.0	0.0	0.0	5,976.9
Columbia	4,441.3	483.1	101.0	57.8	0.0	5,083.2
Kootenay Lake	1,920.3	525.2	107.5	0.0	0.0	2,553.0
Total	**164,537.1**	**19,242.5**	**991.9**	**57.8**	**0.0**	**184,829.3**
Douglas-fir Beetle						
Central Cariboo	41,370.4	8,094.2	2,850.3	939.3	134.7	53,388.8
Chilcotin	5,024.7	8,467.9	1,140.7	528.4	0.0	15,161.8
100 Mile House	9,045.1	3,735.9	348.9	30.1	0.0	13,160.0
Quesnel	2,169.3	597.6	1,202.8	366.0	99.7	4,435.4
Rocky Mountain	263.4	752.4	879.3	131.8	0.0	2,026.9
Columbia	249.6	921.9	722.9	0.0	0.0	1,894.5
Arrow Boundary	76.5	840.7	535.0	0.0	0.0	1,452.1
Kamloops	0.0	708.3	170.9	4.9	0.0	884.0
Cascades	207.4	240.2	20.5	0.0	0.0	468.1
Okanagan Shuswap	0.0	293.2	56.7	6.0	0.0	355.9
Kootenay Lake	40.9	216.5	0.0	0.0	0.0	257.4
Headwaters	67.6	47.8	51.4	0.0	0.0	166.8
Total	**58,514.9**	**24,916.6**	**7,979.6**	**2,006.5**	**234.3**	**93,651.8**
Spruce Beetle						
Central Cariboo	4,128.4	1,072.1	374.9	429.6	0.0	6,005.1
Okanagan Shuswap	54.5	2,308.9	1,222.2	311.7	0.0	3,897.3
Cascades	0.0	1,711.0	1,349.4	323.2	0.0	3,383.6
100 Mile House	1,462.9	394.2	88.2	53.5	0.0	1,998.9
Headwaters	104.2	423.0	1,103.1	0.0	0.0	1,630.3
Quesnel	1,167.8	13.6	66.5	0.0	0.0	1,247.9
Kamloops	0.0	450.1	645.3	0.0	0.0	1,095.4
Rocky Mountain	25.1	0.0	0.0	765.8	0.0	790.9
Chilcotin	251.7	75.7	0.0	0.0	0.0	327.4
Columbia	121.3	30.1	0.0	0.0	0.0	151.4
Total	**7,316.1**	**6,478.7**	**4,849.7**	**1,883.7**	**0.0**	**20,528.2**

Table 2 continued. Area summaries for forest health factors mapped during the 2008 aerial overview surveys

Forest District and Damaging Agent	Area of Infestation (ha)					
	Trace	Light	Moderate	Severe	Very Severe	Total
Western Spruce Budworm						
Central Cariboo	0.0	199,443.2	11,925.8	612.6	0.0	211,981.6
100 Mile House	0.0	163,506.7	11,098.2	0.0	0.0	174,604.9
Cascades	0.0	126,034.1	1,903.4	0.0	0.0	127,937.6
Kamloops	0.0	124,005.3	610.3	0.0	0.0	124,615.6
Okanagan Shuswap	0.0	72,548.0	1,863.8	0.0	0.0	74,411.7
Chilcotin	0.0	34,778.1	5,023.5	1,145.7	0.0	40,947.2
Quesnel	0.0	9,434.1	0.0	0.0	0.0	9,434.1
Headwaters	0.0	2,291.1	0.0	0.0	0.0	2,291.1
Total	**0.0**	**732,040.6**	**32,425.0**	**1,758.2**	**0.0**	**766,223.8**
Two Year Cycle Spruce Budworm						
Headwaters	0.0	50,715.6	304.0	18.6	0.0	51,038.2
Quesnel	0.0	1,812.9	0.0	0.0	0.0	1,812.9
Central Cariboo	0.0	956.2	0.0	0.0	0.0	956.2
100 Mile House	0.0	328.4	0.0	0.0	0.0	328.4
Total	**0.0**	**53,813.2**	**304.0**	**18.6**	**0.0**	**54,135.7**
Douglas-fir Tussock Moth						
Kamloops	0.0	721.4	651.6	876.0	0.0	2,249.0
Okanagan Shuswap	0.0	145.5	49.2	25.4	0.0	220.1
Cascades	0.0	90.0	13.0	13.5	0.0	116.6
Arrow Boundary	0.0	0.0	3.6	7.4	0.0	11.0
Total	**0.0**	**956.9**	**717.4**	**922.2**	**0.0**	**2,596.6**
Aspen Serpentine Leaf Miner						
Headwaters	0.0	8,750.6	0.0	0.0	0.0	8,750.6
Okanagan Shuswap	0.0	1,446.4	138.0	0.0	0.0	1,584.5
Kamloops	0.0	469.1	0.0	0.0	0.0	469.1
Arrow Boundary	0.0	2.6	20.0	0.0	0.0	22.6
Total	**0.0**	**10,668.7**	**158.1**	**0.0**	**0.0**	**10,826.8**
Forest Tent Caterpillar						
Quesnel	0.0	930.3	2,887.3	4,527.1	0.0	8,344.7
Headwaters	0.0	217.9	700.7	0.0	0.0	918.6
Columbia	0.0	39.8	200.7	0.0	0.0	240.5
Rocky Mountain	0.0	33.7	96.5	0.0	0.0	130.2
Arrow Boundary	0.0	11.1	0.0	0.0	0.0	11.1
Total	**0.0**	**1,232.7**	**3,885.2**	**4,527.1**	**0.0**	**9,645.1**
Western Hemlock Looper						
Headwaters	0.0	469.1	0.0	0.0	0.0	469.1
Okanagan Shuswap	0.0	67.9	0.0	0.0	0.0	67.9
Total	**0.0**	**537.0**	**0.0**	**0.0**	**0.0**	**537.0**
Birch Leaf Miner						
Okanagan Shuswap	0.0	738.4	0.0	0.0	0.0	738.4
Total	**0.0**	**738.4**	**0.0**	**0.0**	**0.0**	**738.4**
Satin Moth						
Chilcotin	0.0	25.4	101.2	0.0	0.0	126.6
Total	**0.0**	**25.4**	**101.2**	**0.0**	**0.0**	**126.6**
Larch Needle Blight						
Rocky Mountain	0.0	689.8	2,676.2	6,493.3	0.0	9,859.3
Kootenay Lake	0.0	494.9	636.6	812.5	0.0	1,944.0
Arrow Boundary	0.0	481.6	0.0	0.0	0.0	481.6
Total	**0.0**	**1,666.3**	**3,312.8**	**7,305.7**	**0.0**	**12,284.8**

Regional Overview

Mountain Pine Beetle, *Dendroctonus ponderosae*

Total red attacked area declined slightly in 2008, to 4.81 million hectares, down from 5.38 million hectares in 2007. Large decreases were observed in the area classified as moderate, severe, and very severe, while the total area classified as trace and light increased. While overall area affected remained high, declining attack rates were very evident in the Quesnel, Central Cariboo, Chilcotin, 100 Mile House, and Kamloops Districts, where there has been widespread depletion of most of the available host material. Region-wide, the proportion of attack that was classified as severe or very severe, has fallen from 24.1% in 2006, to 17.6% in 2007, and 5.2% in 2008 (Figure 4). Mountain pine beetle is still expanding in parts of the Cascades and Okanagan Shuswap Districts; and in the Kootenays, all of the Districts experienced significant increases in red attack area.

Approximately 39,570 trees were killed in 3,181 small spot infestations, which is down from 2007 levels (Table 3). Eighty-five percent of these spot infestations were in the Kootenays and the Okanagan.

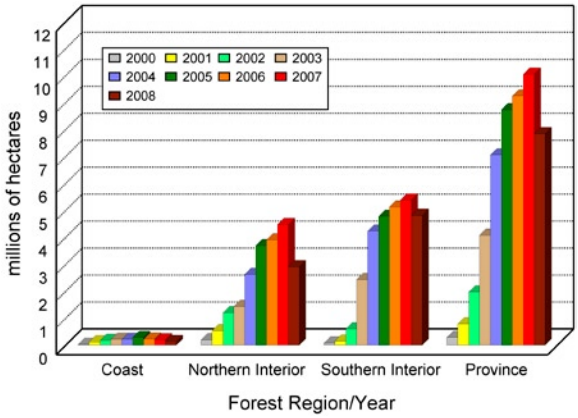

Figure 3. Area affected by mountain pine beetle from 2000 - 2008 in British Columbia, by Forest Region.

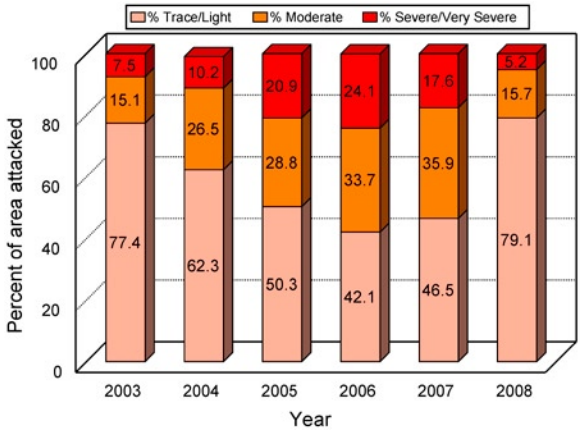

Figure 4. Proportion of mountain pine beetle infested area by infestation severity level, from 2003 - 2008, in the Southern Interior Forest Region.

Table 3. Area infested, number of polygons, average polygon size, and number of trees killed in spot infestations, for mountain pine beetle in the Southern Interior Forest Region, 2001-2008.

Year	Area Infested (ha)	Number of Polygons	Average Polygon Size (ha)	Number of Spot Infestations	Number of Trees Killed in spot infestations
2001	141,176	4,760	29.7	3,672	37,074
2002	612,054	7,349	83.3	6,308	56,054
2003	2,525,722	13,133	192.4	5,270	42,372
2004	4,220,499	41,057	101.9	4,932	63,410
2005	4,853,830	49,381	95.6	3,839	35,033
2006	5,125,879	59,971	85.5	5,672	71,803
2007	5,379,219	59,373	90.6	5,429	71,409
2008	4,812,045	52,402	67.0	3,181	39,569

Due to a cool spring and summer, the beetle flight was relatively late and drawn out across much of the Region (beginning in July, and continuing well into September). 2008 was the second year in a row with cool weather and a prolonged beetle flight. This has, in many areas, led to higher adult mortality, reduced green attack rates, and may lead to reduced brood production and survival over the winter. Low R-values and high overwinter mortality were seen over the winter of 2007-2008 (see the Special Projects section of this report). Overwinter mortality sampling will be conducted in March 2009 to determine mortality rates over the winter of 2008-2009.

Each fall, after the completion of the aerial overview surveys, Beetle Management Unit (BMU) strategies are re-assessed. Nearly 2 million hectares of area previously designated as Suppression have now been re-classified as Holding Action or Salvage. Over 14.5 million hectares (nearly 60% of the Region's land base) are now designated as Salvage. Table 4 lists the area of each District which falls under the different mountain pine beetle strategies.

Table 4. Beetle management unit mountain pine beetle strategy designations in the Southern Interior Forest Region as of December 2008, by number of units, and area (in hectares).

District	Suppression	Holding Action	Salvage	Monitor	Total
Quesnel	0	0	71 (2,077,316)	0	71 (2,077,316)
Central Cariboo	0	0	51 (2,063,411)	0	51 (2,063,411)
100 Mile House	0	0	43 (1,235,998)	0	43 (1,235,998)
Chilcotin	0	0	69 (2,870,249)	0	69 (2,870,249)
Kamloops	0	0	14 (1,315,254)	0	14 (1,315,254)
Cascades	0	0	19 (2,235,592)	1 (20,579)	20 (2,256,171)
Okanagan Shuswap	7 (372,490)	14 (1,205,749)	13 (824,999)	1 (45,929)	35 (2,449,168)
Headwaters	4 (134,652)	1 (72,266)	28 (1,751,656)	9 (1,078,161)	42 (2,902,084)
Columbia	9 (301,254)	0	0	47 (1,824,944)	56 (2,126,198)
Arrow Boundary	7 (334,868)	28 (1,068,051)	5 (174,541)	10 (419,063)	50 (1,996,524)
Kootenay Lake	3 (102,915)	17 (884,511)	0	4 (202,906)	24 (1,190,332)
Rocky Mountain	24 (940,329)	52 (1,818,745)	0	1 (41,458)	77 (2,800,531)
Total	**54 (2,186,508)**	**112 (5,049,322)**	**313 (14,549,016)**	**73 (3,633,040)**	**552 (25,417,887)**

Extensive mountain pine beetle red attack near Forge Mountain, in the Kamloops District.

Mountain pine beetle red attack continued to be very common in younger stands, and was mapped on almost 280,000 hectares. Young pine mortality was widespread throughout the Central Cariboo, 100 Mile House, Quesnel, Kamloops, and Chilcotin Districts, and high in parts of the Headwaters, Cascades, and Okanagan Shuswap Districts. Much of this mortality in the Cariboo was Trace or Light, as it was often occurring in stands with a low component of pine, or young stands that have already sustained significant mortality over the last few years. In the Central Cariboo District, most of the attack classified as young pine was in otherwise mature pine stands, where the mature component is now grey and mountain pine beetle is attacking some of the remaining understory.

Table 5. Green:red mountain pine beetle ratios for the Southern Interior Forest Region, 2008.

Forest District	Average Green:Red Ratio	Range
Okanagan Shuswap	2.0	1 - 6
Headwaters (Robson)	0.6	0.3 - 0.9
Columbia	2.1	1 - 15.0
Rocky Mountain	1.2	0.6 - 5.0
Kootenay Lake	2.0	1.3 - 2.2
Arrow Boundary	1.5	0.3 - 5

Heavily atttacked pine plantation near Clearwater.

Pityogenes attacking a young lodgepole pine tree in late July.

Both plantations, and naturally regenerated young pine stands have been experiencing high levels of mortality over the past several years. Secondary bark beetles, such as *Ips* species, lodgepole pine beetles, and twig beetles, have been very active in many areas, and have contributed to the ongoing young stand and understory mortality. 2008 marked the fourth year of stand specific aerial surveys of young pine and the results are summarized in the "Special Projects" section of this report.

Affected area within provincial parks has increased slightly, totalling nearly 358,000 hectares in 136 separate parks. (Table 6). Thirty-six individual provincial parks sustained at least 1,000 hectares of red attack in 2008. Over 34% of all attack in parks was within the Chilcotin District. The most affected park continued to be Itcha Ilgachuz Park, in the Quesnel and Chilcotin Districts, where red attack was mapped on over 70,000 hectares. Several other provincial parks sustained at least 10,000 hectares of mapped red attack: Ts'yl-Os, Wells Gray,

Big Creek, Kluskoil Lake, Marble Range, and Nazko Lake. Infestations in the four National Parks in the Region (Yoho, Kootenay, Glacier, and Mount Revelstoke) have increased to 30,822 hectares, most of which was within Yoho and Kootenay National Parks.

Table 6. Area (hectares) of mountain pine beetle in provincial parks in the Southern Interior Region in 2008. Numbers in brackets refer to additional areas within National Parks*.

Forest District	Total Number of Parks	Number of Parks with MPB	Area of MPB in Parks (ha)	Total Park Area (ha)
Chilcotin	13	11	122,657	390,766
Central Cariboo	11	5	52,820	195,766
100 Mile House	29	17	40,730	48,342
Quesnel	18	7	37,131	202,497
Headwaters	40	17	25,347	848,744
Kamloops	49	27	19,801	66,498
Okanagan Shuswap	110	30	17,266	186,990
Arrow Boundary	33	8	14,926	169,813
Kootenay Lake	23	9	11,862	215,975
Cascades	35	11	10,938	200,814
Rocky Mountain	35	8 (1)	4,226 (3,358)	272,461 (41,517)
Columbia	21	1 (4)	127 (27,465)	50,929 (387,783)
Total	**305**	**136 (4)**	**357,832 (30,823)**	**2,849,595 (429,300)**

*National Parks - Yoho, Kootenay Lake, Glacier, and Mount Revelstoke.
**Several parks cross over District boundaries, hence these totals are lower than would be indicated by the data in this table.

BC Parks has several ongoing projects, which have been designed to minimize the impacts caused by mountain pine beetle. Many of the projects now underway by Parks are directed at reducing the fire hazard and minimizing hazard to Park users. In Tunkwa Park there has been some minor red/grey attack tree removal by Protection in the campground area. Approximately 6,000 beetle-killed trees were removed along Hydro lines adjacent to the Park, and beetle-kill blow-down was removed from the Park entrance. In Skihist Park, fall and burn programs continue (over 300 green attack Ponderosa pine). As well, verbenone treatment will be applied in the day-use area in the spring of 2009. Ongoing monitoring and control efforts continue in Monk Park, including fall and burn (approximately 300 green attack Ponderosa pine), and verbenone application in the campground and day-use areas. Falling and bucking danger trees for firewood (red attack lodgepole pine) is continuing in a number of affected Parks including Steelhead, Blue Earth Lake, Lac le Jeune, Walloper, Lac de Bois and Emar Lakes.

Other species of pine continued to be killed by mountain pine beetle in many areas. Ponderosa pine mortality increased in most areas, most notably throughout the Merritt, Coldwater River, lower Nicola River, Spences Bridge, and Fraser River areas. Increased mortality was also seen in the Clinton, Bonaparte River, Kingsvale, Princeton, Tulameen, and Okanagan Valley areas. Mortality levels have dropped off in the Kamloops, Chase, Pritchard, and Ashcroft areas, mainly because most of the ponderosa pine in these areas has been killed in previous years. In total, 120,587 hectares of the total area mapped as mounain pine beetle was in ponderosa pine.

Ponderosa pine mortality due to mountain pine beetle attack at Skuhun Creek, Cascades District.

Whitebark pine was killed on 17,283 hectares. Scattered areas of mortality were observed throughout the Selkirk and Purcell Mountains in the Kootenays; in the Cariboo Mountains west of McBride; and at higher elevations in the the Kwoiek Creek, Stein River, Duffy Lake, and Bridge River areas. Ongoing whitebark pine decline and mortality, caused by both mountain pine beetle and white pine blister rust, has been a cause of concern due to its importance as a food and cover source for several bird and mammal species in high elevation ecosystems.

Scattered western white pine mortality was observed in the upper Adams River and Crazy Creek areas.

The fade of MPB-attacked trees was noticeably slower in 2008 and in some locations progressed from the bottom up as seen in this photograph (Nadina Forest District).

Red attacked pine, Surrey Lake, Cascades District.

A young pine stand severely attacked by mountain pine beetle in the Kamloops District.

MPB attack in young pine near Bridge Lake, 100 Mile House District.

Douglas-fir Beetle, *Dendroctonus pseudotsugae*

Douglas-fir beetle infestations continued to be widespread throughout the Cariboo, in the Fraser River, Chilcotin River, Williams Lake, Horsefly, Lac La Hache,and Blackwater River areas. An increase in the number of small scattered infestations was seen in the west Chilcotin, Kamloops, Kootenay Lake, and Trout Lake areas. The overall affected area increased by 15,000 hectares, to 93,652 hectares. The number of spot infestations increased by over 1,000, to 2,427. Nearly 60% of all affected area was in the Central Cariboo District.

Table 7. Number of spot infestations of Douglas-fir beetle in the Southern Interior Forest Region, by District, 2008.

District	# spot infestations	# trees
Central Cariboo	951	8,875
100 Mile House	360	3,571
Chilcotin	291	3,838
Kamloops	222	2,575
Quesnel	221	2,483
Okanagan Shuswap	125	1,295
Arrow Boundary	82	850
Cascades	82	890
Rocky Mountain	37	460
Kootenay Lake	31	345
Headwaters	17	108
Columbia	8	120
Total	**2,427**	**25,410**

Spruce Beetle, *Dendroctonus rufipennis*

Spruce beetle infestations decreased by 40%, to 20,528 hectares. Most of the decline was in the Central Cariboo, 100 Mile House, and Quesnel Districts. Spruce beetle was visible in all Districts except for Kootenay Lake and Arrow Boundary. There are ongoing infestations in the Cayoosh Creek, Downton Lake, Sun Peaks, Snowy Mountain, Kinbasket Lake, and Palliser River areas.

Western Balsam Bark Beetle, *Dryocoetes confusus*

Western balsam bark beetle mortality remains widespread across much of the Region; however, total area mapped decreased by nearly 60%. Most of the decrease was in the Quesnel (down 98,000 hectares), Central Cariboo (down 48,000 hectares), and Headwaters (down 65,000 hectares) Districts. Decreased mortality was seen in most other Districts as well, with the exception of the Chilcotin and Kamloops Districts. In areas where subalpine fir grows with lodgepole pine, the 2008 levels of western balsam bark beetle may have been underestimated due to difficulty in mapping. Many affected areas containing both mountain pine beetle-killed lodgepole pine and western balsam bark beetle-killed subalpine fir made it difficult to discern between the two bark beetles.

Western Spruce Budworm, *Choristoneura occidentalis*

Western spruce budworm remains widespread across the Region; 766,225 hectares were defoliated in 2008. This is a slight decline from 2007 levels of 805,000 hectares; as well, the amount of moderate and severe defoliation has continued to decline, to under 5% of affected area. Defoliation levels often fluctuate annually in response to early spring mortality and timing of larval development and bud flush. In 2008, insect development was very slow (due to unseasonable low temperatures) and subsequently, defoliation levels were reduced. The most significant changes from 2007 were a decrease of 70,000 hectares in the Cascades District, and an increase of 45,000 hectares in the Okanagan Shuswap District. Defoliation was detected in the Quesnel District for the first time since 2004.

Predictive egg mass sampling as conducted in the fall at 739 sites (Table 8). Over 95% of all sample sites were positive for egg masses. Widespread light to moderate defoliation is expected to occur again in 2009, with areas of heavier defoliation scattered throughout the outbreak area. The highest populations in 2009 are expected to be in the Alexis Creek, Williams Lake, Dog Creek, Canoe Creek, 108 Mile House, Loon Lake, Cache Creek, Ashcroft, Walhachin, Kamloops, Merritt, Trout Creek, and Peachland Creek areas.

Table 8. Summary of Southern Interior Forest Region fall 2008 western spruce budworm egg mass sampling results, showing predicted 2008 defoliation.

	Number of sites in each defoliation category					
District	**Nil**	**Light**	**Moderate**	**Severe**	**Total number of sites**	**Average # egg masses/10m² foliage***
Chilcotin	2	6	8	1	17	62.4
Cascades	4	132	55	2	193	40.4
Okanagan Shuswap	4	43	22	0	69	39.7
Central Cariboo	2	56	20	0	78	39.6
Kamloops	19	178	72	1	270	37.1
100 Mile House	5	84	21	0	110	37.1
Headwaters	1	1	0	0	2	11.0
total	35	500	198	4	739	38.2

*Nil = no egg masses found
Light = 1-50 egg masses/10 m² foliage
Moderate = 51-150 egg masses/10m² foliage
Severe = >150 egg masses/10m² foliage

Douglas-fir stand following a year of heavy western spruce budworm defoliation, Cascades District.

2008 Western Spruce Budworm Spray Program

The western spruce budworm (*Choristoneura occidentalis*) expanded significantly in 2007, so an increased management program was implemented in 2008. In total, 61,981 hectares, in 44 separate spray blocks, were treated with Foray 48B (active ingredient *Bacillus thuringiensis* var. *kurstaki*, or *B.t.k.*) at 2.4 litres/ha ($17.02/ha) between June 23 and July 4, 2008. This spray program was the largest to date in the province (Figure 5). A total of 32,966 ha in 22 spray blocks and 28,182 ha in 22 spray blocks were treated in the Kamloops/Merritt area; and the 100 Mile House, Central Cariboo, Chilcotin and Chilliwack areas, respectively. 833 ha in 10 blocks in the Coast Region were treated as part of the Southern Interior Region program in partnership with Don Heppner, Regional Entomologist, and Lacy Stad, Stewardship Forester, Chilliwack District. Western Aerial Applications Ltd. conducted the aerial application of the Kamloops and Chilliwack portion of the program using rotary wing aircraft (315B Lama and Hiller UH12ET) equipped with Simplex spray systems for a cost of $8.22/ha. The Provincial Air Tanker Centre in Kamloops oversaw the aerial application of the Cariboo program using two air tractors (AT802 air tractors) equipped with T-jet spray systems, on a cost-recovery basis ($6.50 per ha). The estimated cost per hectare of the budworm program is $30/ha all-found.

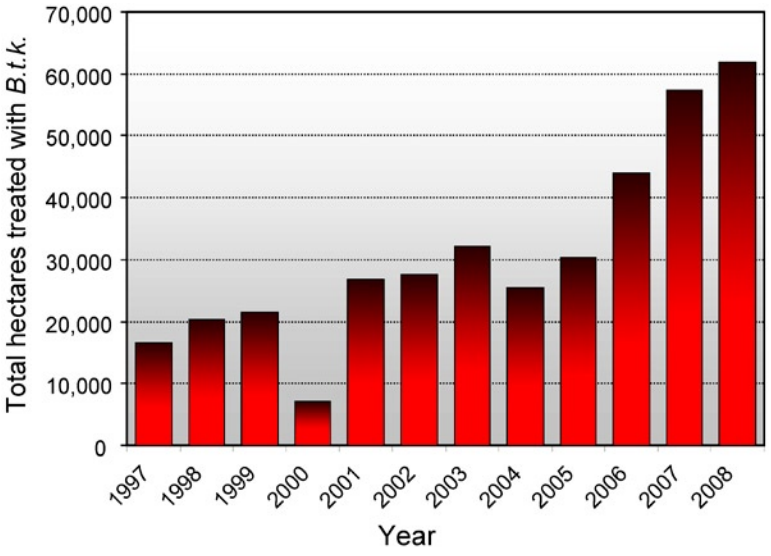

Figure 5. Area treated with *B.t.k.* (in hectares) in the Southern Interior Region, from 1997 - 2008.

A Lama 315B helicopter applying Foray 48B near Pinantan Lake, Kamloops District.

Operational Trial Using A New *B.t.k.* Formulation

A small operational trial was performed to test the efficacy of VBC-60074, a dry flowable formulation of B.t.k. against Foray 48B (the product normally used). VBC-60074 contains 76,000 International Units (IU)/mg of product per kg and was applied in 3 blocks over 292 ha (each block ±100 ha), June 26, 2008, in the Heffley Creek area near Kamloops. The VBC was mixed with water on-site and sprayed with the 315B Lama helicopter at 2.4 litres/ha. The VBC blocks were compared to areas treated with Foray 48B (10,600 IU/mg) and untreated control areas containing similar *C. occidentalis* populations.

Timing of the application was targeted for a Larval Development Index of 3.5 to 4.5 and this was achieved (Figure 6). Evaluations included pre- and post-spray larval sampling and defoliation estimates in each treatment and control block. Fifteen trees per block were assessed (VBC = 45 trees; Foray = 45 trees; control = 30 trees) where two 45 cm branch tips per tree were assessed at each sample date. Sampling dates included one pre-spray and four post-spray samples. Very few insects were present on the final sampling date of July 24, 2008, as most insects had died in treatment blocks or transformed to pupae or adults in control blocks. Larval density (Figure 6), population reduction and percent control using Abbott's formula were calculated to compare treatments (Table 9).

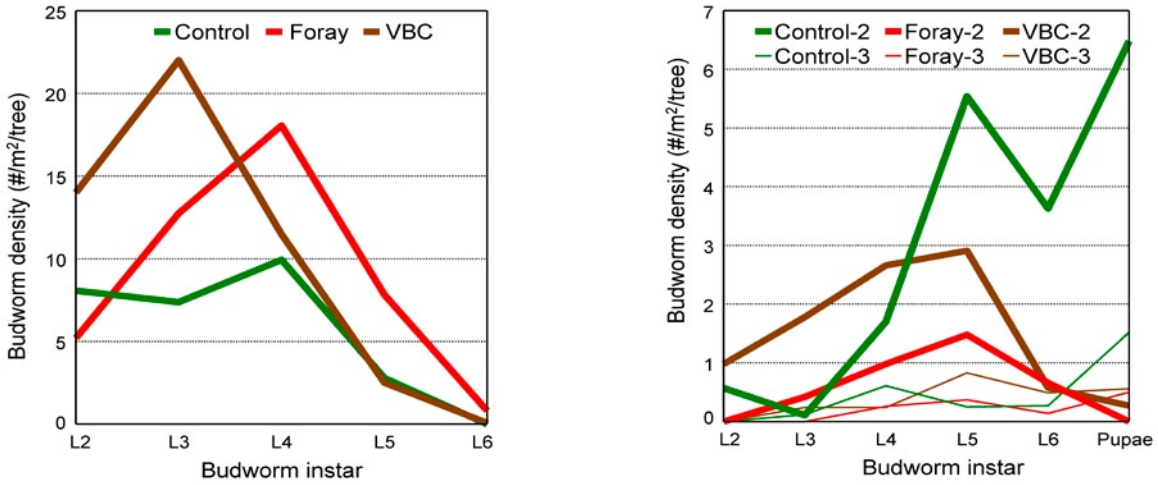

Figure 6. Left graph shows average larval density (by instar) at the pre-spray sampling date (June 25-26, 2008) in each of the treatment regimes. Right graph shows average larval density (by instar) at the 2nd and 3rd sampling date (July10-12 and July 18-19, 2008, respectively) in each of the treatment regimes.

Table 9. Average budworm larvae per m^2, percent larval mortality, Abbott's corrected mortality and average Fette's defoliation estimate for each sampling time for the two *B.t.k.* treatments and control area.

Treatment	Sample Time	Average larval density (#/m^2)	Percent mortality	Abbott's corrected mortality	Average Fette's defoliation
VBC	Pre-spray	50.7			1.8
	Post-1	11.8	76.7	63.6%	3.1
	Post-2	7.8	84.5	78.2%	3.0
Foray	Pre-spray	46.2			2.3
	Post-1	7.9	82.8	73.1%	3.7
	Post-2	3.5	92.5	89.4%	3.4
Control	Pre-spray	27.6		63.6%	1.9
	Post-1	17.6	36.1		4.1
	Post-2	19.5	29.2		3.9

The budworm population was comparable between the VBC and Foray blocks with the control area having lower larval densities (Table 9). The 2nd post-spray sampling date gives the best comparison of relative population densities and treatment efficacy. A 3rd and 4th post-spray sampling was done; however, most insects had pupated and/or eclosed by that time. The percent mortality was high at the 2nd post-spray sampling date in the VBC and Foray blocks, at 84.5% and 92.5% respectively, whereas in the control block it was 29.2%. By the end of the summer feeding period, defoliation levels were similar in all blocks (Table 9). However, in the treated areas, new populations of budworm will have to immigrate into the area to cause future significant defoliation and therefore, damage to these treated blocks should be reduced in 2009 and subsequent years.

The VBC-60074 was as efficacious as Foray 48B (Figure 6; Table 9). Both products reduced budworm populations within target areas. The dry flowable formulation of *B.t.k.* is advantageous in that it does not need to be refrigerated. However, unlike Foray 48B, it must be mixed with water, which requires mixing tanks and water at the staging areas during a spray program.

A typical collection of western spruce budworm larvae and pupae.

Western spruce budworm larval sampling.

WSB spray near Inks Lake.

Review of the Western Spruce Budworm Spray Program In the Cariboo-Chilcotin 1997-2008

Western spruce budworm (Choristoneura occidentalis) is a significant defoliator of Douglas Fir (Pseudotsuga menziesii) forests in the Cariboo-Chilcotin (CC) portion of the Southern Interior Forest region (SIFR), over the last 12 years. Areas were prioritized annually for defoliation severity and those with the highest levels of defoliation were treated with Bacillus thuringiensis var. kurstaki (Btk). Btk is specifically targeted for decreasing populations of western spruce budworm. Between 1997 and 2008 the average treatment area in CC has been 21,207 ha. The largest area was sprayed in 2007, totalling 36,274 ha and the smallest area treated was in 2000 totalling 7,091 ha.

During the last 12 years it has been observed that areas treated generally do not require a Btk spray in following years to control budworm. Data was analyzed on the treatment blocks sprayed and re-sprayed within CC from the start of the program in 1997. Areas of spray overlap were determined for each of the three forest districts within the CC.

In the 12 years of the CC budworm spray program a total of 254,479 ha of Douglas fir forest were treated with Btk. Of the total area treated approximately 87,600 ha were in the Central Cariboo, 131,332 ha in the 100 Mile and 34,946 ha in the Chilcotin district. During the 12 years period approximately 206,963 ha were only treated once, 30,951 ha were treated twice, 7,360 ha were treated three times and a total of 2,212 ha were treated four or more times.

Of the total area treated, approximately 16% (40,523ha) was re-treated at sometime during the 12 years of the program (Fig. 7). More specifically, of the total area sprayed in the Cariboo-Chilcotin 13% of the area was only re-sprayed once, 3% was re-sprayed twice and 1 % was re-sprayed four or more times. The greatest percent area re-sprayed (+/- 18%) was found within the 100 Mile forest district, which has had some Btk spray treatment every year between 1997 and 2008. In contrast, the least amount of area re-sprayed was found within the Chilcotin forest district (14%), which has only had an active control program since 2005.

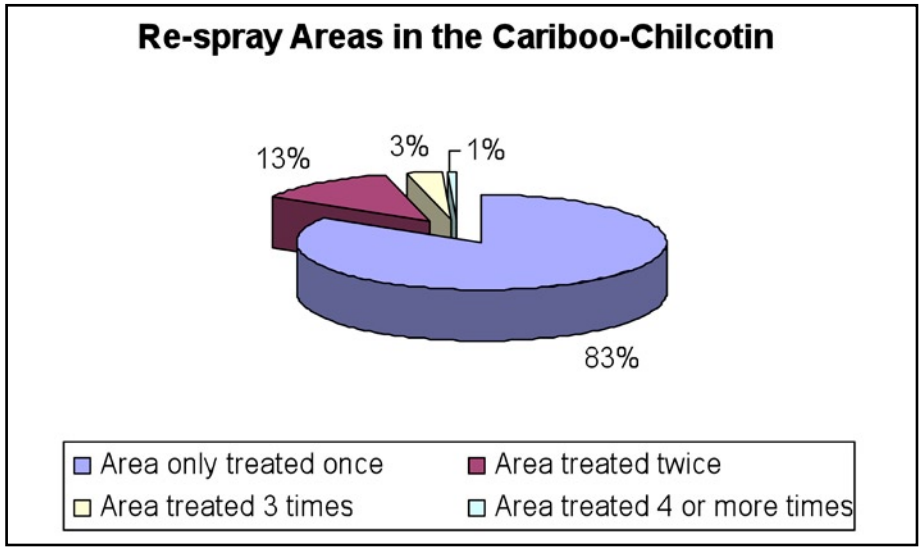

Figure 7: Percentages of area sprayed only once, twice, three times or more than four times between the years of 1997 and 2008.

Western Hemlock Looper, *Lambdina fiscellaria lugubrosa*

Small areas of light defoliation, totalling 537 hectares, were seen in the Headwaters (Hobson Lake) and Okanagan Shuswap (Hunters Creek, Three Valley Gap, and Keefer Lake) Districts. Pheromone trap catches increased to moderate levels at several permanent trapping sites in the North Thompson River, Adams River, and Noisy Creek areas (Table 10). Trap catches remained relatively low (but still increasing) in the Columbia District. 3-tree larval beatings are conducted each year at each of the 6-trap cluster sites as well as 14 additional sites. These beatings yielded very few larvae. These results show that while this year's population was still too low to cause visible damage, numbers are increasing, and more defoliation and an outbreak could occur in the North Thompson, Adams River, Noisy Creek and surrounding areas in 2009-2010.

Table 10. Average number of western hemlock looper moths caught per 6-trap cluster from 2003 - 2008 in the Southern Interior Forest Region.

			Average Trap Catches					
Site	**District**	**Location**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**
1	Headwaters	Serpentine Creek	77	3.5	11.7	2.2	14	232.3
2	Headwaters	Thunder River	69	10.8	8.8	3	44	864.0
3	Headwaters	Mud Lake	71	13.2	7	4	14.2	310.3
4	Headwaters	Murtle Lake Road	150	8.5	11.3	12	21.2	575.7
5	Headwaters	Finn Creek	29	1.7	7	3.8	6.2	781.0
	District Average		**79**	**7.5**	**9.2**	**5**	**19.9**	**552.7**
7	Okanagan Shuswap	Scotch Creek	567	4.5	0.8	2.8	6.2	106.8
8	Okanagan Shuswap	Yard Creek	780	0.2	0.7	11.7	3.5	66.3
9	Okanagan Shuswap	Crazy Creek	1,110	4.2	4.5	0.5	6.7	153.7
10	Okanagan Shuswap	Perry River North	1,471	75	8.2	6	18	206.2
11	Okanagan Shuswap	Three Valley Gap	238	25.5	21.3	4.5	9.2	169.2
12	Okanagan Shuswap	Perry River South	958	30	6	3.7	9.2	82.5
13	Okanagan Shuswap	Kingfisher Creek	203	8.7	24.8	3.3	5.3	227.0
14	Okanagan Shuswap	Noisy Creek	145	4.8	24.8	1.1	10.2	605.8
15	Okanagan Shuswap	Shuswap River E.R.	457	107.3	3	1.7	2.8	72.3
16	Okanagan Shuswap	Greenbush Lake	2,860	192.3	0.3	1.8	logged	29.3
17	Okanagan Shuswap	Adams River	no traps	1.3	9.7	3.2	13.2	512.2
	District Average		**806**	**38.4**	**8.1**	**3.7**	**8.4**	**202.9**
66	Columbia	Sutherland Falls	n/a	2.5	2.5	1	1.2	28.8
72	Columbia	Trout Lake	n/a	7	6.2	2	1.2	22.2
73	Columbia	Martha Creek	n/a	16.6	7.7	2.2	0.8	8.0
74	Columbia	Goldstream River	n/a	2.2	5.3	3.8	2.8	4.0
75	Columbia	Downie Creek	n/a	no traps	1.3	1.3	1	29.5
76	Columbia	Bigmouth Creek	n/a	2.3	8.5	13.4	0.7	9.3
78	Columbia	Carnes Creek	n/a	1.2	4.3	1.5	1.2	16.2
83	Columbia	Begbie Creek	n/a	9.2	12.7	2.5	1.2	24.5
84	Columbia	Pitt Creek Rec Site	n/a	1.8	1	2.6	1.8	15.7
85	Columbia	Redrock	n/a	1.8	22.7	17.3	7.5	89.2
87	Columbia	Jumping Creek	n/a	3.3	9.4	0.5	1	27.3
	District Average		**n/a**	**4.8**	**7.4**	**4.1**	**1.9**	**25.0**

Douglas-fir Tussock Moth, *Orgyia pseudotsugata*

Douglas-fir tussock moth populations reached severe outbreak levels in several areas in 2008. Light to severe defoliation occurred in the Kamloops, Six Mile, Heffley Creek, and Barnhartvale areas in the Kamloops District; in the Richter Pass and Osoyoos areas in the Okanagan Shuswap District; and near Hedley and Keremeos in the Cascades District. Small, localized areas of defoliation were also seen in the Stump Lake and Rock Creek areas. A detailed helicopter survey conducted in late summer delineated 2,597 hectares of dry Douglas-fir forests affected by tussock moth, 63% of which were moderately to severely defoliated. Very discrete spots of tussock moth defoliation were observed in 2007. Subsequently in 2008 when populations increased in these and nearby areas, patches of tree mortality were evident. Sites that were moderately or severely defoliated in 2008 are likely to experience significant tree mortality in 2009. Permanent pheromone trap catches increased, to an average of 51.2 moths per trap. The highest trap catches were in the Heffley Creek, Six Mile, and Robbins Range areas (Table 12). Single traps were deployed to supplement the 6-trap sites and of 152 singlet traps placed, 30% (45 traps) had elevated moth counts of over 10 moths per trap. Three-tree larval beatings were conducted at 23 sites in the Similkameen and Cache Creek - Veasy Lake areas. An average of 37.5 larvae were collected per site, which is an increase from 2.9 larvae per site collected in 2007. Very high larval numbers (over 200 larvae per site) were collected in some of the sites near Hedley.

Nine areas were checked/sampled in the West Kootenays based on known 2008 defoliation and detailed helicopter surveys. Only 2 sites had tussock moth defoliation: Rock Creek and Bridesville, with the former having potential for expanded defoliation in 2009 as it occurred in a forested area. The defoliation which occurred in Bridesville, was single-tree defoliation on private property with little potential for expansion into forested areas. This area will be monitored in 2009.

Ground surveys were conducted on over 7,500 hectares in the fall of 2008, to delineate the distribution and estimate the magnitude of tussock moth populations. Surveys were conducted in 19 geographic locations in areas of historic tussock moth defoliation, with current defoliation, high trap catches, or reports of possible tussock moth activity. Population estimates (based on occurrence of new egg masses) were made for 5,600 sites within the area surveyed. 82% of all sites visited were positive for tussock moth, and 48% of all sites had high enough numbers of egg masses to indicate moderate to severe defoliation in 2009. The area with the greatest proportion of sites predicting severe defoliation was in the Similkameen (53%) (Table 14).

Table 11. Summary of single traps placed throughout the southern districts showing number of traps placed, the number catching more than 10 moths per trap and the average number of moths in these traps.

Location	# traps placed	# traps with >10 moths/trap	Average (of traps with >10 moths/trap)
Kamloops	52	9	21.1
Cascades (Merritt)	29	13	17.0
(Lillooet)	14	4	21.0
Okanagan Shuswap	57	19	17.7
Total	**152**	**45**	

Table 12. Average number of Douglas-fir tussock moths caught per 6-trap cluster from 2002 - 2008 in the Southern Interior Forest Region (Okanagan Shuswap, Cascades, and Kamloops Forest Districts).

		Average Trap Catches						
Site	**Location**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**
1	McLure	0.2	6.3	3.3	0.0	9.8	33.3	65.7
2	Heffley Creek	6.7	76.3	5.5	38.0	14.8	34.2	89.8
3	Inks Lake	7.8	30.0	1.5	0.3	10.2	5.6	58.8
4	Six Mile	3.5	67.0	9.7	33.6	52.5	73.5	73.3
5	Battle Creek	10.7	67.7	5.6	1.2	14.0	34.8	64.5
6	Barnes Lake	10.3	52.2	6.7	1.5	34.5	21.3	58.0
7	Carquille/Veasey Lk.	16.3	83.0	2.7	0.0	13.8	22.5	59.0
8	Pavilion	1.0	9.7	0.3	0.0	1.5	15.7	40.0
9	Stump Lake	0.0	3.2	1.2	3.8	2.8	8.7	61.8
10	Robbin's Range	3.5	10.7	13.8	40.2	18.3	80.5	75.2
11	Chase	28.0	36.3	11.2	9.3	0.0	0.0	25.3
12	Yankee Flats	1.7	1.0	0.3	2.0	0.0	0.0	38.5
13	Vernon	28.8	24.8	22.7	79.8	12.2	1.3	24.8
14	Winfield/Wood Lake	0.3	1.4	6.7	11.0	0.3	1.0	38.8
15	Kelowna	0.5	burned	burned	burned	burned	burned	burned
16	Summerland	1.5	0.0	0.0	4.5	1.0	0.3	43.5
17	Kaleden	1.2	0.3	0.3	18.6	11.6	29.0	55.4
18	Blue Lake	2.7	9.2	8.4	39.8	8.3	1.3	63.2
19	Stemwinder Park	2.5	1.2	1.0	29.5	1.5	17.8	40.2
20	Ashnola River	1.2	0.5	0.0	14.3	0.0	12.3	43.3
21	Spences Bridge	0.7	21.3	1.5	0.0	1.5	10.2	5.7
	Regional Average	6.1	25.1	5.1	16.4	10.4	20.2	51.2

Table 13. Average number of Douglas-fir tussock moths caught per trap (single trap per site) from 1994 - 2008.

	Forest District					
	Kamloops	**Okanagan Shuswap**			**Cascades**	
Year		**Salmon Arm**	**Vernon**	**Penticton**	**Merritt**	**Lillooet**
	(±30 traps[1])	(9 traps)	(±46 traps)	(27-30 traps)	(±30 traps)	(15 traps)
1994	19.5	NT	NT	NT	0.1	8.0
1995	10.4	NT	0.9	3.6	2.6	NT
1996	1.9	NT	1.5	4.4	1.9	1.2
1997	17.0	0.0	2.5	9.3	17.0	1.6
1998	25.8	0.0	10.6	24.4	25.8	4.9
1999	4.8	0.0	6.8	27.0	19.7	2.5
2000	3.6	2.9	5.9	19.3	17.0	2.0
2001	3.1	0.1	1.9	4.9	4.8	1.0
2002	15.2	2.0	5.6	6.6	13.8	2.4
2003	25.8	11.9	11.9	5.0	5.9	5.4
2004	18.7	6.0	9.8	4.9	4.2	2.0
2005	1.7	0	1.5	0.2	1.4	0
2006	3.7	0	1.6	0.3	2.1	0.4
2007	1.2	N/T	N/T	1.3	2.0	2.3
2008	10.9	2.3	7.9	7.7	8.9	8.6

[1]: in 2004, Kamloops changed from 100 sites to 30 sites.
[2]: NT= no traps placed

Table 14. Hectares surveyed for Douglas-fir tussock moth egg masses, by area, showing proportion of sites (%) visited falling into the various predicted defoliation categories.

Location	Hectares	Percent of sites in each defoliation prediction category					
	Surveyed	Nil	Cocoons	Very Low	Low	Moderate	Severe
Heffley	1,251	21	11	9	15	15	29
Jamieson Creek	434	23	3	5	10	17	42
Scheidam Lk	145	18	9	8	6	15	44
Pritchard	208	7	5	12	12	21	44
Six Mile	924	15	15	13	16	14	27
Iron Mask	561	24	7	6	13	11	40
Barnhartvale	2,977	19	10	10	15	15	31
Battle Creek	21	28	8	40	9	13	2
Barnes lake	19	14	10	31	17	17	10
Veasy Lake	8	29	12	35	12	12	0
Stump Lake 1	20	12	7	7	17	10	46
Stump Lake 2	15	25	25	50	0	0	0
Summerland	3	100	0	0	0	0	0
Kaleden 1	19	16	26	32	26	0	0
Kaleden 2	164	30	8	5	7	8	42
Stemwinder	77	5	14	22	7	29	23
Similkameen	121	9	7	4	11	17	53
Richter Pass	533	8	6	8	9	18	50
West Kootenays	63	82	7	0	0	4	7

Douglas-fir tussock moth defoliation near Beaton Road, Kamloops District.

2008 Douglas-fir Tussock Moth Virus Control Program

A total of 911 ha were treated with nuclear polyhedrosis virus (NPV) in the Kamloops area. Two formulations of the virus were used, Virtuss® (P.C.P. No. 17786, Canadian formulation) and TM Biocontrol-1® (P.C.P. No. 19293, USA formulation). The applications were done using a Hiller 12-E equipped with beecomist nozzles on a Simplex spray system. Areas with higher egg mass densities received full coverage of the virus mix, whereas areas with lower egg mass densities were treated using the alternate swath methodology. The total effective treatment area was 1,130 ha (Table 15). Virtuss was applied on 426 ha (10,640 grams NPV) in the Six-Mile, Beaton Road and Iron Mask areas. TM Biocontrol-1 was applied on 485 ha (2,185 grams NPV) in the Robbins Range and Heffley Creek areas. The two products were mixed on site with food grade molasses, lignosulphite and water. The mix was applied at 10 litres per ha. Virus should normally be applied immediately upon larval hatch and as larvae begin dispersing from the egg masses. However, this spring (2008), there was very heavy rain, so treatment was delayed and did not take place until June 11-12, 2008. Areas that had been defoliated in 2007 or had very high egg mass densities suffered significant defoliation from feeding larvae prior to the virus taking effect. Field checks on 15 July 2008, 5 weeks post-spray, revealed high levels of virus infection and larval mortality. Subsequent checks on 8 August 2008 showed that the virus had spread outside of some blocks into surrounding populations. Follow-up egg mass surveys revealed very low counts within treated blocks.

Virus treatments are being planned for approximately 3,000 ha in 2009. Many new areas within the historic range of tussock moth have high egg counts. Five new information pamphlets on tussock moth have been produced, and can be downloaded from the SIR Forest Health web site (www.for.gov.bc.ca/rsi/ForestHealth/Tussock_Moth_Information.htm).

Table 15. Area treated (ha) in 2008 with NPV (nuclear polyhedrosis virus) in the Kamloops area using two methods of application.

Virus Coverage	hectare-equivalents	Hectares
alternate swath	491.2	273.8
full coverage	639.1	639.1
Total ha	1,130.4	912.9

NPV - infected Douglas-fir tussock moth larva.

Two-Year Cycle Budworm, *Choristoneura biennis*

2008 was an "on" year in the feeding cycle of two-year cycle budworm, when larvae enter their second year of development. Populations appear to be increasing again in the southern portion of the Headwaters District. Defoliation was mapped on 54,136 hectares, most of which was in Wells Gray Park and surrounding areas. Small areas were lightly defoliated in the Quesnel, Central Cariboo, and 100 Mile House Districts.

Aspen Serpentine Leaf Miner, *Phyllocnistis populiella*

Aspen serpentine leaf miner was once again very common throughout the Cariboo, and defoliation was noted in nearly all aspen stands. No attempt was made to map it due to the difficulty of accurately quantifying its incidence over very large areas. Defoliation was mapped on 10,827 hectares in the Headwaters, Okanagan Shuswap, and Kamloops Districts; again, actual incidence at low levels is much greater than indicated by this total.

Aspen serpentine leaf miner defoliation in Wells Gray Park.

Larch Needle Blight, *Hypodermella laricis*

Larch needle blight damage declined slightly, from 13,540 hectares in 2007, to 12,285 hectares in 2008. Most of the defoliation was concentrated in the Rocky Mountain and Arrow Boundary Districts, in the Findlay Creek, Skookumchuck Creek, and Creston areas. Most of the larch stands that sustained severe defoliation in 2006 appear to be recovering.

Forest tent caterpillar, Malacosoma disstria.

Forest Tent Caterpillar, *Malacosoma disstria*

Forest tent caterpillar damage was recorded on 9,645 hectares, nearly 90% of which was classified as moderate or severe. Most of the affected area was east of Quesnel, along Highway 26; and along Highway 16 west of Tete Jaune Cache.

Gypsy Moth, *Lymantria dispar*

There were no positive pheromone trap catches in the Region in 2008.

Windthrow

Several significant windstorms during the fall of 2007 resulted in windthrow events. The most widespread of these was in the Okanagan Shuswap District, where nearly 1,700 hectares of pine and pine-spruce stands were windthrown south of Kelowna. Another large windthrow event in the Marble Range, south of Big Bar Lake, affected over 770 hectares of pine-spruce stands. Scattered smaller pockets of windthrow occured throughout the eastern parts of the Quesnel and Central Cariboo Districts, as well as the Rocky Mountain, Kootenay Lake, Arrow Boundary, Cascades, and Headwaters Districts. Total area mapped was 3,625 hectares, although many smaller and more scattered areas of blowdown likely went undetected.

Severe windthrow in mixed pine-spruce north of Chute Lake, Okanagan Shuswap District.

Wildfire

Due to the cooler than average spring and early summer, wildfire activity was low in 2008, with only 3,830 hectares affected.

Other

Other forest health factors observed during the aerial overview surveys included 738 hectares of birch leaf miner in the Okanagan Shuswap District, 127 hectares of satin moth, 73 hectares of landslide damage, and 85 hectares of flooding mortality. A mix of larch needle blight and Douglas-fir needle cast (*Rhabdocline pseudotsugae*) damaged 471 hectares of Douglas-fir - western larch in the Rocky Mountain District, and defoliation from an unknown cause was mapped on 697 hectares in the Arrow Boundary and Kootenay Lake Districts.

Nelson Area Summary

The Nelson portion of the 2008 aerial overview survey was conducted between July 21 and August 21, and required 116.8 hours over 22 days of flying. The surveys covered the Arrow Boundary, Columbia, Kootenay Lake, and Rocky Mountain Forest Districts, as well as all national parks. Surveyors initially attempted to begin the surveys on July 8th and 9th, but due to slow colour change in beetle-killed trees, the surveys were delayed. Weather conditions were generally good, with some smoke and haze in early August, resulting from wildfires in the U.S. Surveys were conducted by contract personnel (Neal Emery and Adam O'Grady of Nazca Consulting) and utilized Cessna 336 and 337 aircraft, operated by High Alpine Air Services and Kootenay Direct Airlines.

Arrow Boundary Forest District

Mountain Pine Beetle

Infested area more than doubled, from 41,143 hectares in 2007, to 88,166 hectares in 2008. Most of the increases were in the trace and light categories, although increases were seen in all infestation severity classes. Both the number of polygons, and the average polygon size, increased. The number of small spot infestations remained nearly unchanged, at 919 (11,375 trees). Expanded infestations in the Granby River, Inonoaklin River, Big Sheep Creek, Dog Creek, and Renata areas accounted for most of the increased area. A large increase in smaller, scattered areas of attack was seen all along the east side of Lower Arrow Lake, and throughout the Castlegar - Rossland area.

Scattered whitebark pine mortality was mapped on 587 hectares, and a few ponderosa pine were killed around Castelgar and the Boundary area.

Douglas-fir Beetle

A 2.75-fold increase in area affected (from 388 hectares in 2007, to 1,452 hectares in 2008) was a result of some smaller spot infestations coalescing into larger areas of light to moderate mortality near Midway. Increased activity was also seen in the Beaton area. In general, although the number of smaller more scattered infestations decreased (especially in the Kettle River area), Douglas-fir beetle is still active across much of the District.

Western Balsam Bark Beetle

Western balsam bark beetle continued to be active throughout the District; total area affected was down slightly from 12,555 hectares in 2007, to 10,540 hectares in 2008. Most of the affected area continued to be classified as trace and light.

Douglas-fir Tussock Moth

A few small, isolated pockets of defoliation were detected, in Rock Creek and Bridesville. No pheromone traps were deployed nearby, but ground surveys indicated high populations in the immediate areas.

A helicopter reconaissance covering the Salmo, Fruitvale, Montrose, Deer Park, Paulson, Christina Lake, Grand Forks, Greenwood and Midway areas detected little clearly identifiable defoliation. Ground surveys failed to find further evidence of tussock moth populations in these, and other areas of historical defoliation.

A small patch of severe Douglas-fir tussock moth defoliation on private land near Rock Creek, Arrow Boundary District.

Larch Needle Blight

The only detectable damage was in the McKinley Creek area, where 481 hectares of western larch were lightly defoliated. Most larch stands that were heavily affected in 2006 now appear to have recovered, and no further mortality has been observed.

Other

Other forest health factors detected were 11 hectares of forest tent caterpillar southwest of Nelson, 66 hectares of windthrow, and 345 hectares of wildfire. An unknown defoliating insect caused 421 hectares of light and moderate defoliation on Douglas-fir, in several small scattered pockets in the District. Ground checks were attempted at one location, but no samples suitable for identification were collected.

Columbia Forest District

Mountain Pine Beetle

The area affected by mountain pine beetle has increased by over 2.3-fold, to 41,084 hectares. Most of the increase was in the Field and Kootenay Crossing areas, in Yoho and Kootenay National Parks, and along the Kootenay River. In these areas, numerous smaller more lightly attacked polygons expanded into larger areas of red attack. Smaller infestations continue to be scattered throughout the Golden, Blaeberry River, Beaver River, Kinbasket Lake, Bachelor Creek, and Arrow Lake areas. An additional 1,540 trees were killed in 127 small spot infestations. Whitebark pine continued to be killed in scattered high elevation locations.

Western Balsam Bark Beetle

Total area affected declined from 9,814 hectares in 2007, to 5,083 hectares in 2008. Although mortality continues to be scattered across many high-elevation areas, most of the affected areas were around Golden, Yoho National Park, and Kootenay National Park.

Douglas-fir Beetle

Douglas-fir beetle activity increased, from only 129 hectares in 2007, to 1,895 hectares in 2008. Most of the mortality was in the Kootenay Crossing area, and near Revelstoke, in the Frisby Ridge and Woolsey Creek areas. Better timing of the aerial surveys to tree fade likely accounts for most of this apparent increase, as District staff indicate that Douglas-fir beetle populations have remained fairly static.

Spruce Beetle

151 hectares of spruce beetle was mapped in the Cummins River area. No other spruce beetle activity was observed in the District.

Western Hemlock Looper

No defoliation was detected during the aerial overview surveys. Trap catches at 11 permanent trapping locations increased to 25 male moths/trap. Three-tree beatings at these and 14 additional sites yielded only 8 larvae, however, trace levels of defoliation were visible from the ground at the Pitt Creek Rec Site and Beaver River sites. The causal agent was inconclusive, but may have been hemlock sawfly.

Other

Other forest health factors recorded were 241 hectares of forest tent caterpillar near Revelstoke, 47 hectares of flooding damage, and 58 hectares of slide damage.

Mountain pine beetle in the northern Rocky Mountain District.

Rocky Mountain Forest District

Mountain Pine Beetle

Total area of red attack more than doubled, from 45,150 hectares in 2007, to 99,410 hectares in 2008. The most significant increases were in the Cranbrook, Kimberly, Kootenay River, and Cross River areas. Along with this increase in area, there has been an increase in both the number of larger infestations recorded (from 1,113 polygons, to 1,357 polygons), and the average size of each infestation (from 40.6 hectares, to 73.3 hectares). The number of smaller spot infestations declined from 1,450 to 679.

Whitebark pine mortality increased slightly, from 4,095 hectares, to 5,030 hectares. This was scattered through the Selkirks, and in the Lussier River - Wild Horse River areas.

Douglas-Fir Beetle

Douglas-fir beetle populations remain active in the District, and red attack was mapped on 2,027 hectares. The number of spot infestations decreased, from 123 to 37, mainly due to decreased activity in the Kootenay National Park and Kootenay River areas. Decreased mortality was also seen in the Grassmere area. New infestations were observed in the vicinity of Gold Creek and Whiteswan Lake.

Western Balsam Bark Beetle

After a large increase in 2007, western balsam bark beetle mortality levels have fallen, from 13,073 hectares, to 8,000 hectares. Most of the affected areas were still classified as Trace or Light.

Spruce Beetle

Most of the spruce beetle activity in the District continues to be in Fenwick Creek, with a smaller infestation in the Flathead area. The total area mapped decreased from 1,090 hectares, to 791 hectares. Most of the affected area was classified as Severe.

Larch Needle Blight

Larch needle blight damage increased slightly, from 8,032 hectares in 2007, to 9,860 hectares in 2009. Defoliated stands were in the Findley Creek, Doctor Creek, Skookumchuck Creek, and Buhl Creek areas. Most of the defoliation was moderate to severe. A few mixed Douglas-fir - western larch stands near Wardner and Skookumchuck Creek were affected by both larch needle blight and Douglas-fir needle cast (*Rhabdocline pseudotsugae*).

Other

Forest tent caterpillar defoliated 130 hectares of aspen in the Redding Creek and Flathead River areas. Abiotic agents caused low levels of damage in 2008 - wildfire burned 651 hectares, and windthrow damaged 115 hectares.

Kootenay Lake Forest District

Mountain Pine Beetle

Significant increases in red attack (both in area, and in severity levels) were seen throughout the Nelson, Kaslo, and Riondel areas, and total area affected increased by 2.5-fold, to 55,139 hectares. Increases were also seen in the average polygon size. Polygon size more than doubled from 33.7 to 71.3 hectares between 2007-08. The number of spot infestations has dropped by a third, to 455 (6,225 trees), mainly due to a decrease in the number of spots in the southeast of the District. Infestations were widespread throughout most of the District.

Western Balsam Bark Beetle

Mortality levels dropped throughout the District; only 2,553 hectares of mostly Trace attack was mapped. Most of the affected area was near Summit Creek and Lardeau.

Douglas-Fir Beetle

Although Douglas-fir beetle activity increased in 2008, damage was still relatively limited - trace to light attack was mapped on 257 hectares, and only 31 spot infestations were detected. Most of the infested areas were in the Lardeau River, Ainsworth, and Wyndell areas.

Squirrel feeding on mistletoe infections causing damage to pine in Hawkins Creek, Kootenay Lake District.

Mountain pine beetle attack in West Arm Provincial Park, Kootenay Lake District.

Larch Needle Blight

Larch needle blight defoliated 1,944 hectares of western larch stands, in the Summit Creek - Corn Creek area. In 2007, most of the affected stands were in the Creston area.

Larch needle blight near Creston.

Other

An unknown defoliator on hemlock was observed in several scattered locations in the District in 2008. Damage was limited to 276 hectares of mostly light defoliation. Field checks were attempted at one location near Nelson; however, no positive identification of the causal agent was made. District staff observed a combination of mistletoe, and squirrel feeding causing damage to pine trees at Hawkins Creek.

Other forest health factors mapped during the overview surveys included 99 hectares of windthrow, and 571 hectares of wildfire.

Kamloops Area Summary

The Kamloops portion of the aerial overview surveys were conducted between July 21 - August 12 2008, and required 57.5 hours of flight time over 12 days. Surveys covered the Kamloops, Okanagan, Merritt, and Lillooet Timber Supply Areas. Weather conditions for the surveys were generally good, with most days being clear and cloud-free. Smoke from wildfires in the U.S. caused some haze issues in early August, which required relocating the survey areas for a few days. All surveys were conducted by Kevin Buxton (Ministry of Forests) and Janice Hodge (JCH Forest Pest Management), and utilized a Cessna 206 operated by Westair Aviation and a Cessna 205 operated by Southern Skies Aviation.

Kamloops Forest District

Mountain Pine Beetle

While mortality was still widespread across all susceptible stands in the District, overall area affected dropped by 23% to 232,270 hectares. Red attack levels also fell in most areas, with the proportion of attacked area classified as Moderate or Greater declining from 60% to 27%. The most apparent declines in red attack levels were in the Bonaparte Plateau, Tunkwa Lake, Forge Mountain, and Scottie Creek areas. This decline results from the depletion of available host material, as many of the stands in these areas have now lost the majority of their mature pine.

Extensive grey and red attacked pine, Molliman Lake, Kamloops District.

Red attack was seen in young pine stands (aged 20-40 years), throughout the Wentworth Creek, Watching Creek, Jamieson Creek, Mayson Lake, Bonaparte Lake, Community Lake, Barriere River, Georges Creek, Paxton Valley, Dardanelles Lake, and Lac le Jeune areas. In total, over 18,000 hectares of young pine stands were affected.

Mountain pine beetle attack in ponderosa pine has declined, both in overall area and red attack levels, most noticeably in the Kamloops, Kamloops Lake, Pritchard, and Barriere areas. Of the total area affected by mountain pine beetle, 34,168 hectares was in ponderosa pine stands (15% of the total), over 75% of which was classified as trace or light.

Spruce Beetle

Area affected by spruce beetle declined, from 1,721 hectares in 2007, to 1,095 hectares in 2008. Most of this decrease was in the Porcupine Ridge area. Mortality in the Sun Peaks area expanded into the upper Cahilty Creek area, and into the resort area. Aggressive salvage harvesting has removed much of the affected timber from the north side of Tod Mountain. Scattered pockets of spruce beetle continue to be active in the upper Hat Creek area as well.

Western Balsam Bark Beetle

Affected area was up from 5,293 hectares to 9,742 hectares,due to a large increase in mortality in the Porcupine Ridge-Upper Wentworth Creek area. Over the last 2-3 years, severe mountain pine beetle attack in mixed lodgepole pine/subalpine fir stands has masked much of the western balsam bark beetle mortality on the Bonaparte Plateau. Scattered mortality continued to be observed across the northeast of the District, in the Barriere Lakes, Chu Chu Creek, and Nikwikwai Creek areas.

Douglas-fir Beetle

Douglas-fir beetle activity appears to be on the increase, across much of the District. Light and moderate mortality was mapped on 844 hectares (a 3.6-fold increase over 2007 levels), and 222 smaller spot infestations killed another 2,575 trees (a 4-fold increase from 2007). Many new small spot infestations were mapped throughout the Deadman River - Sabiston Creek area, and along the North Thompson between Barriere and Clearwater. Infestations also increased in the Paul Lake, Heffley Creek, Louis Creek, Adams Lake, Pass Lake, and Oregon Jack areas. Tree fade was well timed with the aerial surveys this year.

Western Spruce Budworm

Defoliated area remained almost unchanged, at 124,616 hectares. Nearly all of the defoliated area was classified as light. Damage levels declined in the Criss Creek-Sabiston Creek area, which were treated with *B.t.k.* in 2007. Just under 23,000 hectares were treated with *B.t.k.* in the District in 2008, and defoliation levels were reduced in some of the treated areas near Harper Mountain, Pinantan Lake, Heffley Creek, and Monte Creek. Defoliation expanded in the Watching Creek, Pass Lake, Dairly Creek, Jamieson Creek, Sullivan Lake, and Scottie Creek areas. Egg mass sampling conducted in the fall of 2008 indicate that budworm defoliation will be widespread again in 2009, with the highest populations in the Cache Creek, Ashcroft, Walhachin, Dairy Creek, and Heffley Creek areas.

Douglas-fir Tussock Moth

Douglas-fir tussock moth populations contined to increase sharply in several locations, and defoliation was visible on 2,249 hectares. A spray program was conducted in June, and 1,130 hectares were treated with nuclear polyhedrosis virus (see page 19 of this report). Due to the slow-acting nature of the virus, most of the sprayed areas suffered some damage, but these locations should not require further treatment. Ground surveys conducted through the fall helped to pinpoint areas where high populations will occur in 2009; these areas include Heffley Creek, Jamieson Creek, Barnhartvale, Rose Hill, Ironmask, Cherry Creek, and Six Mile. High priority areas will be considered for further virus treatments in 2009.

A young Douglas-fir severely defoliated by Douglas-fir tussock moth near Kamloops.

Other

Other forest health factors included 469 hectares of aspen serpentine leaf miner defoliation, and 75 hectares of wildfire.

Cascades Forest District

Mountain Pine Beetle

Affected area has increased slightly, from 320,060 hectares in 2007, to 370,871 hectares in 2008. The increased attack was all in the trace and light categories; the area classified as moderate or greater decreased. Mature lodgepole pine mortality increased in the south central portion of the Merritt TSA (in the Kingsvale, Aspen Grove, and Rampart Creek areas), and in parts of the Lillooet TSA (the Yalakom River and Bridge River areas). In much of the northern part of the Merritt TSA, red attack levls have begun to decline as the available mature lodgepole pine has become depleted. A relatively late and non-synchronous beetle flight in 2007 also contributed to lower red attack levels in many areas.

Extensive new attack near Pennask Lake, Cascades District.

The area of attack in other pine species, namely ponderosa pine, has increased substantially. Nearly 72,000 hectares of ponderosa pine were attacked, which is a five-fold increase from 2007 area. A huge increase in both the area, and severity, of attack was seen throughout the Merritt, lower Coldwater River, Kingsvale, Nicola River, Thompson River, and Fraser River areas. Widespread, but scattered ponderosa pine mortality was seen in theTulameen, Allison Creek, and Princeton areas. Whitebark pine continued to be attacked by mountain pine beetle in scattered areas throughout the Kwoiek Creek, Texas Creek, Stein River, Cayoosh Creek, and Bridge River areas.

Younger lodgepole pine stands (20-50 years of age, mostly plantations) sustained attack on 1,838 hectares, which was scattered in the Rush Creek, Glimpse Lake, Surrey Lake, Ketchan Lake, and Spius Creek areas.

Ponderosa pine mortality resulting from mountain pine beetle attack in the Fraser Canyon, Cascades District.

Extensive new mountain pine beetle attack, Pimainus Creek, Cascades District.

Western Balsam Bark Beetle

Although western balsam bark beetle remained active in many areas, overall affected area declined to 8,581 hectares. Mortality levels fell in most of the Merritt TSA, especially in the Siwash Lake, Alaric Creek, Tulameen river, Maka Creek, and Spius Creek areas.

Douglas-fir Beetle

Douglas-fir beetle mortality increased from 41 hectares in 2007, to 468 hectares in 2008. A firther 890 trees were killed in 82 small spot infestations. Most of attack was in the Big Bar, Lillooet, Downton Lake, and Bridge River areas.

Spruce Beetle

A total of 3,384 hectares of attack were mapped, up from 1,656 hectares in 2007. An increase in spruce beetle activity was seen in the Cayoosh Range, especially in the Lost Valley Creek, Copper Creek, Cinnamon Creek, and Phair Creek areas. There was also an increase in small, scattered pockets of attack in the Yalakom River and Shulaps Range. An ongoing infestation in the Flat Top Mountain area continued, and a new infestation was detected in Arthur Seat Provincial Park.

Spruce beetle in Arthur Seat Provincial Park, Cascades District.

Western Spruce Budworm

A cool spring in 2008 resulted in delayed larval dispersal across much of the District. Larval development was not well synchronized with bud development, and damage levels were reduced, especially throughout much of the Lillooet TSA, and higher elevation sites in the Merritt TSA. The visibly defoliated area fell by 35%, to 127,940 hectares, and the proportion of defoliated area classified as moderate or severe by aerial survey standards fell from 22% in 2007, to 1.5% in 2008. It is important to note, that in multi-layered stands, aerial surveys detect overstorey tree defolitation much more readily than understorey defoliation. Many sites have sustained high levels of damage to the understorey layers due to several successive years of larval feeding, even though damage to the overstorey layer has been much lower. Several high priority sites with high levels of understorey damage were treated with *B.t.k.* in June and July in the Nicola Lake, Missezula Lake, Larsen Hill, and Coquihalla Toll Booth areas. Treated area totalled 5,760 hectares.

A Lama 315B helicopter applying B.t.k. near the Coquihalla Toll Booth, Cascades District.

Egg mass surveys conducted in October indicate that budworm populations will be variable but widespread in 2009. Over 98% of the sites surveyed were positive for egg masses, with most sites predicting light to moderate defoliation.

Douglas-fir Tussock Moth

Douglas-fir tussock moth populations increased to outbreak levels, and aerial surveys recorded 117 hectares of defoliation. The damage was localized near Hedley, in and around Stemwinder Provincial Park, Chuchuwayha Indian Reserve 2, and Ashnola Indian Reserve 10, and was limited to stands along the valley bottom, close to the Similkameen River. Ground surveys conducted during the fall indicate that high larval populations will occur in the area in 2009, and much more severe levels of defoliation are expected. Nearly all of the defoliation is predicted to occur on private land and Indian Reserve in 2009. This, along with the proximity of the Similkameen River to these areas, puts constaints on aerial treatment options.

Douglas-fir tussock moth defoliation beside Highway 3, south of Hedley, Cascades District.

Other

Other forest health factors detected during the overview surveys were 226 hectares of wildfire, and 22 hectares of windthrow near Texas Creek.

Okanagan Shuswap Forest District

Mountain Pine Beetle

Mountain pine beetle red attack increased from 153,352 hectres in 2007, to 171,075 hectares in 2008. The largest expansions were west of Okanagan Lake between Peachland Creek and Trout Creek, where extensive new infestations were mapped. Other "hot spots" were in the McCulloch Lakes, Highway 33, Harris Creek, Ferry Creek, Kettle River, Cherry Creek, and Sugar Lake areas. The most extensive moderate and severe red attack occurred throughout the west-central areas of the District, near Tahaetkun Mountain, Barton Lake, Whiterocks Mountain, and Headwaters Lakes. Populations are very active across most of the District, except for areas around Weyman Creek, Falkland, and Chase Creek, where red attack levels have declined sharply due to host depletion. A relatively drawn-out and late beetle flight in most areas of the District (beginning in July, and continuing well into September) resulted in lower green:red ratios, and may lead to reduced brood production and survival over the winter.

Extensive red attack and salvage harvesting in the upper Nicola River, Okanagan Shuswap District.

Ponderosa pine continued to be attacked by both mountain pine beetle and western pine beetle, and mortality was mapped on 11,110 hectares. There was a significant increase in attack all along the west side of Okanagan Lake, from Deep Creek south to Summerland. High levels of attack continued in the Westwold - Falkland area, and was also scattered through the Enderby, Armstrong, and Lumby areas. Western pine beetle is active in many of these stands. Mountain pine beetle attack in ponderosa pine is still spotty in the south of the District, as beetle pressure is not yet high. Much of the mature ponderosa pine near Chase has been killed and attack levels have declined in the area.

A young pine stand in the Fly Hills area, exhibiting a mixture of new and one year old attack.

Whitebark pine was killed over a 165 hectare area in Snowy Protected Area, and western white pine was killed on 78 hectares in the Crazy Creek and Perry River drainages.

Douglas-fir Beetle

Red attack was mapped on 356 hectares, an increase from the 59 hectares mapped in 2007. An additional 125 small spot infestations killed 1,295 trees. Activity was seen in the Scotch Creek, Shuswap Lake, Chase, Cherryville, Mission Creek, Naramata, Shuttleworth Creek, Vaseaux Creek, and Eneal Lakes areas. District personnel indicate that beetle populations have been generally static, and that good timing between tree fade and the aerial surveys accounted for the apparent increase.

Spruce Beetle

Most spruce beetle activity continued to be in and around Cathedral Park and Snowy Protected Area. Some of the infestations in the Ashnola area probably related to mortality from the 2006 wildfires. The overall mapped area was 3,897 hectares, down from 5,874 hectares in 2007. This does not seem to reflect the increase that District staff have been observing in the field. Most attacked trees north of the Ashnola were still green in July and August, and would not have been picked up from the air. Ground surveys indicate that the infestation has been moving north, and some harvesting is scheduled for this winter in the Young Creek area.

Spruce beetle-attacked trees exhibiting typical woodpecker feeding, Ashnola River, Okanagan Shuswap District.

Western Balsam Bark Beetle

Western balsam bark beetle populations have been active across much of the District for many years, especially in the Greystokes, Mission Creek, Upper Kettle River, Winnifred Creek, Shuswap Highlands, and Hunters Range areas. More scattered mortality was also mapped in the Mabel Lake, Sugar Lake, and Apex Mountain areas. Infestations in the Pennask Mountain and Tahaetkun Mountain areas appear to be declining, although new mountain pine beetle infestations masked much of the balsam bark beetle activity in these locations.

Douglas-fir Tussock Moth

Populations of Douglas-fir tussock moth are increasing in the South Okanagan. Defoliation was visible in the Richter Pass, Kaleden, and Shoemaker Creek (Lucky R Trailer Park) areas, the majority of which was on private land or within the South Okanagan Grasslands Protected Area. Ground surveys indicate that severe defoliation will occur in the Kaleden and Richter Pass areas in 2009. Pheromone trap catches (both 6-trap clusters, and the single trap sites) were up, particularly across the South Okanagan. Trap catches also increased in the Central Okanagan, and populations are expected to continue increasing in 2009. Control with NPV is being considered in some areas, but treatment options are limited because of the private land and provincial park status of most of the affected areas.

Western Spruce Budworm

Budworm populations increased and expanded across much of the District, and defoliated area increased 2.5-fold from 2007 levels, to 74,411 hectares. Damage was recorded all along the west side of Okanagan Lake, and throughout the Shingle Creek, Marron Valley, Orofino Mountain, and Mount Kobau areas. Scattered pockets of defoliation were also seen in the Scotch Creek, Chase Creek, Shuswap, Whiteman Creek, and Coldstream areas. Defoliation levels were markedly reduced in the Westwold area, following a successful 4,316 hectare *B.t.k.* spray program in June. Egg mass surveys were conducted at 69 sites in the fall, and the highest budworm populations in 2009 are predicted to be in the Trout Creek and Peachland creek areas.

Western spruce budworm defoliation on Mount Kobau, Okanagan Shuswap District.

Western Hemlock Looper

Light defoliation was detected in three small pockets, near Keefer Lake, Hunters Creek, and Three Valley Gap. Total affected area was 68 hectares. Average pheromone trap catches increased to 203 moths per 6-trap cluster, with the highest catches at the Noisy Creek and Adams River sites (Table __). Three-tree beatings collected very few larvae, which indicates that although populations are increasing, densities are still low and widespread defoliation should not be expected in 2009.

Aspen Serpentine Leaf Miner

Trembling aspen was defoliated by aspen serpentine leaf miner on 1,585 hectares. Most of the damage was along the north side of Shuswap Lake, in the Ross Creek and Five Mile Creek areas. Smaller pockets of defoliation were detected in the Perry River and Seymour River areas. Most of the defoliation was light, and no long term damage is expected.

Windthrow

A major wind event in November 2007 resulted in extensive windthrow near Kelowna. Nearly 1,700 hectares of pine and pine-spruce stands were windthrown in the Bellevue and KLO Creek area. Much of this windthrown timber is being salvage harvested and this should reduce the risk of spruce beetle buildup. Scattered pockets of pine windthrow also occurred east of Penticton, at Mount Christie and Shuttleworth Creek. A few smaller areas of windthrow were detected north of Sugar Lake along the Seymour River, where hemlock, cedar and spruce were affected.

Other

Other disturbances mapped were 738 hectares of birch leaf miner (near Sugar Lake, and Scotch Creek), 253 hectares of wildfire, and 14 hectares of flooding damage.

Severe windthrow in mixed pine-spruce north of Chute Lake, Okanagan Shuswap District.

Mountain Pine Beetle

After several years of expanding infestations, levels have begun to decline, mainly due to host depletion. This is most evident in the south of the District, where severity levels, in addition to infested area, are declining. Affected area dropped by one-third in 2008, to 164,464 hectares. Most of the decline in the south part of the District was due to host depletion in Wells Gray Park, Clearwater River, TFL #18, Birch Island, Vavenby, Adams Lake, and Adams River. Decreased red attack area was also seen in the Robson Valley, most notably along the Fraser River between Valemount and McBride, and in Mount Robson Park. Areas in the Robson TSA that are close to the B.C. - Alberta border are showing relatively static red attack levels. Most of the affected area in the Robson Vally continued to be classified as light or trace; however, a significant increase in red attack was seen in the Dunster area, where a large area as classified as very severe. Both overall infested area, and red attack levels, are expected to continue declining next year especially in the south, as available mature pine is further depleted. Mature healthy pine is still abundant in the Valemount area, and there is potential for infestation levels to increase in this area.

Red attack was observed in many young pine plantations, in the TFL #18, Vavenby, and Blue River areas. A large area of 40 year old fire-regenerated pine was severely attacked in the lower Raft River area. Overall, just over 6,000 hectares of young pine stands were affected.

Whitebark pine mortality was common in higher elevation areas in the Cariboo Mountains, in the Raush River, Castle Creek, and Dore River areas.

Western Balsam Bark Beetle

Very little western balsam bark beetle was mapped in the Robson TSA, and as a result the overall affected area in the district dropped from 90,240 hectares in 2007, to 24,027 hectares in 2008. In the south, mortality was scattered across the Wells Gray Park, Raft River, Avola, Vavenby, and Adams River areas. Nearly 95% of the mortality was classified as Trace.

Severe attack in young pine near Clearwater, Headwaters District.

Spruce Beetle

Spruce beetle mortality increased in the Dawson Creek -Baker Creek area, where nearly 1,000 hectares were infested. Several small, scattered infestations were mapped west of Clearwater Lake and Hobson Lake, and the infestation near Gollen Creek killed trees on just over 200 hectares.

Douglas-fir Beetle

Douglas-fir beetle activity remains low in the District. Surveys detected small infestations in the Dawson Creek, Mount Robson Park, Mount MacLennan, Vavenby, and Blackpool areas. Overall, 167 hectares, and 17 additional small spot infestations, were mapped.

Western Spruce Budworm

Defoliation was mapped in scattered pockets, in the Blackpool, Mann Creek, Green Mountain, and Gollen Creek areas. Affected area totalled 2,290 hectares, all of which was Light. This represents over threefold increase from 2007 levels of 620 hectares. Eggmass sampling conducted during the fall indicate that populations should remain generally low and spotty in 2009.

Two-Year Cycle Budworm

After declining from the last peak in 2000, populations of two-year cycle budworm are on the increase in the southern portion of the District. Defoliation was mapped on 51,038 hectares (up from 10,479 hectares in 2006, the last "on" year in the feeding cycle), and was scattered at high elevations throughout Wells Gray Park, and in the North Thompson River, Mad River, Raft River, and TFL #18 areas.

Two-year cycle budworm defoliation near Valemount, Headwaters District.

Western Hemlock Looper

Light defoliation was mapped on 469 hectares along the east side of Hobson Lake, in Wells Gray Park. Pheromone trap catches were up sharply at the 5 permanent trapping sites, to an average of 553 moths per 6 trap cluster (Table __). The highest trap catches were at the Thunder River, Murtle Lake Road, and Finn Creek sites, which indicates that defoliation may occur in the Blue River areas within the next 1-2 years. There has been no significant defoliation in the North Thompson or Fraser River high hemlock looper hazard areas since the 1991 - 1993 outbreak.

Aspen Serpentine Leaf Miner

Aspen serpentine leaf miner populations were high enough to produce visible defoliation in some areas, especially in the lower Wells Gray Park, Mann Creek, and Cayenne Creek areas. This defoliator is typically present in most aspen stands in the District, but damage levels are often low and difficult to detect from the air.

Dothistroma Needle Blight

A reconnaissance flight conducted by Regional Pathologists in June of 2007 identified several sites where lodgepole pine was being damaged, in the Holmes River, Castle Creek, Kinbasket Lake, and North Thompson River areas. Little damage has been observed during the aerial overview surveys as it is very difficult to identify from the elevation at which the surveys are conducted.

Other

Other abiotic disturbances observed during the overview surveys were 106 hectares of wildfire, and 85 hectares of flood damage.

Cariboo Area Summary

The Cariboo portion of the aerial overview surveys began on July 11 and finished August 15. Two contract crews surveyed the area encompassed by the Quesnel, Central Cariboo, 100 Mile House and Chilcotin Forest Districts as well as the Robson Valley TSA portion of the Headwaters Forest District. A total of 180.2 hours of aircraft time over 27 crew-days were expended to map this area, which included a portion of the Mid-Coast Forest District in the Coast Forest Region. Approximately 23 hours (4 crew days) of the total were spent flying portions of the Coast Region. In October, an additional 34.4 hours over 6 days, were spent completing unsurveyed areas in the Northern Interior Forest Region. Surveys were conducted by contract personnel (Joe Cortese, Don Wright, Mikko Sapponen, and Bob Erickson) and utilized Cessna 180, 185, and 206 aircraft.

Quesnel Forest District

Mountain Pine Beetle

Overall infested area in the District fell by nearly 40%, to 712,727 hectares. Mature pine has been severely depleted in most areas, and as a consequence, red attack severity levels have continued to drop sharply. Over 80% of the area was classified as Trace or Light, with only 4% of the infested area classified as Severe or Very Severe. The outbreak decline has been most evident across most of the central and eastern portions of the District. In west Quesnel District, most of the land base is still Light or Trace mountain pine beetle attack. There are some extensive areas of Moderate to Severe attack in the Baldface Mountain, Itcha Mountain, upper Coglistiko River, and upper Baezaeko River areas.

Many stands in the west part of the District are comprised of a significant sub-dominant pine component. In the early years of the outbreak, the overstorey component was killed by mountain pine beetle. Subsequently, as the beetle has run out of host material, this subdominant lodgepole pine component is now being attacked by both mountain pine beetle and *Ips* beetle. Mortality in young pine plantations under 40 years of age remains high, with over 45,000 hectares still showing red attack in 2008. Affected plantations were recorded throughout the Snaking River, Baker Creek, Pantage Lake, Narcosli Creek, Sardine Creek, and Swift River areas.

Extensive areas of grey pine are now common in the Quesnel District.

Spruce Beetle

A spruce beetle infestation in the Swift River area has continued to decline to 1,248 hectares. The widespread trace mortality of 2006 appears to have subsided. Although beetles have been building up in scattered windthrow for the past few years, in most areas populations do not appear to have risen high enough to attack much standing timber. A lack of available host in many areas in the east of the District may also be limiting population growth.

Douglas-fir Beetle

Overall affected area was down, from 7,560 hectares in 2007, to 4,435 hectares in 2008. However, in 2008, 38% of the affected area was classified as Moderate, Severe, or Very Severe, as compared to only 9% 2007. At the same time, the number of small spot infestations has continued to increase, from 88 (1,380 trees) in 2007, to 221 (2,485 trees) in 2008. These numbers indicate that Douglas-fir beetle populations are increasing. Most of the affected areas were along the Fraser River, especially near the confluence of the Fraser and the Blackwater. Several new, small infestations were mapped in the Nazko area.

Western Balsam Bark Beetle

Populations appear to be down across most of the District - affected area fell by nearly 95%, to just 5,977 hectares. Most of the remaining infested area was classified as Trace.

Western Spruce Budworm

Western spruce budworm populations increased along the Fraser River south of Quesnel, and 9,435 hectares were lightly defoliated. This is the most northerly record of visible defoliation by budworm, and the first time since 2003 - 2005 that defoliation has been detected in the District. No egg mass surveys were conducted.

Two-year Cycle Budworm

The only detectable defoliation was along the east side of Isaac Lake, in Bowron Lakes Park. 2008 was an “on” year in the feeding cycle of two-year cycle budworm, and this very low level of damage suggests that populations have declined to endemic levels in most areas.

Forest Tent Caterpillar

Forest tent caterpillar defoliated aspen stands on 8,345 hectares in the Cottonwood River, Frye Creek, and Kersley Creek areas. Much of the defoliation was moderate to severe, however, little permanent damage is expected.

Other

Aspen serpentine leaf miner was once again very widespread, and defoliation was noted in nearly all aspen stands. No attempt was made to map it due to the difficulty of accurately quantifying its incidence over very large areas.

Wildfire damage was recorded on 437 hectares.

Central Cariboo Forest District

Mountain Pine Beetle

After peaking at 843,690 hectares in 2007, red attack area in the District has begun to decline, to 602,222 hectares in 2008. Affected area dropped throughout the Beaver Creek, Big Lake, Cariboo River, Horsefly, Quesnel Lake, Mackin Creek, and Meldrum Creek areas, where most of the available mature pine has been killed. At the same time, red attack rates fell sharply in the southwest portion of the District - the widespread areas that were classified as Severe and Very Severe in 2007, were mostly classified as Light or Moderate in 2008.

Red attack in younger pine stands was widespread across most of the District, and was mapped on 113,447 hectares. Much of this younger attacked pine was remnant, sub-dominant or understorey trees in otherwise mature stands that have had their overstorey killed. These trees are now being killed by mountain pine beetle, *Ips* beetles, and other secondary beetles.

Douglas-fir Beetle

Douglas-fir beetle populations have continued to expand throughout the District, and tree mortality is occurring in almost all areas with a significant Douglas-fir component. Red attack was mapped on 53,390 hectares, up from 47,760 in 2007. Most of this attack area continues to be classified as Trace. As well, the number of small spot infestations has increased from 542 in 2007, to 951 in 2008. The most significant increases in attack were in the Meldrum Creek, Springhouse, and Churn Creek areas.

Spruce Beetle

Spruce beetle activity has continued to decline from 30,000 hectares in 2006 to 6,005 hectares in 2008. Areas with decreased but still active infestations included Niagra Creek, Horsefly River, Miner Lake, Bootjack Lake, and Potato Mountain. The large, severe infestation in McKusky Creek area appears to have collapsed, but new infestations were observed in the Molybdenite Creek and Tisdall Lake areas. This general decline may be due to multiple factors: depletion of available host material and less scattered windthrow over the last few years

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Western Balsam Bark Beetle

Western balsam bark beetle populations appear to be declining. Trace and Light attack was mapped on 20,976 hectares, in scattered areas around Quesnel Lake, Moffat Lake, and the upper Horsefly River.

Western Spruce Budworm

Western spruce budworm continues to be widespread across the District, and defoliation was mapped on 211,982 hectares. Damage levels decreased in the Meldrum Creek, Chimney Lake, and Empire Valley areas, while defoliation spread into the McCleese Lake and Soda Creek areas. 8,746 hectares of high-priority stands were treated with *Btk* in the District in 2008, near Williams Lake, Joe's Lake, Farwell Creek, and Gaspard Creek. Budworm defoliation is expected to be widespread again in 2009, with the most damage being in the Chimney creek, Bingam Creek, Dog Creek, Alkali Creek, Pine Valley, Soda Creek, and Gaspard Creek areas.

Other

Other forest health factors detected during the aerial surveys were 956 hectares of light two-year cycle budworm defoliation north of Keithley Creek, 360 hectares of scattered windthrow, and 413 hectares of wildfire.

Heavy mortality in spruce following several years of spruce beetle attack.

Chilcotin Forest District

Mountain Pine Beetle

Mountain pine beetle red attack levels began to decline across most of the District, after peaking in 2007. Although red attack is still present in nearly all pine stands in the District (total area was just over 1.5 million hectares - over half of the total District land base), the proportion of attacked area classified as moderate or greater fell from nearly 75%, to less than 10%. No areas were rated as Very Severe. Nearly all of the extensive areas in the central portion of the District rated as Moderate attack in 2007, were rated as Trace and Light in 2008. Moderate red attack was still mapped in the Itcha-Ilgatchuz, Punkutlaenkut Lake, Kleena Kleene, and upper Taseko River areas. Attack in young pine was mostly limited to the Hanceville and Alex Graham area, where remnant understorey trees were killed by mountain pine beetle, *Ips*, and other secondary beetles.

Western Balsam Bark Beetle

Western balsam bark beetle continues to be confined to the Coast and Chilcotin Mountains. Trace and Light attack was mapped on 19,685 hectares.

Spruce Beetle

Spruce beetle populations continue to be low. 327 hectares of Trace and Light attack were mapped in the Mosley Creek and Chilko Lake areas.

Douglas-fir Beetle

Douglas-fir beetle populations continued to expand in 2008. Overall area was up by 50% to 15,162 hectares, and the number of additional small, spot infestations has increased from 88 to 291. Increased mortality was seen all through the Big Creek, Kloh Lake, Hanceville, Alexis Creek, and Redstone areas. New infestations were detected in the Taseko River, Chilko River, Sapeye Lake, Tatlayoko Lake, Klinaklini River, and McClinchy Lake areas. The new infestations in the Klinaklini River and McClinchy Lake areas were likely a result of beetle populations building up in timber damaged by the 2004 Kleena Kleene and Lonesome Lake fires, while chronic western spruce budworm activity has been contributing to the increased damage in other areas.

Douglas-fir beetle.

Scattered mountain pine beetle mortality at high elevation in the South Chilcotin Mountains. The current year's red attack is clearly discernible from older, more dull-coloured trees in this photograph.

Western Spruce Budworm

Western spruce budworm damage declined in the Puntzi Lake-Pyper Lake area, and was no longer visible from the air. Defoliation was widespread along the Chilcotin River corridor, and moderate to severe defoliation occurred near Alexis Creek and Lees Corner. Total defoliated area was down by 30% to 40,947 hectares. 1,468 hectares of high-priority, chronically defoliated Douglas-fir near Alexis Creek was aerially treated with *B.t.k.* in June. This treatment appears to have reduced damage levels within the spray blocks. Moderate to severe defoliation is expected in the Alexis Creek and Haines Creek areas in 2009, while light to moderate defoliation is expected in most other areas along the Chilcotin River.

Other

Satin moth defoliated 127 hectares of aspen along the east side of Chilko Lake (near Nemiah Creek). Several small, scattered wildfires burned 120 hectares near Tatlayoko Lake. Slide damage was mapped on 15 hectares.

100 Mile House Forest District

Mountain Pine Beetle

Overall infested area has remained nearly unchanged for the third year in a row, at 742,076 hectares - just over 60% of the entire District land base. However, the area classified as moderate, severe, or very severe fell for the second year in a row, from a high of 438,340 hectares in 2006, to just over 200,000 hectares in 2008. Red attack levels have fallen in nearly all areas of the District, especially in the Marble Range, Green Lake, Murphy Lake, Jim Creek, and Windy Creek areas. Most of the attack in the northern portion of the District is now Trace. Considerable areas of severe and very severe attack still exist around HiHium Lake, Eagan Lake, Bonaparte Lake, and Hathaway Lake. Young pine stands continued to be affected, and just over 80,000 hectares showed visible red attack.

Mountain pine beetle continued to attack ponderosa pine, throughout the valley bottoms in the Kelly Lake, Clinton, Bonaparte River, and Fraser River areas. This attack in ponderosa pine accounted for 15,755 hectares of the total area affected.

Severely attacked pine stands south of Bonaparte Lake, on the border of Kamloops and 100 Mile House Districts.

Douglas-fir Beetle

Douglas-fir beetle populations have continued to expand. Total infested area was up by 35% to 13,160 hectares (68% of which was classified as Trace), while the number of small spot infestations increased from 226 to 360. Increased activity was seen in the Lac La Hache, Forest Grove, Canim Lake, Clinton, Bonaparte River, Loon Lake, and Vidette Lake areas. Infestation levels remained relatively stable in the Canoe Creek and Big Bar Creek areas.

Spruce Beetle

Spruce beetle activity has continued to decline, as in most other areas of the Cariboo. Affected area fell from 8,643 hectares in 2007, to 2,000 hectares in 2008. Nearly 75% of the infested area was classified as Trace attack. The remaining beetle activity was in the Boss Creek, Deception Creek, and Hendrix Creek areas.

Western Balsam Bark Beetle

All mortality continued to be confined to higher elevations in the northeast part of the District, near Boss Creek, Mt. Hendrix, and Deception Creek. Trace and Light attack was mapped on 10,540 hectares, down from 19,233 hectares in 2007.

Western Spruce Budworm

Budworm populations continued to be high across much of the District. Defoliation was mapped on 174,605 hectares, up slightly from 2007 levels of 165,995 hectares. Defoliation expanded into the Dog Creek area, and the most severe damage was in the Loon Lake, Meadow Creek, Canoe Creek, and Big Bar Creek areas.

An agressive spray program using aerially applied *B.t.k.* was carried out in June, on 19,510 hectares. The treatments appear to have been successful, as egg mass survey results predict only light defoliation within the sprayed areas in 2009. Moderate defoliation is expected to occur in the Loon Lake, Kelly Lake, Canoe Creek, and Dog Creek areas in 2009.

Conair AT-802 applying B.t.k.

Douglas-fir Tussock Moth

Pheromone traps were deployed in 6-trap clusters, at 24 sites in the District. The average catch was only 2.5 moths per trap; this indicates that populations are still low and no defoliation should occur in 2009.

Other

A large windthrow event in the Marble Range, south of Big Bar Lake, affected over 770 hectares of pine-spruce stands. Two-year cycle budworm defoliated a small area (328 hectares) south of Mahood Lake, and a few small wildfires burned 650 hectares.

A few days prior to Christmas 2008, heavy snowfall and freezing rain caused heavy damage to timber across much of the northern area of the District. Trees up to and over 40 cm DBH were affected, which may result in Douglas-fir beetle and spruce beetle populations building up in the fallen trees.

Snow and ice breakage near 108 Mile House.

Forest Health Projects

Summary Of 2007-2008 Bark Beetle Overwintering Mortality Estimates

Overwintering mortality sampling is conducted annually to provide an estimate of beetle population trends, and brood success and survival. A standard methodology for sample collection and evaluation is used, as referenced in the 2004 version of this report (available in .pdf format from <http://www.for.gov.bc.ca/rsi/ForestHealth/overview_reports/Overview_2004.html>). In 2008, an updated, standardized methodology was implemented, where two bark samples were taken from each of the north and south aspects of sample trees. Samples were obtained by using a 4-inch (10 cm) hole saw and a gas-powered drill.

Two numbers are generated for each sample, the R-value and the % brood mortality. The R-value is a measure of the ratio of successful beetle progeny to initial attack rates, and is a good indicator of population trends. Any R-value greater that 4.0 indicates a generally increasing population. The % mortality is a direct measure of the brood mortality up until the time of sampling, which is usually conducted in March, after most winter mortality has occurred.

Mountain Pine Beetle

Mountain pine beetle brood mortality must reach annual levels of 97% in order for the population to decline significantly. Winter mortality usually accounts for the majority of annual brood mortality. Winter mortality rates below 70% have little effect on population growth rates. During March - April of 2008, extensive sampling for mountain pine beetle was conducted in all Districts, at a total of 178 sites. Of these, 36 sites were in young lodgepole pine stands (20-40 years of age).

Mountain pine beetle overwintering mortality rates were higher over the 2007-2008 winter than during the past several winters. Brood mortality in mature pine averaged 73.2 % across the Region, with the highest mortality in the Central Cariboo District and Lillooet TSA. Brood mortality was lower in the Kootenays and the Robson Valley. Brood mortality was generally very high (at or near 100%) in young pine in most areas. R-values in mature pine were below 4.0 in all Districts, except for the Robson Valley, where R-values were quite high.

Collecting bark samples for mountain pine beetle overwinter mortality surveys in the Kootenays.

Due to intermittent cool, wet weather, the beetle flight period was delayed, and prolonged over several weeks in many areas of the Region in 2007. This often resulted in increased adult mortality, and underdeveloped brood. These factors likely contributed to the high overwintering mortality and low R-values seen over the winter. 2008 was the second year in a row with cool weather and an often prolonged beetle flight. This has again, in many areas, led to higher adult mortality, late brood development, and lowered green attack rates. This underdeveloped brood will be more susceptible to overwinter mortality over the winter of 2008 - 2009. Updated spring 2009 overwintering mortality estimates will be available on the Southern Interior Region Forest Health webpage in April <http://www.for.gov.bc.ca/rsi/ForestHealth/MBB_updates.html>.

Table 1. Percent mortality of mountain pine beetle progeny during the winter of 2007-2008, with associated R-values.

District or TSA	Number of Sites	Number of Samples	Average % Mortality	Average R-Value
Arrow Boundary - mature pine	18	166	58%	3.5
Kootenay Lake - mature pine	12	115	68%	2.7
Columbia (Golden) - mature pine	13	113	69%	2.0
Rocky Mountain - mature pine	16	158	58%	3.8
Merritt TSA - mature pine	13	126	86%	0.9
Merritt TSA - young pine	3	24	63%	2.6
Lillooet TSA - mature pine	11	110	100%	0.1
Lillooet TSA - young pine	4	40	99%	0.2
Okanagan Shuswap - mature pine	11	97	71%	2.0
Okanagan Shuswap - young pine	6	50	100%	0
Kamloops - mature pine	6	55	90%	0.3
Kamloops - young pine	6	51	96%	0.2
Headwaters (Clearwater) - mature pine	9	88	82%	1.2
Headwaters (Clearwater) - young pine	2	19	100%	0
Headwaters (Robson Valley) - mature pine	10	100	39%	10.6
Headwaters - Mt. Robson Park	17	161	92%	1.2
Quesnel - young pine only	5	50	100%	0
100 Mile House - young pine only	1	10	98%	0.1
Central Cariboo - mature pine	5	50	97%	0
Central Cariboo - young pine	5	50	100%	0
Chilcotin - mature pine	1	10	37%	2.9
Chilcotin - young pine	4	40	84%	2.2
Totals/Averages - Mature Pine	142	1,349	73	2.4
Totals/Averages - Young Pine	36	334	93	0.6
Totals/Averages - Region	**178**	**1,683**	**81%**	**1.7**

Douglas-fir Beetle

Sampling for Douglas-fir beetle was carried out in the Central Cariboo, Chilcotin, and 100 Mile House Districts (5 sites in each District). Larval mortality over the 2007 - 2008 winter averaged 82.5%, down from 94.9% over the winter of 2006 - 2007. R-values were relativley low, at 3.1 (Table 2).

Table 2. Percent mortality of Douglas-fir beetle progeny during the winter of 2007-2008, with associated R-values.

District or TSA	Number of Sites	Number of Samples	Average % mortality	Average R-Value
Central Cariboo	9	90	81.0	3.1
Chilcotin	11	110	77.8	4.2
100 Mile House	9	90	88.6	2.1
Totals/Averages	**29**	**290**	**82.5**	**3.1**

2008 Report on the Impacts of Mountain Pine Beetle in Young Pine

The overall objectives of this project were to quantify mortality due to mountain pine beetle in young lodgepole pine stands and to estimate the duration and severity of future attack. In addition, verbenone trials were conducted in 2007 and 2008 to evaluate the potential of protecting high-risk young stands. The 2008 assessments included stand specific aerial surveys and re-assessment of 8 of 24 permanent sample plots.

2008 Verbenone flake application in young lodgepole pine stands at risk to mountain pine beetle

A trial designed to test the efficacy of Disrupt Micro-Flake VBN (Verbenone flakes) at protecting high-risk young pine from MPB attack was conducted on approximately 177 ha (Helmer Road area, Cascades Forest District) (Fig. 1) using a Hiller 12E helicopter equipped with a spreader at 6.5-6.7 kg/ha (15% a.i. by weight, 1,000 gm a.i. per ha) on July 23, 2008. The selected stands were between 25 and 35 years old, with less then 15% in-stand 2007 MPB attack. Seven treatment blocks and 7 control blocks, each ±20 ha, were selected in areas of moderate to high adjacent MPB pressure. Each of the 14 blocks had 3 baited Lindgren funnel traps located within the blocks. Beetles were collected twice a week during peak flight and then weekly until cessation of flight in late September 2008.

Efficacy assessments were conducted in all treatment and control blocks in October 2008. Assessments consisted of the following:

1. 10 strip plots per block (each strip plot was 3 m x 100 m)
2. 5 variable radius plots per block to assess attack status and tree statistics (dbh) – each plot had an average of 5-8 trees
3. Star-probe at each trap: 3 m width in each of the cardinal directions to determine trap influence. MPB attack was recorded

All trees >10cm were assessed, and all MPB or other bark beetle (e.g. Ips) attack was recorded (regardless of tree size).

2008 Results

The highest mountain pine beetle catches in baited Lindgren funnel traps occurred in mid-August (Fig. 1) with the peak flight occurring between Aug 14 and Aug 22, 2008. Higher trap catches were recorded in the control blocks throughout the summer except on the first sampling date.

Strip survey results showed very low levels of MPB attack in all stands, treated or control (Table 1). There was no significant difference in attack levels (t-test, $P<0.05$) between treated and control areas, with average mass attack of 27 attacks per ha and 22 attacks per ha, respectively (Table 1). 2008 attack levels generally remained static or decreased in the control blocks when compared with the 2007 results. The treated blocks also saw a decrease in attack levels in 2008 (Table 1). The 2008 attack was a result of both beetles emerging from within the stand, as well as from the surrounding area.

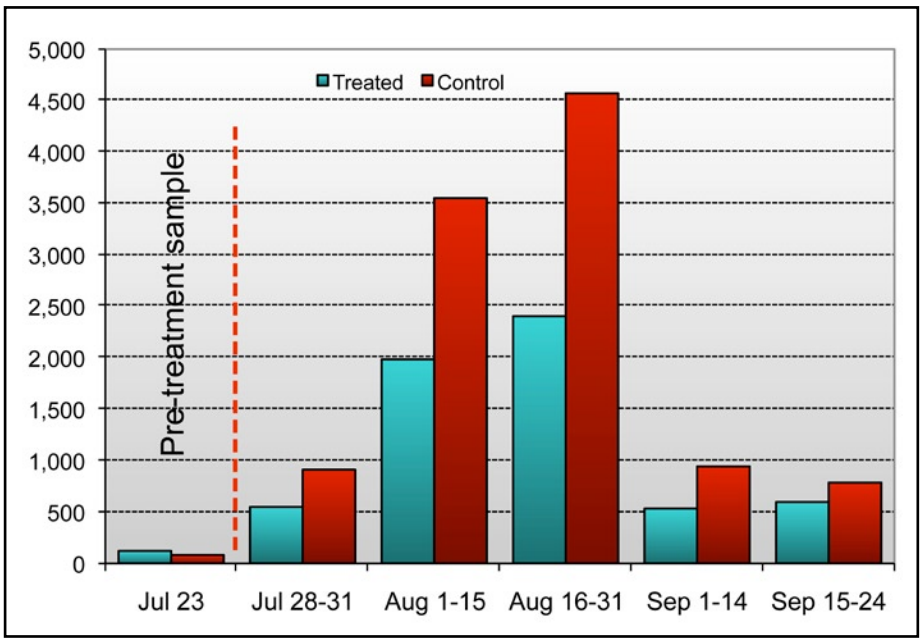


Figure 1. Total number of mountain pine beetles caught in semiochemical-baited Lindgren funnel traps located within verbenone-treated and untreated (control) blocks. Trap catches from the seven treated and control blocks were combined. The July 23rd collection date represents the "pre-treatment" sample.

Table 1. Average number of old (2007) and new (2008) mountain pine beetle mass attacks per hectare in verbenone flake-treated blocks and control blocks.

	Ave. MPB attack/ha in Control		Ave. MPB attack/ha in Treated	
Block	**2007**	**2008**	**2007**	**2008**
1	16.7 ± 52.7	3.3 ± 10.5	210.0 ±197.5	36.7 ± 45.7
2	30.0 ± 63.7	40.0 ± 69.9	203.3 ± 184.2	23.3 ± 35.3
3	100.0 ± 93.0	96.7 ± 249.7	180.0 ± 84.9	90.0 ± 205.5
4	140.0 ± 161.6	36.7 ± 61.8	240.0 ± 122.5	6.7 ± 21.1
5	0	0	0	0
6	0	0	0	0
7	0	13.3 ± 28.1	10.0 ± 31.6	0
Ave	**41.0 ± 90.5**	**27.1 ± 102.2**	**120.5 ± 152.5**	**22.4 ± 83.4**

Results of the star probes and plots did not show significant effect as a result of the verbenone treatment. There was very low attack in all blocks and beetles chose the largest trees which were not always in the vicinity of traps. Some star probes indicated some influence due to treatment (Fig. 2). Due to the very small tree size (Table 2) in all blocks plus only moderate risk from surrounding mature stands the verbenone treatment was not greatly challenged.

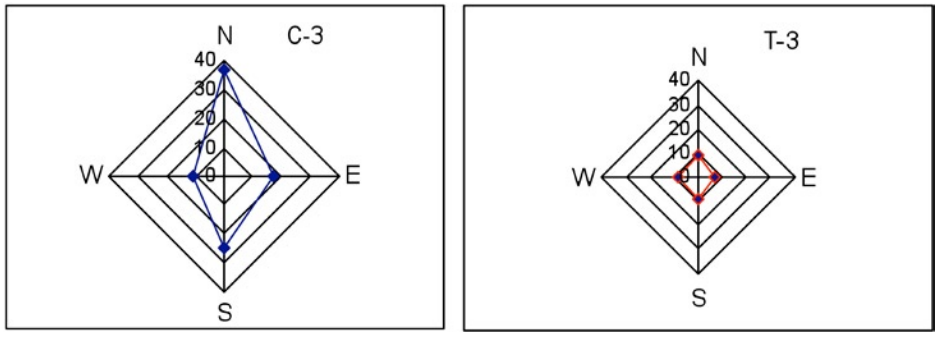


Figure 2. Results from star probes conducted at traps in Control Block 3 and Treatment Block 3 showing area of attack around baited Lindgren funnel traps.

Table 2. Summary from circular plots assessed in the verbenone flake trial showing, by treatment block, average pine diameter at breast height (DBH), percent healthy pine, percent with successful 2008 MPB attack, percent with old MPB attack, percent unsuccessful 2008 MPB attack and percent pine dead from mortality agents other than MPB.

			Pine status (% of Pl stems)				
Treatment Regime	**N (Pl)**	**Average DBH (cm)**	**Healthy**	**2008 MPB attack**	**Old MPB attack**	**2008. Unsuccess. attack**	**Dead (other causes)**
Treatment-1	42	13.4	81.0	7.1	9.5	2.4	0
Treatment-2	44	13.9	77.3	9.1	4.5	9.1	0
Treatment-3	40	13.9	82.5	0.0	17.5	0.0	0
Treatment-4	42	13.2	90.4	2.4	4.8	2.4	0
Treatment-5	43	11.5	100.0	0.0	0.0	0.0	0
Treatment-6	41	12.0	97.6	0.0	0.0	2.4	0
Treatment-7	39	12.7	97.4	0.0	0.0	2.6	0
Average		**12.9**	**89.5**	**2.7**	**5.2**	**2.7**	**0.0**
Control-1	38	12.6	100	0	0	0	0
Control-2	42	13.1	100	0	0	0	0
Control-3	43	13.3	83.7	2.3	9.3	4.7	0
Control-4	43	12.8	72.1	9.3	11.6	7.0	0
Control-5	46	11.4	100	0	0	0	0
Control-6	45	11.6	100	0	0	0	0
Control-7	46	11.7	100	0	0	0	0
Average		**12.4**	**93.7**	**1.7**	**3.0**	**1.7**	**0.0**

The 2007 verbenone flake blocks were photographed from the air in July 2007 and July 2008 (Fig. 3). The photographs and visual estimations of attack (Table 3) show that slightly elevated attack occurred in the control blocks but there was still attack in treated blocks (Fig. 3). Given that stands used in the trials in 2007 and 2008 are low susceptibility in the classical sense as well as at reduced risk (compared to the risk presented in 2006 beetle flight) the verbenone treatment blocks should have sustained noticeably less attack compared to the control blocks if it was effective. However, we did not see significantly noticeable differences in attack levels between treatments and controls in either of the two years.

2007 verbenone flake treatment	2008 aerial assessment	
	% grey	% red
C-1	3	10
C-2	18	10
C-3	1	4
C-4	2	15
C-5	1	6
T-1	3	5
T-2	0	3
T-3	0	1
T-4	0.5	3
T-5	4	12

Table 3. Results of an aerial assessment of the 2007 verbenone flake trial showing percent grey attack (MPB attack present prior to treatment) and percent red attack (MPB attack occurring post-treatment).

Figure 3. Aerial photographs of the 2007 verbenone trial. Photographs on the left were taken in July 2007 and photos on the left were taken in July 2008.

July 2007	**July 2008**
	
Control - 1	Control - 1
	
Control - 2	Control - 2
	
Control - 3	Control - 3
	
Control - 4	Control - 4

Figure 3 continued. Aerial photographs of the 2007 verbenone trial. Photographs on the left were taken in July 2007 and photos on the left were taken in July 2008.

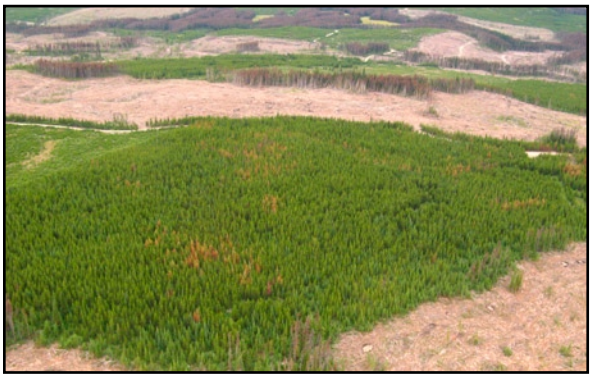
July 2007	**July 2008**
	
Control - 5	Control - 5
	
Treatment - 1	Treatment - 1
	
Treatment - 2	Treatment - 2
	
Treatment - 3	Treatment - 3

Figure 3 continued. Aerial photographs of the 2007 verbenone trial. Photographs on the left were taken in July 2007 and photos on the left were taken in July 2008.

July 2007 **July 2008**

Treatment - 4

Treatment - 4

Treatment - 5

Treatment - 5

Evaluation of MPB Outbreak on Young Pine – Year 4

In 2008, approximately 47,321 ha of young pine, aged 20 to 55 years, was assessed from the air for mortality (Table 1). Over 1,778 polygons in 9 forest Districts were surveyed for a total exceeding 7,634 polygons assessed since 2005. Many polygons were surveyed in more than one year to monitor the progression of attack and influence of the outbreak on young pine mortality. The average percent red attack (2007 attack) decreased in all 7 districts surveyed in both 2007 and 2008, with the exception of the Headwaters District (DHW) that saw a three-fold increase in red attack (Table 1). This trend directly reflects the trends of the general MPB outbreak in 2007 and 2008 in mature stands throughout BC. There is significantly lesser red attack in the central Districts and the most active areas are now located in the south and on the periphery of the outbreak area. The decline of MPB attack in young stands is more rapid in young stands as the risk in adjacent stands declines. Although, as noticed in stands used in the verbenone trial, there is ongoing, low levels of MPB attack from beetles generated within these young stands. However, additional, significant mortality is unlikely once the outbreak diminishes in surrounding mature forests (about two year post-peak).

Aerial surveys of young stands were conducted within the core and leading edge of the outbreak area each year. The peak red attack mapped occurred overall in 2007, reflecting the severe populations of MPB seen in the 2006 beetle flight (Table 2). The average total attack increased steadily from 2005-2008, as did the percent of stands affected, with over 85% of stands assessed in 2008 having some level of MPB mortality (Table 2).

Table 1. Summary of hectares, mapsheets and polygons aerially surveyed in 2008, by District, showing average percent red attack, percent total attack (red + grey attack) and percent stands affected (showing some level of MPB attack). The average percent red attack mapped in 2007 is also shown as a comparison. Districts are denoted by: DCC=Central Cariboo; DCS=Cascades; DHW=Headwaters; DKA=Kamloops; DMH=100 Mile House; DND=Nadina; DOS=Okanagan Shuswap; DPG=Prince George; and, DQU=Quesnel.

	DCC	DCS	DHW	DKA	DMH	DND	DOS	DPG	DQU	Total
Ha surveyed (2008)	5,464	5,086		3,783	10,421	5,790	4,530	2,659	9,589	47,321
No. mapsheets	28	27	4	21	38	21	23	9	31	202
No. polygons	217	223	32	241	350	134	212	109	260	1,778
Ave. % red attack (2007)	16.3	17.0	7.0	44.0	34.1	10.2	14.4		29.1	
Ave. % red attack (2008)	6.4	5.0	23.6	12.0	9.8	3.5	6.6	3.8	0.5	
Ave. % total attack	28.3	10.4	41.9	36.9	37.8	8.9	14.3	40.5	29.2	
% stands affected	91.7	70.0	96.9	97.5	94.0	59.7	77.7	95.4	88.1	

Table 2. Average over all districts surveyed of percent red attack, total attack (red + grey attack) and percent stands affected (showing some level of MPB attack) by year surveyed.

	Average MPB attack over all Districts			
	2005	2006	2007	2008
Ave. % red attack	3	10	3	10
Ave. % total attack	18	10	3	10
% stands affected	1	4	3	10

The aerial surveys conducted in 2008 showed a sharp decline in the number of new stands having greater than 50% mortality (Table 3). Districts in the north and central portion of the MPB outbreak area continued to have the highest number of stands with between 25% and greater stem mortality. The one exception is Kamloops District that has over 32% of young pine stands surveyed with over 50% mortality and 22.5% of stands with 26-50% mortality (Table 3). However, Kamloops District (16,500 ha young pine 20-55 years) has approximately one third the area of young pine that Prince George District has and about one quarter the area of young pine that Quesnel has. The districts where the MPB outbreak is still very active, for example Nadina, Cascades and Okanagan Shuswap, had far fewer polygons falling into the higher attack level categories (Table 3). If the outbreak continues to decrease as observed in 2007 and 2008, the threat to young pine stands will be greatly reduced.

Given stands were randomly selected each year for survey the comparisons from year to year vary but strong trends are evident. By 2008 most stands surveyed had some level of mortality (Table 4) with Nadina having the lowest proportionally overall. The total attack (within stands having some level of attack) observed in 2008 remained fairly static in Kamloops, Okanagan Shuswap, 100 Mile House, Central Cariboo and Quesnel from

2007 to 2008. This reflects the reduction in risk from adjacent mature stands as the MPB outbreak declines in these Districts. Also, in most areas the MPB flight and attack was reduced in 2008 compared to previous years due to less than optimal summer conditions during emergence and flight times. Districts seeing some increased attack in young stands included Cascades, Headwaters and Nadina. These Districts are on the more active, leading edge of the MPB outbreak area in mature stands and therefore had more attack although reduced from what could have occurred if the MPB flight had been more synchronized in 2008.

Table 3. Percent of stands surveyed in 2008, in 9 Districts, having no attack (0% stems attacked) to over 50% stems attacked. The total number of stands surveyed in each district is also shown.

% attack	Percent (%) of stands within each attack category								
(reds & greys)	DND	DPG	DQU	DCC	DMH	DHW	DKA	DCS	DOS
0%	40.3	4.6	11.9	8.3	6.0	3.1	2.5	30.0	22.3
1-10%	38.8	16.5	28.8	20.7	16.3	25.0	22.5	45.7	36.0
11-25%	7.5	11.0	11.9	24.4	16.3	12.5	20.4	9.4	19.9
26-50%	9.0	30.3	21.9	28.6	27.7	18.8	22.5	7.6	16.6
>50%	4.5	37.6	25.4	18.0	33.7	40.6	32.1	7.2	5.2
Total no. polygons	134	109	260	217	350	32	240	223	211

Table 4. The number of stands, by Districts, with and without MPB attack and the average percent total attack (red + grey) within attacked stands by age.

	Percent stands with MPB attack		Average % attack in attacked stands	
Age	2007	2008	2007	2008
Kamloops				
20-25	92.9%	96.3%	37.9	31.0
26-30	98.7%	100.0%	58.2	57.1
31-40	97.4%	100.0%	63.6	55.3
41-50	100.0%	100.0%	46.8	35.6
51-55	100.0%		53.4	
Cascades				
20-25	57.6%	65.4%	13	10.2
26-30	63.3%	71.4%	26.3	12.1
31-40	87.5%	82.5%	24.8	30.2
41-50	97.5%	100.0%	36.2	85.5
51-55	100.0%		24.9	
Okanagan Shuswap				
20-25	73.2%	77.4%	18.5	18.4
26-30	69.6%	78.0%	22.6	17.9
31-40	78.6%	81.3%	20.2	26.0
41-50	70.0%	100.0%	38.1	2.4
51-55	100.0%	100.0%	36.7	28.5
Headwaters				
20-25	70.6%	96.4%	4.6	41.9
26-30	80.0%	100.0%	12.5	54.5
31-40	70.0%	100.0%	14.7	49.5
41-50	41.7%		14.7	
51-55	69.2%		15.2	

Table 4 continued. The number of stands, by Districts, with and without MPB attack and the average percent total attack (red + grey) within attacked stands by age.

	Percent stands with MPB attack		Average % attack in attacked stands	
Age	2007	2008	2007	2008
100 Mile House				
20-25	92.0%	88.4%	27.5	32.2
26-30	97.1%	100.0%	50.7	45.3
31-40	98.7%	100.0%	53.8	50.8
41-50	100.0%	100.0%	43.8	53.1
51-55	100.0%	100.0%	47.1	48.0
Central Cariboo				
20-25	80.0%	87.9%	20.5	24.7
26-30	91.1%	95.7%	32.2	38.2
31-40	95.7%	100.0%	38.4	40.0
41-50	100.0%	100.0%	34.9	42.1
51-55	100.0%	100.0%	47	38.0
Quesnel				
20-25	91.6%	82.4%	34.2	25.4
26-30	100.0%	98.4%	47.9	43.2
31-40	100.0%	96.6%	48	46.7
41-50	100.0%	86.7%	45.3	34.0
51-55	100.0%	100.0%	31.9	30.5
Nadina				
20-25	40.7%	48.7%	11.4	10.9
26-30	80.0%	76.2%	12.1	12.6
31-40	89.5%	79.3%	20.6	22.8
41-50	100.0%	50.0%	37.8	17.2
51-55	100.0%		47.5	

Permanent sample plots: biological and tree attribute assessments

Twenty four permanent sample plots were established (15 plots in 2005, 9 plots in 2006) to monitor and assess the impact, risk and biological parameters of mountain pine beetle, and other forest health factors, in young pine stands. Plots were established throughout a variety of ecological zones susceptible to the mountain pine beetle and were located in chronologically different phases of the outbreak. In 2008, 8 of the 24 plots were re-assessed. These plots are located in areas where the outbreak has recently declined or is still active (Table 5). Of key interest in 2008 was the level and risk of attack by secondary insects (twig beetles), such as Pityogenes and Ips. The highest levels of secondary insect attack were noted in the Dragon Lake (Quesnel area) and Meldrum Creek (Williams Lake) plots (Tables 5 and 6), with 14.9% and 24.7% respectively. The secondary insects at Dragon Lake primarily attacked trees which had been previously attacked by the MPB (strip or unsuccessful attack), while the trees at Meldrum Creek, were much smaller in diameter, due do the stand being naturally regenerated and there, the secondary insects behaved more as primary tree killers (Tables 5, 6).

Table 5. Percent of trees attacked by secondary bark beetles such as Ips or twig beetles in 8 permanent sample plots re-assessed in 2008. Plot number, District, geographic location, approximate age, biogeoclimatic ecosystem classification (BEC), density (stems per ha) and treatment regime is shown (nat. regen. = natural regeneration; Sp=spaced; Pr=pruned; Fe=fertilized).

Plot #	District	Location	Age	BEC	Density	Treatment	% trees with twig/*Ips*
1	DQU	Dragon Lake	31-40	SBS dw1	804	Spaced	14.9%
2	DQU	Fish Lake	31-40	SBS dw2	880	Spaced	1.4%
10	DCC	Meldrum Creek	31-40	SBPS xc	1,636	nat. regen	24.7%
11	DCC	Spokin Lake	26-30	SBPS mk	1,228	Spaced	3.9%
14	DMH	Little Fort	41-50	IDF dk3	1,432	nat. regen	9.8%
16	DKA	Jamieson Creek	26-30	MS dm2	836	Sp/Pr/Fe	4.3%
17	DKA	Community Lakes	31-40	IDF dk2	1,644	Spaced	7.3%
18	DCS	Spius Creek	26-30	MS	996	Sp/Pr/Fe	0.0%

Table 6. Percent green attack by year assessed, percent old MPB attack, strip attack and cumulative attack in the 8 plots assessed in 2008.

Plot #	Percent green attack				% old attack	Strip or unsuccessful attack	Cumulative twig/*Ips*
	2008	2007	2006	2005			
1	0	2.0	13.9	0.5	20.9	7.0	44.3
2	0	0	0	43.5	12.4	8.1	64.0
10	0	0	0	42.8	0	3.2	46.0
11	0	8.1	16.3	0	0	7.8	32.2
14	1.4	13.4	0.3	60.8	0	10.4	86.3
16	0	10.0	70.8	0	0	8.6	89.4
17	4.2	9.9	36.7	11.1	0	3.2	65.1
18	13.4	6.1	9.3	0	0	13.4	42.2

The highest level of 2008 mountain pine beetle attack was in the Spius Creek plot, with 13.4% green attack, located south of Merritt (Plot 18, Table 6). All other plots assessed had very low levels of green attack (Table 6). Plots 1, 2, 10 and 14 sustained MPB attack early in the cycle of the beetles' movement into younger age classes when levels of attack in surrounding mature stands were severe (Table 6). Plots 14, 16, and 17 had high attack levels in 2006 and 2007 corresponding to the peak years of attack in surrounding mature pine stands. MPB risk was lower in 2008, due to sub-optimal flight conditions and lower brood survival. Unless the outbreak builds again substantially in the south, the risk to many of the remaining young stands is declining.

There was less checking and woodpecker action on trees in plots located in Districts more recently impacted by MPB such as 100 Mile House, Kamloops and Cscades (Table 7). Plot 1, located in and area impacted by MPB early in the outbreak, had a high degree of checking and woodpecker action on both trees killed by MPB and Ips. Woodpeckers seem particularly active on trees killed by secondary insects, perhaps due to the timing of attack by these insects (early in the summer) or density of larvae. The overall observation from the assessment of checking is that these young trees degrade rapidly.

Table 7. The percent of MPB-killed and Ips/twig beetle-killed trees displaying no checking (nil), low, moderate or high levels of checking in the 8 plots assessed in 2008. The percent trees with woodpecker action are also noted.

Plot #	Location	% of MPB-killed trees with checking				% trees with woodpecker
		Nil	Low	Moderate	High	
1	DQU	10.9	17.2	21.9	50.0	20
2	DQU	2.6	17.9	40.2	39.3	11
10	DCC	54.0	30.9	12.2	2.9	7
11	DCC	42.6	14.7	22.1	20.6	35
14	DMH	37.0	26.9	19.2	16.9	17
16	DKA	50.0	30.0	16.3	3.8	11
17	DKA	56.0	13.8	22.9	7.3	13
18	DCS	26.3	39.5	21.1	13.2	23
Plot #	Location	% of *Ips*/twig beetle killed trees				% trees with woodpecker
		Nil	Low	Moderate	High	
1	DQU	13.3	10.0	23.3	53.3	66
2	DQU	33.3	66.7	0.0	0.0	15
10	DCC	19.8	28.7	39.6	11.9	13
11	DCC	25.0	25.0	25.0	25.0	52
14	DMH	62.9	8.6	25.7	2.9	29
16	DKA	44.4	44.4	11.1	0.0	26
17	DKA	83.3	16.7	10.0	6.7	33
18	DCS	0.0	0.0	0.0	0.0	0

Secondary bark beetle attack on young pine

Pityogenes galleries

Pathology Update

Michael Murray, Forest Pathologist
Southern Interior Forest Region, Nelson, B.C.

Disease Resistance Screening for Whitebark Pine

The combined offence by mountain pine beetles and non-native white pine blister rust has challenged the ability of whitebark pine populations to exist. The Southern Interior Region seems to be the most impacted region in BC. Up to 90% of whitebark pine is estimated to have died over the past several decades in certain places like the Selkirk Mountains. This important tree for wildlife is succumbing to the non-native scourge, white pine blister rust. The pine's steady decline has been accelerated with the recent mountain pine beetle epidemic. In fact, the insects have outpaced the disease as the leading cause of death, at least for the short-term. As a response to these factors, in 2008, the Province of BC placed whitebark pine on the 'blue-list' of species. It is the only listed tree species that suffers immediate threats throughout its entire natural range.

In order to retain whitebark pine for the values it provides, we must actively pursue protection, conservation and restoration. We estimate that only about 0-5% of wild trees are naturally resistant to blister rust. These rare individuals are the life-link to the tree's future. Through formal rust screening efforts, several trees are showing resistance – in the US. To date, only a few pines from BC have begun the screening process, and no resistance has been detected yet. Once trees are discovered, they can be protected and bred for outplanting progeny, thus restoring denuded stands. Most of whitebark pine's geographic range lies in Canada and we can ensure success of outplantings by using Canadian parent trees. Thus, we wish to formalize and accelerate a Province-wide screening program. Experts from BC and Alberta convene in February (2009) to discuss opportunities and challenges.

Whitebark pine seedlings undergoing blister rust resistance screening in the U.S.

The Search for Rust Resistant Pines

As a tree accustomed to living at high altitudes (>1,900m), whitebark pine tend to reside in remote places. Finding trees which may be naturally resistant to white pine blister rust is not always a simple matter. Pine populations tend to be small or sparse and don't have roads through them. Those that do have roads usually require a long slow drive on an unmaintained road and are often denuded by past timber extraction. In the past several years, mountain pine beetles have further decimated many of the best cone-producing pines. And once friendly-fires tend to kill trees which are now suffering increasing drought stress.

Given the challenges to reaching and identifying healthy rust-resistant trees, we must carefully plan and execute our search. Local District staff knowledge and inventory maps are a foundation to start with. Orthophotos and Google Earth are useful in examining/verifying both the landcover and accessibility of whitebark pine stands. The 3-dimensional feature of Google Earth is especially convenient for getting a sense of the topographic relief near any given site.

During the summer of 2008, many sites were considered for field assessment in the Nelson area. These sites were first examined with the aerial imagery mentioned. A reconnaissance of eight sites was accomplished to identify candidate trees for rust resistance screening and assess site suitability for long-term monitoring plots.

Observations of forest health were made. Due to a combination of blister rust and beetles, up to 75% of trees were dead and dying at some locations. Recent beetle induced mortality was especially prominent at Mt. MacGregor, Meteor Mine and Red Mountain. Many whitebark pine had perished in the stand-replacing expanses of the Springer Creek fire (2007) several kilometres south from Meteor Mine.

Further work includes 1) reconnaissance of additional sites in the SIR, 2) select trees for screening, 3) install long-term monitoring plots.

Table 1. Whitebark pine sites near Nelson.

Site	Accessibility (Drive Time / Walk Time)	Suitability for Monitoring Plot
Kootenay Pass	Moderate (1hr/1hr)	Marginal (sparse trees)
Ripple Mountain	Moderate-Difficult (3hr/30min)	Marginal (sparse trees)
Red Mountain	Easy-Moderate (1hr/0min)	Acceptable
Meteor Mine	Easy-Moderate (2hr/1hr)	Marginal (sparse trees)
Mt. Thompson LO	Easy (2hr/0min)	Unacceptable (sparse trees)
Mt. MacGregor	Moderate (3hr/0min)	Unacceptable (sparse trees)
Gray Creek Pass	Easy (2hr/0min)	Unacceptable (sparse trees)
Near Porcupine Lake	Difficult (2hr/1hr)	Unacceptable (sparse trees)

Whitebark Pine Observations from the West Kootenays

Brendan Wilson
Instructor, Selkirk College

In September and October of 2008, students lead by Instructor Brendan Wilson of Selkirk College visited several timberline forest sites in the West Kootenay. They carried out white pine blister rust and mountain pine beetle surveys on the whitebark pine population in these areas and quantified the forest structure. At Mt Gimli, a steep forested ridge (~ 200 years old) on the edge of Valhalla Provincial Park, they found that greater than 95% of the mature cone bearing individuals were dead, apparently as result of mountain pine beetle (MPB). Of the remaining live individuals, 25% had been green-attacked by MPB, and 50% had evidence of white pine blister rust (presence of inactive cankers). No MPB was found in the smaller immature trees, however, 13% of these seedlings and saplings were infected with white pine blister rust. They saw similar trends in two other sites near the park boundary, although no quantitative data was collected. The Selkirk Crew also collected data on Cornice Ridge in Stageleap Provincial Park. At this site the forest was younger (~50 years old) and more sparse. Predictably, there was no evidence of pine beetle in this stand, although blister rust infection was more prevalent. 81% of the seedlings and saplings were found with identifiable cankers.

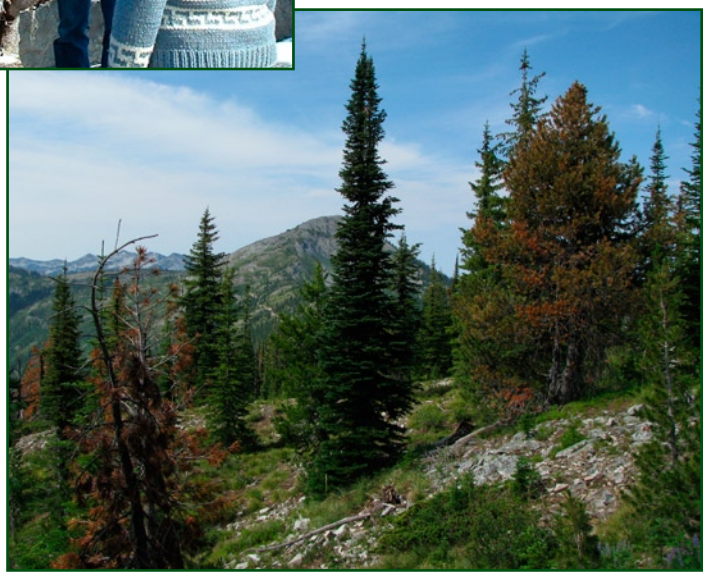
Dothistroma (aka red-band) needle blight (Dothistroma septosporum) found on young rust-resistant white pine near Duncan Lake.

Upcoming Meetings

Whitebark Pine Science and Management Conference, September 10-11, 2009. Nelson, B.C.

Declining whitebark pine populations are the subject of an international conference to be held this year. Whitebark pine has been drastically reduced due to the introduced white pine blister rust plague plus the recent beetle epidemic. The focus of this gathering is on science and management in Canada with a host of speakers the first day, followed by a field trip the second day. Topics will include biological status, management, and restoration. Some of the world's leading experts on whitebark pine are expected to attend. For more information, please contact Michael.Murray@gov.bc.ca or visit www.whitebarkfound.org.

Pathologist, Michael Murray discusses seed collection for blister rust screening at a whitebark pine workshop in 2005.



Dead and dying whitebark pine above the Slocan Valley near Meteor Mine. Saplings on left are afflicted with blister rust. The mature tree on right is under attack by mountain pine beetle.

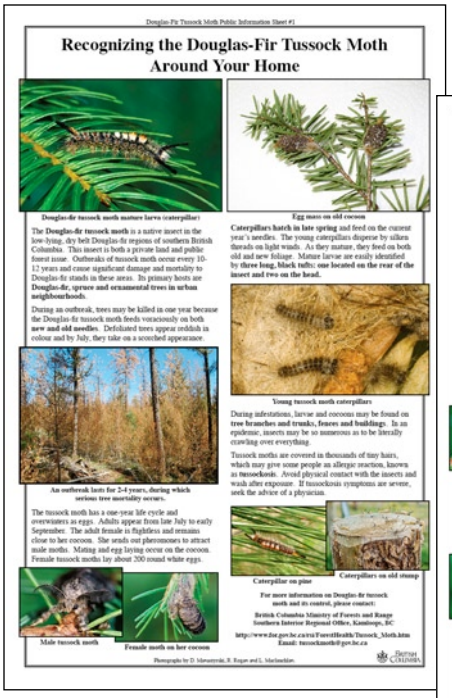
About twenty Douglas-fir trees were toppled in a natural blowdown event in the Champion Lakes Provincial Park, near Castlegar. These trees had been weakened by laminated root rot (Phellinus weirii) prior to falling upon a popular trail.

New Publications

Maclauchlan, L.E. and J.E. Brooks. 2009. Influence of past forestry practices on western spruce budworm defoliation and associated impacts in southern British Columbia. Journal of Ecosystem Management (in press).

Maclauchlan, L.E., P.M. Hall, I.S. Otvos and J.E. Brooks. 2009. An integrated system for the Douglas-fir tussock moth in Southern British Columbia. Journal of Ecosystem Management (in press).

Five new communication posters for Douglas-fir tussock moth



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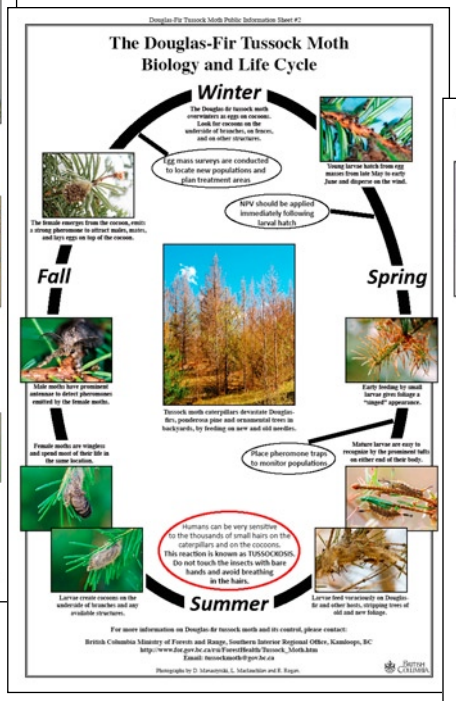

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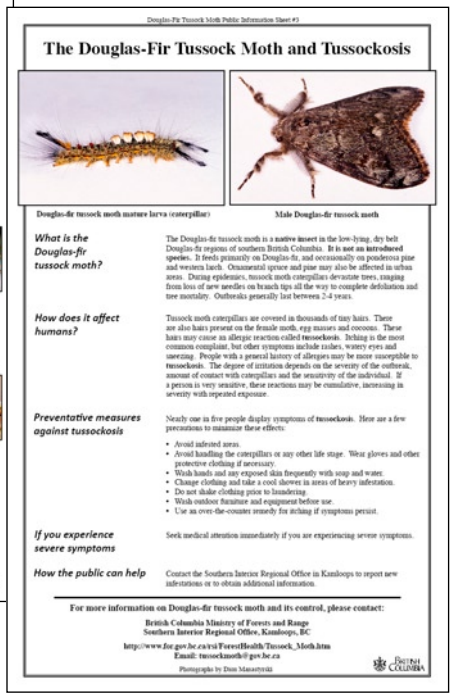

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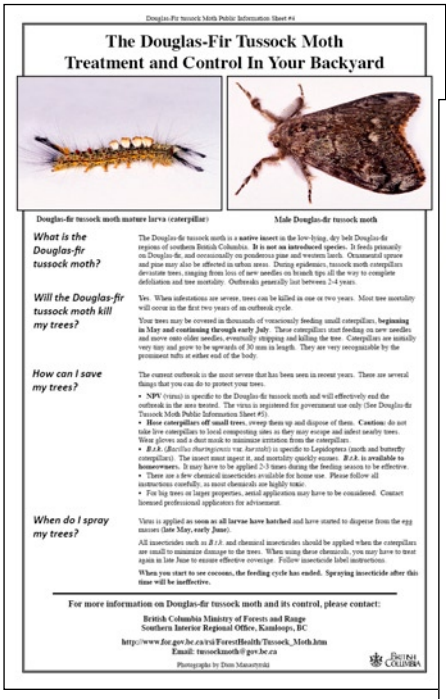

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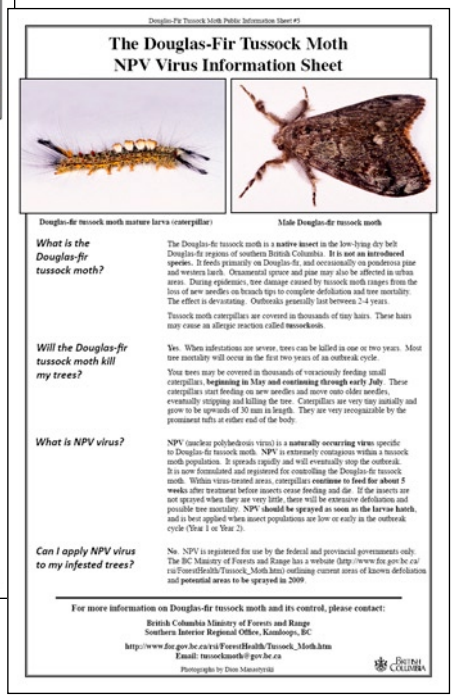

#5

Four new communication posters for western spruce budworm

#1

#2

#3

#4

Mountain pine beetle attack in young pine - time series photographs

Kamloops 092I057_492 2007

Kamloops 092I057_492 2008

Central Caribou 093B050_395 2005

Central Caribou 093B050_395 2007

100 Mile House 092P084_873 2006

100 Mile House 092P084_873 2007

Quesnel 093B056_183 2006

Quesnel 093B056_183 2007

Vanderhoof 093G072_350_351 2005

Vanderhoof 093G072_350_351 2006

Prince George 093G084_292 2006

Prince George 093G084_292 2008

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http://www.earthpics.ca

Line drawings by Lynn Kristmanson

This report is available in PDF format at http://www.for.gov.bc.ca/rsi/ForestHealth/Overview.htm