

Summary
of
Aerial
Overview
Surveys
in the Kam-
loops Forest
Region

1998



Collated By:

*Text and Design,
Lorraine Ma-
clauchlan,
Ministry of Forests
Regional
Entomologist -
Kamloops, BC*

*Text and
Aerial Surveys,
Kevin Buxton*

*Aerial Surveys,
Shane Collingridge*

*Layout,
Trisha Rimmer*

Overview of Forest Health in the Kamloops Forest Region



Western balsam
bark beetle

INTRODUCTION

The 1998 aerial overview surveys of the Kamloops Forest Region were conducted from July 7 - August 21, 1998. Seventeen days of flying, totaling 94.4 hours, were required for full coverage of the Region.

The results of the overview surveys are reported by forest district for the major pests detected: mountain pine beetle (MPB), Douglas-fir beetle (DFB), spruce beetle (SB), western balsam bark beetle (BBB), western spruce budworm (WSB), two-year cycle spruce budworm, and Douglas-fir tussock moth (DFTM). Surveys were completed to the standards set out by the Ministry of Forests Aerial Overview Surveys Forest Insect and Diseases Training Program.

Due to several large wildfires occurring in the Region during the survey period, there were many days with poor visibility. Visibility was marginal in the northern areas of the Salmon Arm and Kamloops Districts, as well as most of the Clearwater District. Due to this limited visibility, it is likely that some defoliation ratings may have been underestimated, and some areas with only light defoliation may have been missed completely.

REGIONAL OVERVIEW

Mountain Pine Beetle

Mountain pine beetle infestations were mapped over 19,100 hectares in 1998, of which 12,400 ha were in the Merritt Forest

District. The area of red attack mapped is virtually unchanged from the 1997 total of 19,200 ha (Table 1) despite substantial control efforts. Significant pine mortality also occurred in the Penticton, Kamloops, and Vernon districts, with lesser amounts in the Salmon Arm and Lillooet Districts. In addition, a further 7,500 pine were killed in spot infestations of 1-50 trees.

Table 1. Area of mature lodgepole pine killed by MPB in the Kamloops Region (Taken from F.I.D.S. Annual Reports 1987-95 and MOF data 1996-98).

Year	Affected Area (ha)
1987	19,000
1988	17,600
1989	21,100
1990	6,000
1991	19,000
1992	21,000
1993	19,925
1994	8,865
1995	8,865
1996	12,000
1997	19,200
1998	19,100

The red attack mapped represents lodgepole pine attacked and killed by the mountain pine beetle in 1997 and does not give an indication of the extent and severity of 1998 attack by the beetle. Ground reconnaissance was conducted in all districts and the results show

a significant increase in beetle attack in 1998. Mountain pine beetle population trends can be estimated by calculating the ratio of currently attacked trees (green) to one-year-old attacked trees (red). A ratio of >1 indicates an increasing population; a ratio of <1 indicates a declining population. The green to red ratios, which are used as an indicator of beetle population expansion, ranged from a low of 2:1 in Penticton and Lillooet, to 20:1 in Kamloops and Merritt, and 25:1 in Salmon Arm and Vernon (Table 2). This exponential increase can be attributed to a series of mild winters and a very short, coordinated attack period this summer brought on by warm, dry conditions. Early indications are that expansion rates will be similar in 1999 unless significant brood removal is accomplished prior to the 1999 flight or high overwinter mortality occurs.

Douglas-fir Beetle

1,100 ha of Douglas-fir beetle caused mortality was mapped in the region, down from a 1997 high of 1,300 ha. In addition, 1,840 trees were killed in spot infestations of 1-30 trees. Most of the damage occurred in the Kamloops, Merritt, and Vernon districts.

Spruce Beetle

Only 151 ha of current spruce beetle infestation was mapped, down from 1,350 ha in 1997. A further 130 trees were mapped in spot infestations. This decrease is more likely due to the difficult surveying conditions in many areas during 1998 (hazy air caused by a number of major wildfires, combined with lack of noticeable foliar fading) than to any large decline in the overall area affected by the beetle. The most active spruce beetle population is on T.F.L. #18, north of Clearwater.

Table 2. 1998 green to red ratios for the mountain pine beetle in the 7 forest districts in the Kamloops Forest Region.

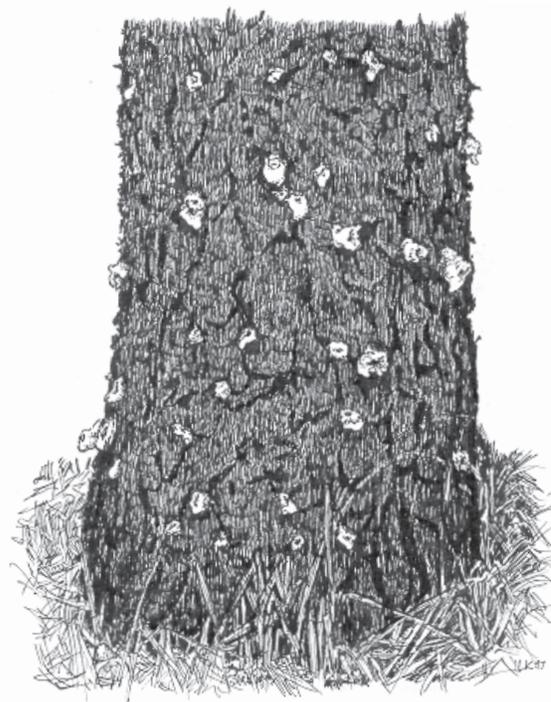
Bark Beetle	Clearwater	Kamloops	Salmon Arm	Vernon	Penticton	Merritt	Lillooet
MPB	5:1	20:1	25:1	25:1	2:1	20:1	2:1
SB	8:1	3:1	1:1	1:1	3:1	0.1:1	1:1
DFB	2:1	5:1	6:1	6:1	1:1	0.1:1	0.5:1

Western Balsam Bark Beetle

This insect caused significant mortality over 7,700 ha in 1998, down from 22,900 ha in 1997. Infestations were mapped in all districts; however, the largest areas affected were in the Vernon (4,100 ha) and Penticton (1,600 ha) districts.

Western Spruce Budworm

Defoliation caused by this insect increased for the third straight year to 61,300 ha, up from 45,700 ha in 1997, 25,000 ha in 1996, and 2,100 ha in 1995 (Fig. 1). Large increases in area were seen in the Lillooet and Vernon districts, while infestations in Kamloops, Penticton, and Merritt districts were stable to increasing. Over 55,200 ha of the defoliation was light, with the remaining 6,000 ha moderately defoliated. Western spruce budworm defoliation in the region is illustrated in Figures 2-5.



Bole of lodgepole pine attacked by mountain pine beetle. Note pitch tubes, formed at beetle entry points by a mixture of pitch and beetle frass.

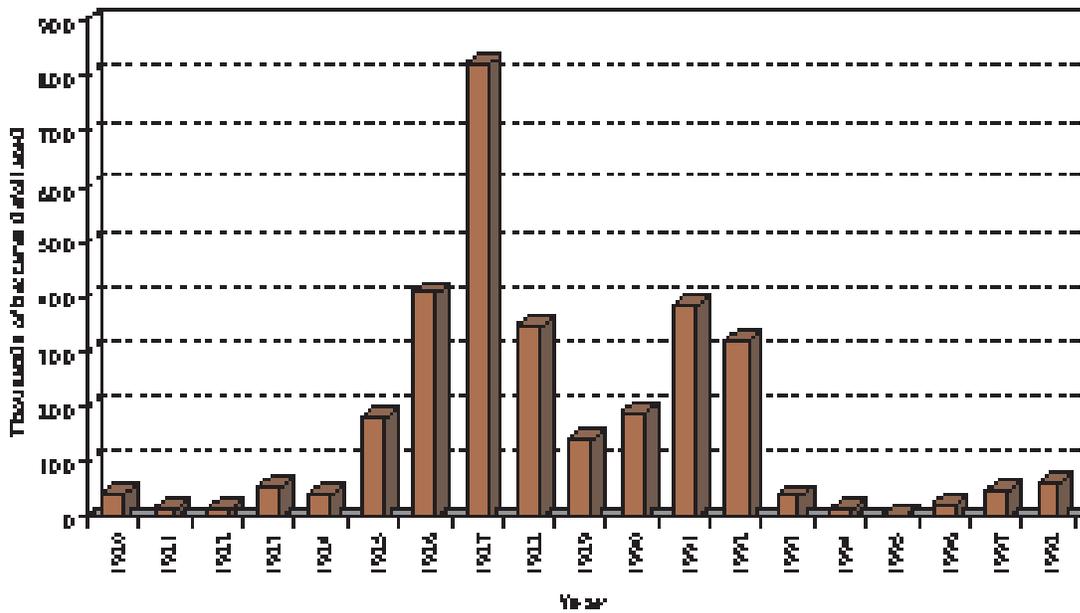


Figure 1. History of western spruce budworm defoliation from 1980 to 1998 in the Kamloops Forest Region

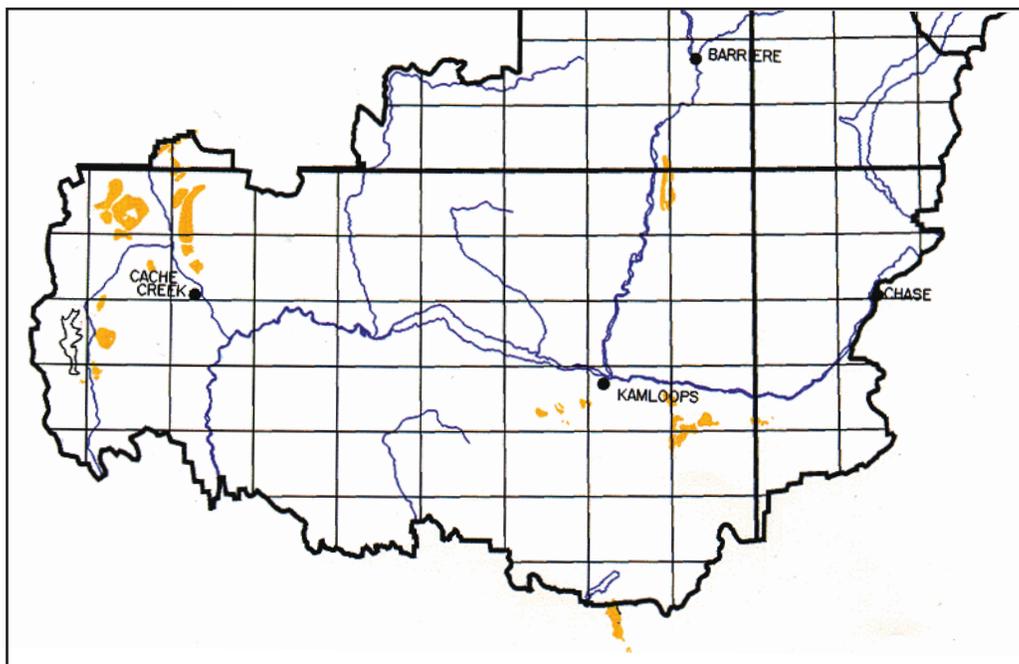


Figure 2. Area defoliated by western spruce budworm in the Kamloops TSA in 1998.

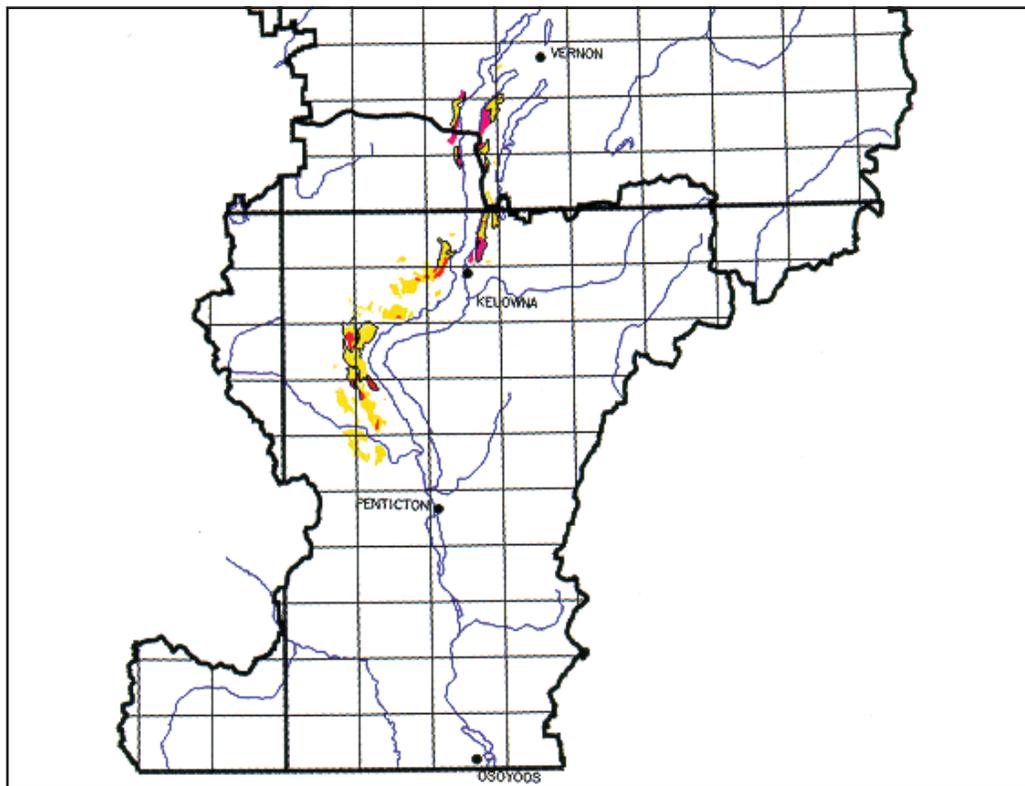


Figure 3. Area defoliated by the western spruce budworm in the Okanagan TSA in 1998.

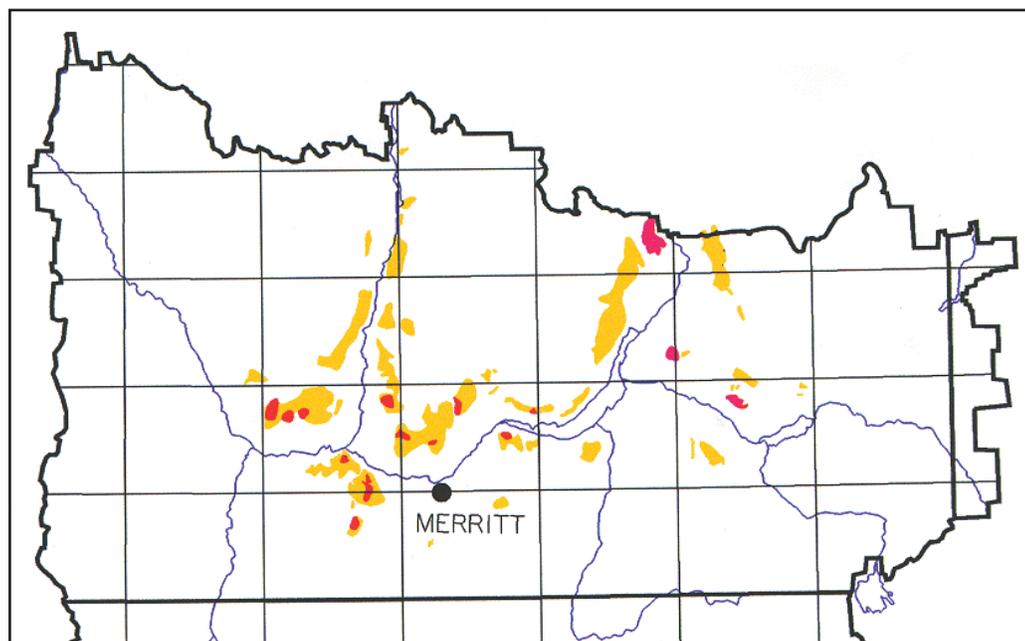


Figure 4. Area defoliated by western spruce budworm in the Merritt TSA in 1998.

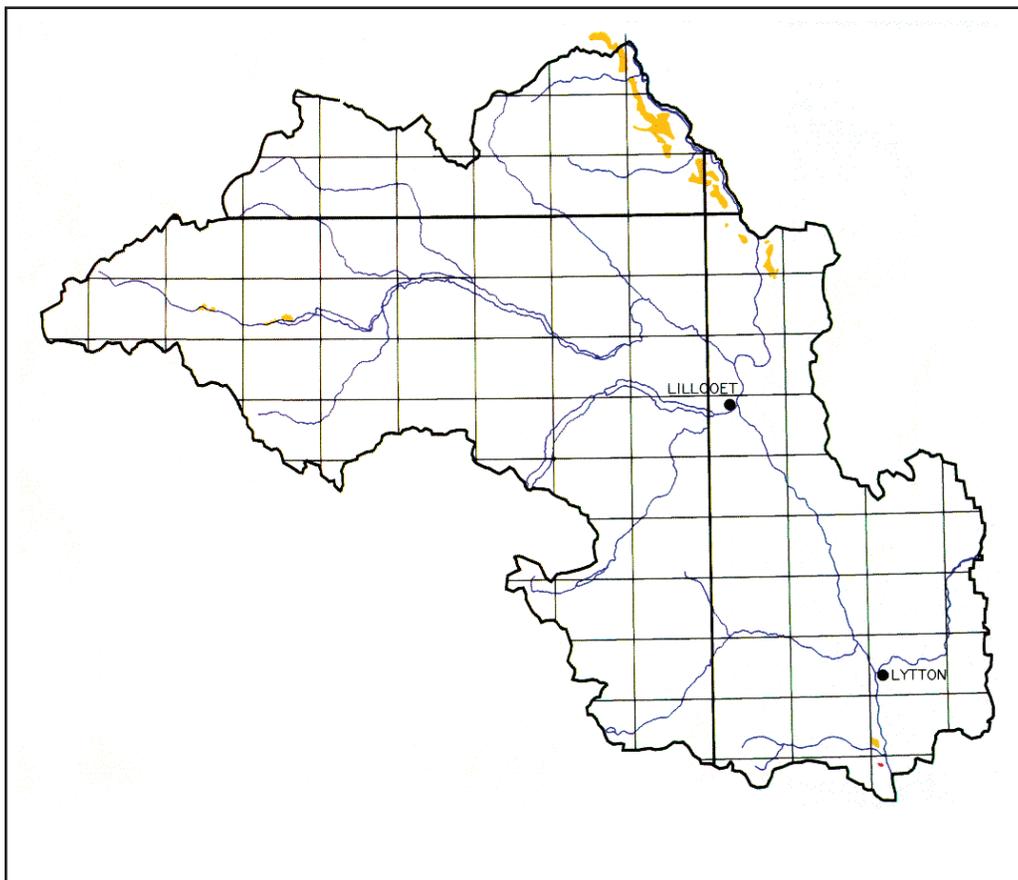


Figure 5. Area defoliated by western spruce budworm in the Lillooet TSA in 1998.

SUMMARY OF 1998 WESTERN SPRUCE BUDWORM SPRAY PROGRAM

Approximately 7,600 ha in 12 blocks were treated with *B.t.k.* (Table 3) between June 3 and June 9, 1998. Larval mortality in treated blocks ranged from 29% - 82%, and defoliation was 35% less severe, on average, in treated blocks than in untreated blocks.

It is anticipated that budworm populations are on the increase throughout the Region, especially in the Okanagan and Lillooet TSAs. Egg mass sampling was completed in the fall of 1998 to predict population and defoliation levels in 1999 (Table 4). Preliminary analysis of this data has delineated approximately 36,000 ha that may require treatment with *B.t.k.* in 1999.

Table 3. Area treated in 1998 with *Bacillus thuringiensis* var. *kurstaki* (*B.t.k.*) to control western spruce budworm.

Forest District	Ha. treated with <i>B.t.k.</i>
Kamloops	310 ha
Merritt	7,287 ha



Western spruce budworm



Two-Year Cycle Spruce Budworm

Approximately 35,300 ha of high elevation subalpine fir/spruce forests were defoliated by the two-year cycle budworm, mostly in the Clearwater forest district. This is the fourth largest infestation recorded in the Kamloops Forest Region since 1980. The budworm is in its second year (3rd-4th instar) of development, therefore the next year of noticeable defoliation from this insect will be 2000. Defoliation area and severity were likely underestimated, due to very poor visibility from smoke haze during the survey.

Douglas-fir Tussock Moth

A small pocket of defoliation was observed "in the wild" for a second consecutive year. Approximately 50 ha of Douglas-fir were moderately defoliated in and around Knox Mountain Park near Kelowna. A high population of western spruce budworm covering the same area made it difficult to determine the extent of defoliation attributable to the tussock moth. The area was aerially treated with nuclear polyhedrosis virus (NPV) in July of 1998. Subsequent egg mass surveys in the fall showed promising results in the treated area, and revealed increasing populations in several locations surrounding the treated area. Defoliation may occur at these sites in 1999.

Table 4. Summary of 1998 western spruce budworm fall egg mass sampling, showing the number of sites that are predicted to have nil, light, moderate or severe defoliation in 1999, by forest district.

District	Severity Rating (no. sites)				Total
	Nil	Light	Moderate	Severe	
Kamloops	115	27	6	0	148
Salmon Arm	34	2	3	1	40
Vernon	18	16	6	13	53
Penticton	11	27	17	1	56
Merritt	8	31	27	9	75
Lillooet	23	38	5	1	53
Total	209	141	64	25	425

Table 5. Average yearly trap catches for Douglas-fir tussock moth in several forest districts in the Kamloops Forest Region (1988-98). Average trap catches >25 indicate an incipient outbreak.

Year	District (mean no. of moths per trap)					Average
	Kamloops	Vernon	Merritt	Lillooet	Penticton	
1988	8.1	3.5	5.6	-	-	5.7
1989	9.2	6.4	6.8	-	-	7.5
1990	17.7	26.0	14.7	6.4	-	16.2
1991	37.0	20.3	39.5	21.3	40.7	31.8
1992	29.9	14.8	25.4	27.3	39.7	27.4
1993	23.7	6.0	2.8	5.0	2.6	8.0
1994	19.5	-	0.7	8.0	-	9.4
1995	10.4	0.5	3.4	-	3.6	4.5
1996	1.9	46.0	1.9	1.2	4.4	11.1
1997	17.0	39.0	17.0	1.6	9.1	16.7
1998	25.8	46.0	25.8	4.9	24.4	25.4



Outbreak populations of tussock moth may be expected within 1-3 years, based on historical periodicity of outbreaks, and on the general trend of increasing single-trap site catches (Table 5). Plans are underway to re-institute the Forest Insect and Disease Survey (FIDS) 6-trap cluster monitoring sites for the tussock moth in 1999. Egg mass sampling is currently being conducted by Regional crews to locate any epicenters where single trap catches were high in 1998. Areas with high populations may then be considered for treatment with NPV in May, 1999, to prevent further population buildup and damage.

Western Hemlock Looper

No defoliation was seen during the overview surveys in 1998; however, based on historical outbreak patterns (Fig. 6), it is expected that populations may increase to damaging levels within the next 1-3 years. Plans are currently underway to implement a population monitoring program for this insect, utilizing a series of permanent pheromone trapping sites situated in areas designated as being at high risk of defoliation. Operational research trials were conducted in 1993 to register *B.t.k.* for use

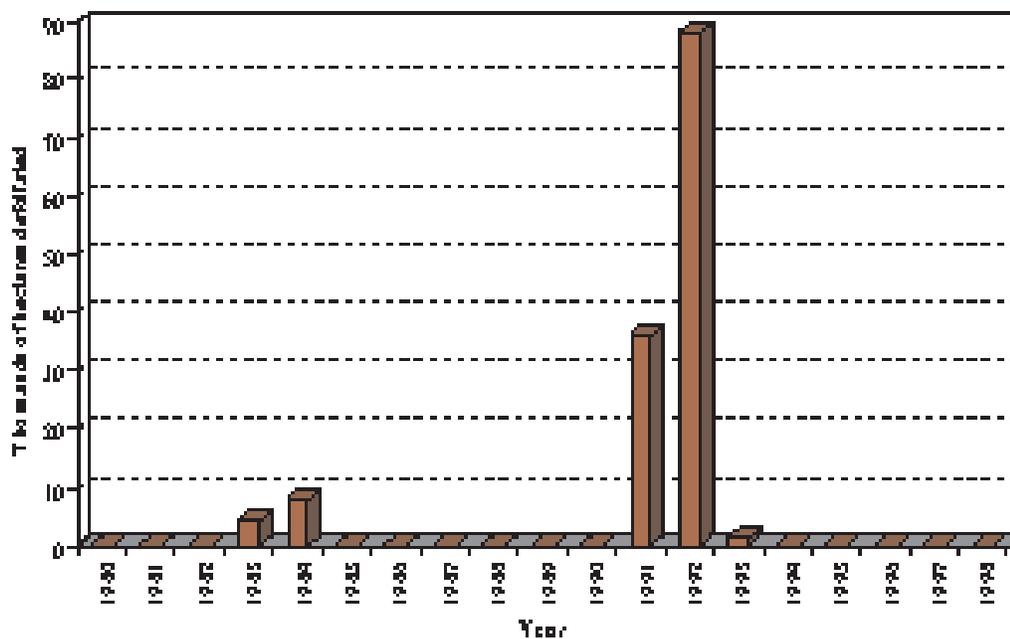
against the hemlock looper and with additional laboratory bioassays, this insecticide should be available for use during the next outbreak.

KAMLOOPS TSA

KAMLOOPS FOREST DISTRICT

Mountain Pine Beetle

Nearly 2,800 ha of attack were mapped in the Kamloops District in 1998 - 1,763 ha light attack, 980 ha moderate, and 47 ha severe attack. As well, 1,400 trees were killed in spot infestations, mostly associated with larger outbreak areas. Significant areas of damage included: the Red Lake/Red Plateau area, Heffley Lake, an area south of Disdero Lakes, several areas in the Louis Creek drainage, the Fadear/Cicero Creeks area, the upper East Barriere River, Johnson Creek, and Fishtrap and Peterson Creeks west of Barriere.



loops Forest Region.

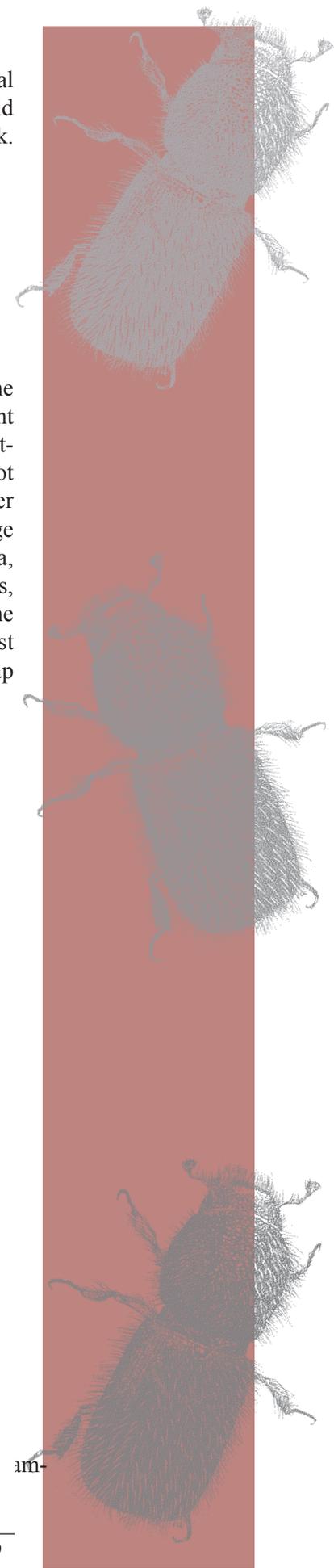
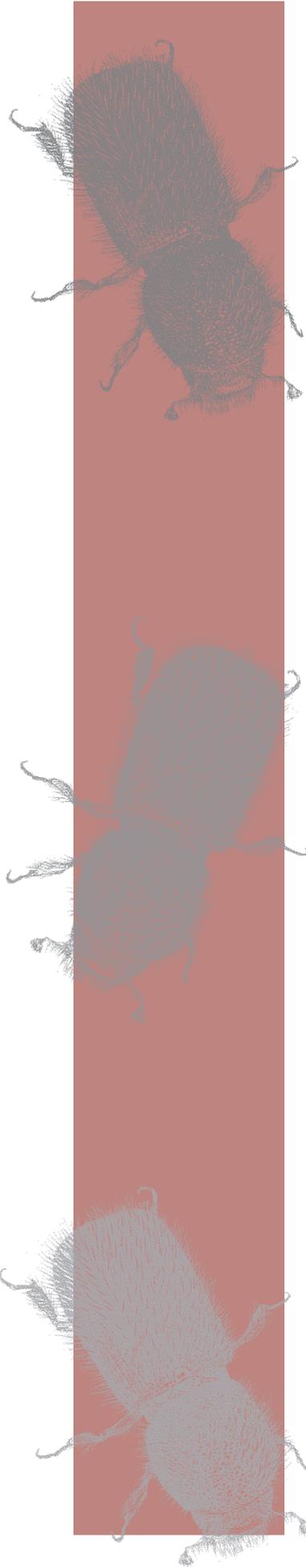


Table 6. Summary of the 1998 Kamloops Forest Region's aerial overview surveys, showing hectares affected, by district, by major forest insect pests.

Forest District and pest type	Area of Infestation			Total
	Light*	Moderate*	Severe*	
Mountain Pine Beetle				
Clearwater	6	0	0	6
Kamloops	1,763	980	47	2,790
Salmon Arm	399	38	22	459
Vernon	628	319	0	947
Penticton	1,777	303	0	2,080
Merritt	4,886	6,230	1,273	12,389
Lillooet	306	280	144	730
Total	9,765	8,150	1,486	19,401
Douglas-fir Beetle				
Kamloops	290	193	67	549
Salmon Arm	74	0	0	74
Vernon	116	8	0	124
Penticton	54	15	0	70
Merritt	208	39	22	269
Lillooet	8	0	15	23
Total	750	255	104	1,109
Spruce Beetle				
Vernon	0	6	0	6
Penticton	0	12	0	12
Merritt	18	27	0	45
Lillooet	57	7	0	64
Total	75	52	0	127
Western Balsam Bark Beetle				
Clearwater	168	0	0	168
Kamloops	273	0	0	273
Salmon Arm	329	0	0	329
Vernon	3,694	411	0	4,105
Penticton	1,616	17	0	1,633
Merritt	510	6	0	516
Lillooet	565	70	7	642
Total	7,155	504	7	7,666
Western Spruce Budworm				
Kamloops	16,788	0	0	16,788
Salmon Arm	36	0	0	36
Vernon	2,292	1,251	0	3,543
Penticton	14,736	2,796	0	17,531
Merritt	14,535	2,000	0	16,535
Lillooet	6,875	0	0	6,875
Total	55,293	6,047	0	61,340
Two-year Cycle Spruce Budworm				
Clearwater	34,583	501	0	35,084
Kamloops	9	0	0	9
Salmon Arm	102	0	0	102
Total	34,694	501	0	35,195

*severity ratings for bark beetle attack levels: light = 1-10% current attack
 moderate = 11-30% current attack
 severe = >30% current attack



As noted in Table 2, green to red attack ratios were very high in 1998, averaging 20:1. This gives a strong indication that a major increase in both area and severity of attacks is likely for 1999.

Douglas-fir Beetle

The Douglas-fir beetle damaged approximately 550 ha of forest in the Kamloops District in 1998, most of which was light to moderate attack. Approximately 775 trees were attacked in spot infestations. Most attack was mapped around Hat Creek, Duffey Lake/Durand Creek west of Greenstone mountain, the upper end of Peterson Creek, Jamieson Creek, Skull Creek, as well as numerous spot infestations north of Little Fort, and east of the Deadman River.

Population levels appear to be increasing in the district, with green to red attack ratios averaging 5 to 1 (Table 2).

Western Balsam Bark Beetle

Active areas of damage caused by this insect was limited to 275 ha of light attack, mostly located in scattered pockets on the Bonaparte Plateau west of the North Thompson River.

Western Spruce Budworm

Defoliation by this insect was mapped on 16,780 ha in 1998, up from 15,000 ha in 1997, and 2,670 ha in 1996. In the western part of the district, most damage occurred in the same general vicinity as in previous years, and accounted for the majority of the area defoliated: Hat Creek, Maiden Creek, both sides of the Bonaparte River north of Cache Creek, Scottie Creek, and Loon Lake. Defoliation expanded in the Campbell Creek/Barnhartvale area, and new defoliation was mapped west of Kamloops in the Inks Lake area, and north of the city around Huff and Orchard lakes.

All defoliation observed from the air was light, but subsequent ground checks revealed more severe defoliation to understory trees.

Egg mass sampling results were variable. Some areas predicted an increase in spruce budworm populations, while others predicted a decline.

Two-Year Cycle Spruce Budworm

Damage due to this insect was limited to 9 ha of light defoliation northwest of Taweel Lake, and was a result of defoliation spilling over the boundary of TFL #18 in the Clearwater District.

CLEARWATER FOREST DISTRICT

NOTE: Visibility was very poor over much of this district during the aerial flights, especially the northern and eastern portions, due to large wildfires near Avola and Silver Creek, and several smaller ones in the upper reaches of the North Thompson River. It must be emphasized that some disturbances may have been missed during the surveying, especially two-year cycle budworm, spruce beetle, and minor infestations of other bark beetles.



Balsam fir



Mountain Pine Beetle

Damage due to this insect was limited to a single 6 ha patch of light attack northeast of Little Fort, and 215 trees killed in spot infestations east of Clearwater, and near Clearwater and Hobson Lakes in Wells Gray Park.

Populations appear to be on the increase in the district for 1999, with an average green to red attack ratio of 5:1.

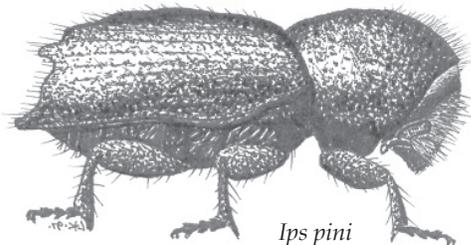
Western Balsam Bark Beetle

Damage due to this beetle was limited to small patches of light attack scattered throughout the North Thompson River drainage, and other high elevation areas of the district.

Two-Year Cycle Spruce Budworm

Defoliation covered over 35,000 ha in the district in 1998, down from 92,500 ha in the last feeding year of 1996. This was the fourth largest area defoliated by the two-year cycle budworm in the Clearwater District since 1980.

Extensive defoliation was mapped in TFL #18, many high elevation stands in Wells Gray Park, and along the North Thompson River and along most of its' tributaries north of Avola.



OKANAGAN TSA

SALMON ARM FOREST DISTRICT

NOTE: A large portion of the district (approximately 90,000 ha) was not included in the aerial survey in 1998, due to an air traffic restriction around the Silver Creek Fire and dense smoke which persisted until after the aerial surveys were completed. This encompassed the area between Salmon Arm and Chase Creek, from Bolean Lake to the north side of Shuswap Lake near Celista. Any for-

est health disturbances in this area were not mapped during the aerial flights. Additionally, poor visibility was a factor during the aerial surveys in the northern and eastern portions of the district due to smoke from the above fire, and other wildfires in the Okanagan.

Mountain Pine Beetle

Approximately 2,800 ha of red attack were mapped in 1998, of which 399 ha were light attack, 38 ha were moderate attack, and 22 ha were severe attack. In addition, 330 trees were killed in spot infestations of 5-50 trees. The bulk of the attack was mapped in the Chase Creek/Six Mile Creek area, with some small infestations in the lower end of Scotch Creek and near White Lake.

A significant increase in attack is expected in 1999 in most infestation areas, with green to red ratios averaging 25 to 1.

Douglas-fir Beetle

Approximately 75 ha of light attack were mapped, occurring in small pockets of spot infestations of 5-10 trees in the Larch Hills, Canoe Creek, east of Bastion Mountain, and on the east side of Seymour Arm north of Cinnemousun Narrows.

Populations appear to be on the increase in the district, with green to red attack ratios averaging 6 to 1.

Western Balsam Bark Beetle

Light attack by this beetle was mapped on 330 ha, most of which occurred in upper Scotch Creek. Other lightly attacked areas were mapped near Bolean Lake.

Western Spruce Budworm

A small area of new defoliation (light) was mapped on the north side of the Shuswap River, between Enderby and Ashton Creek. In addition, defoliation was reported in the Silver Creek area prior to the aerial surveys; however, the reported defoliation fell within the area which was not surveyed (see note above) in 1998. Egg mass sampling results predict an increasing population and moderate defoliation in the Silver Creek area in 1999.



Two-Year Cycle Spruce Budworm

A 102 ha patch of light defoliation was mapped near Ratchford Creek.

VERNON FOREST DISTRICT

Mountain Pine Beetle

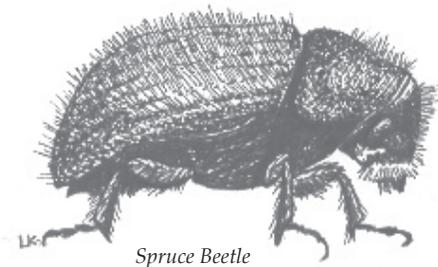
Nearly 950 ha of attack was mapped in the Vernon District in 1998. 630 ha of the attack were classified as light attack, while the remaining 320 ha were classified as moderate attack. An additional 880 trees were killed in spot infestations of 5-50 trees. Most of the areas of damage were located near the Chase Creek/Estekwalan Mountain area, and at Weyman Creek, Stephens Lakes, Salmon River, Monte Creek, and Naswhito Creek in TFL #49. Other areas of attack included Pinaus Lake, scattered areas east of Vernon between Coldstream and Armstrong, and Currie Creek, east of Cherryville.

Large increases in attack severity and area are expected in 1999, with green to red attack ratios averaging 25 to 1 in 1998.

Douglas-fir Beetle

Damage caused by this insect covered 125 ha in 1998. Most of the damage was classed as light attack; an additional 300 trees were killed in spot infestations of 5-20 trees. Most tree mortality occurred at Weyman Creek, Monte Creek, Ewer Creek, and Shorts Creek on TFL #49, an area near Tuktakamin Mountain south of Falkland, and numerous spot infestations near Coldstream.

An average green to red attack ratio of 6:1 in 1998 is indicative of an increasing population for 1999.



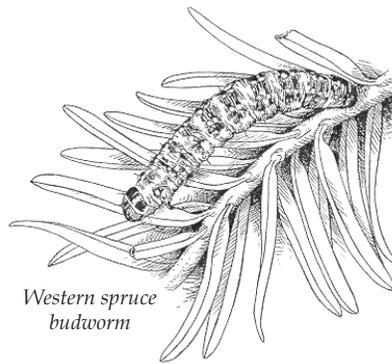
Spruce Beetle

Spruce Beetle

The only area of attack mapped was a 6 ha area of moderate attack in Latewhos Creek. Populations appear to be remaining stable in the district.

Western Balsam Bark Beetle

A major infestation of this beetle continued in the Buck Hills/Harris Creek area south of Lumby, and contributed to the bulk of the 4,100 ha of attack in the district. Other areas attacked were in Winnifred Creek, several areas in the Monashee Mountains south of Sugar Lake, and a few scattered areas west of Okanagan Lake.



Western spruce budworm

Western Spruce Budworm

Defoliation expanded in 1998 to 3,500 ha, up from 600 ha in 1997. Defoliation was mapped on the east side of Okanagan Lake along Predator Ridge, and new defoliation was mapped along the west side of the lake from Sugarloaf Mountain south to Caesars including parts of TFL #49, and a new pocket of defoliation was also mapped between Falkland and Glenemma. Egg mass sampling conducted in the fall of 1998 indicates a further expansion of defoliation and an increase in defoliation severity in 1999 on both sides of Okanagan Lake.

PENTICTON FOREST DISTRICT

Mountain Pine Beetle

Over 2,000 ha of red attack were mapped in the Penticton district in 1998, of which 1,780 ha were light attack, and 300 ha were moderate attack. An additional 1,650 trees were attacked in spot infestations of 5-30 trees. A





large, inaccessible infestation in Snehumption Creek continued for the third year, and was responsible for the bulk of the attack. Significant damage also occurred in the Similkameen River/Ashnola River area, Cathedral Park, and Hedley Creek, while smaller pockets of damage were mapped in Skulaow Creek and Okanagan Mountain Park.

Populations of this insect appear to be stable to slightly increasing, with an average green to red attack ratio of 2 to 1.

Douglas-fir Beetle

70 ha of attack were mapped in the district in 1998, and an additional 130 trees were killed in spot infestations of 5-10 trees. The damage was scattered throughout the districts' lower elevation Douglas-fir stands.

Population levels appear to be stable in the district, based on a green to red attack ratio of 1 to 1.

Spruce Beetle

A single 12 ha area was moderately attacked in the upper end of Lacoma Creek, near Dobbin Lake.

Western Balsam Bark Beetle

Over 1,600 ha of attack was mapped in the district in 1998, most of which occurred in the Buck Hills/Mission Creek area, and near Greyback Lake and Municipal Creek. Other small pockets were scattered throughout the high elevation areas of the district.

Western Spruce Budworm

Defoliation occurred on over 17,500 ha in 1998. Approximately 14,700 ha were lightly defoliated, and 2,800 ha were moderately defoliated. Most of the damage occurred on the west side of Okanagan Lake from Lambly Creek south to Summerland, where the majority of low elevation fir stands were defoliated. Much of this area has now sustained three consecutive years of defoliation and scattered tree mortality is noticeable. Defoliation was mapped on the east side of Okanagan Lake between Kelowna and Winfield for the first time during the present outbreak cycle. Fall

egg mass sampling predicts a stable population on most of the west side of Okanagan Lake, and an increasing population on the east side of the lake, where moderate to severe defoliation is expected in 1999.

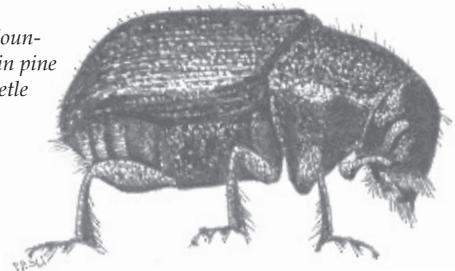
Douglas-fir Tussock Moth

Approximately 50 ha of Douglas-fir were moderately defoliated on private forested land near Knox Mountain Park in Kelowna. A high population of western spruce budworm in the area made it difficult to determine the extent of defoliation attributable to the tussock moth. The area was treated with an aerial application of NPV virus in July of 1998. Subsequent egg mass surveys in the fall of 1998 showed promising results in the treated area, and revealed increasing populations in several small surrounding areas on private land. Some visible defoliation is expected at these sites in 1999.

MERRITT TSA

MERRITT FOREST DISTRICT

Mountain pine beetle



Mountain Pine Beetle

Mountain pine beetle caused mortality on over 12,300 ha in the Merritt District in 1998, an increase from 9,500 ha in 1997. Over half of this area was moderately or severely attacked (6,230 ha and 1,270 ha respectively). In addition, a further 2,360 trees were killed in spot infestations of 5-50 trees. The majority of the damage occurred south of Princeton along the Similkameen River, Whipsaw Creek, and associated smaller drainages. Other significant damage was mapped to the east of Princeton, between Tulameen and Princeton, and in widespread small pockets and spot infesta-



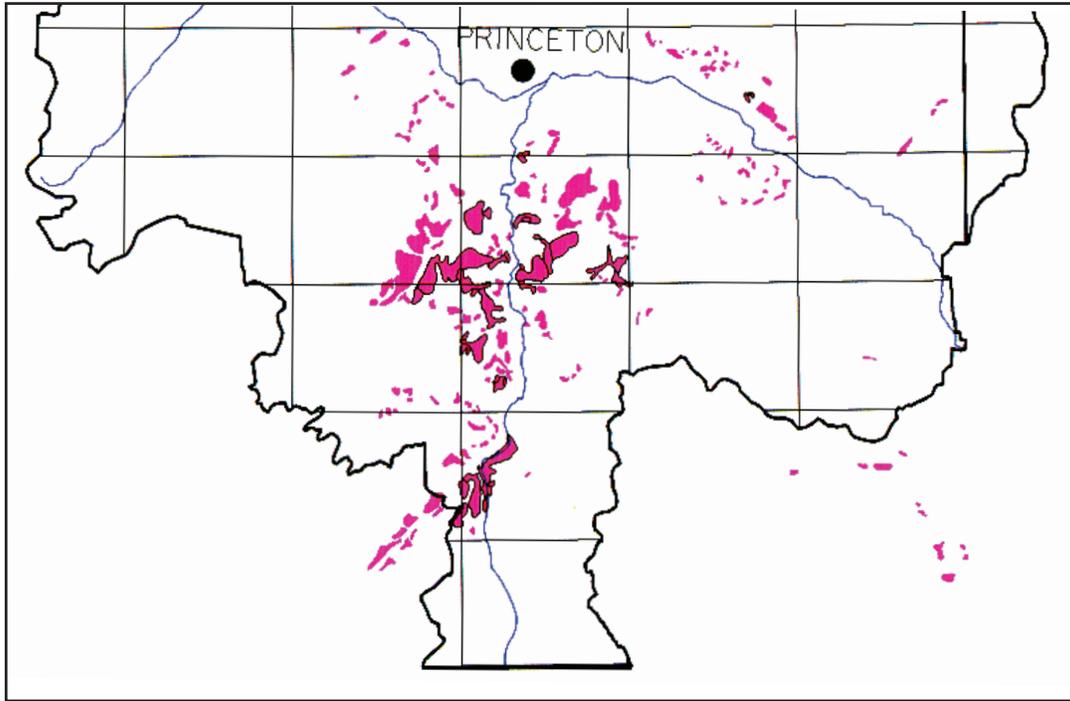


Figure 7. Area attacked by mountain pine beetle, in the Princeton area (Merritt TSA) as mapped by the 1998 aerial overview surveys.

tions north of Princeton, Hayes Creek, Rampart Creek, Otter Creek, Siwash Creek, and near Allison and Alleyne Lakes. A few small pockets of moderate attack were also mapped to the east of Douglas Lake. The results of the 1998 aerial overview survey for mountain pine beetle in the Princeton area are illustrated in Figure 7.

The green to red attack ratio averaged 20:1 in the Merritt district in 1998, indicating that a significant increase in both attack area and severity can be expected in 1999. The mountain pine beetle population is also increasing in the northern portion of the district.

Douglas-fir Beetle

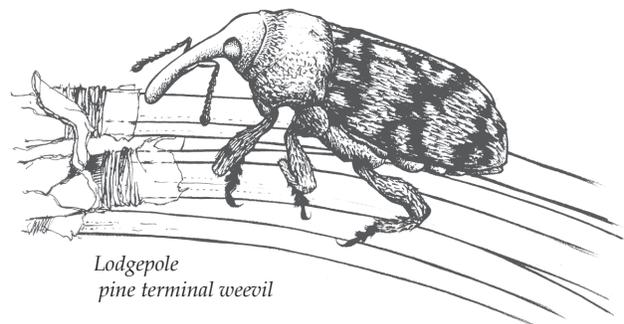
Approximately 270 ha of Douglas-fir were attacked in 1998. An additional 400 trees were killed in spot infestations of 5-25 trees. The attack was scattered throughout the district, with larger patches of light attack occurring near Kentucky Lake and Hayes Creek.

Douglas-fir beetle populations appear to be declining in the district, with an average green to red attack ratio of 0.1:1.

Spruce Beetle

Damage due to this insect decreased to 45 ha in 1998 from 460 ha in 1997. A small area of light attack was mapped in Lawless Creek, northwest of Tulameen, and two areas of moderate attack were mapped in Skwum Creek, west of Tulameen, and at Paul Creek, north of Cathedral Park.

An average green to red attack ratio of 0.1 to 1 indicates that populations and damage will continue to decrease in 1999.



Lodgepole
pine terminal weevil



Western Balsam Bark Beetle

Approximately 520 ha of mostly light attack were mapped. The largest areas of attack were in the Spius Creek area, and numerous smaller patches were mapped in the Siwash Creek area south of the Coquihalla Connector highway.

Western Spruce Budworm

Over 16,500 ha of defoliation was mapped, 14,500 ha of which was light defoliation. The affected area remains nearly unchanged from the 1997 total of 16,100 ha. This static population is in part due to 7,287 ha of the infestation being treated with *B.t.k.* in June, 1998. Defoliation was mapped at Swakum Mountain, Lindley Creek/Lower Nicola, Promontory Hill, along both sides of Guichon Creek, north to Mamit Lake, along Nicola Lake and Moore Creek, north to Stump Lake, and in scattered patches around Peter Hope Lake and Douglas Lake.

Egg mass sampling completed in the fall of 1998 shows a stable population, and similar levels of defoliation should be seen in 1999, with some areas of moderate and severe defoliation.

LILLOOET TSA

LILLOOET FOREST DISTRICT

Mountain Pine Beetle

Mountain pine beetle damaged 730 ha in the Lillooet District in 1998. Major areas of attack were in Tyaughton Creek, the east side of Anderson Lake in Lost Valley Creek, and Murray, Luluwissin, and Sleetsis Creeks north of Lytton. A further 650 trees were killed in spot infestations of 5-30 trees, mostly in Murray, Luluwissin, and Twaal Creeks.

Average green to red attack ratios of 2:1 in 1998 indicate that populations of this insect are stable to slightly increasing in the district.

Douglas-fir Beetle

Approximately 23 ha of Douglas-fir were attacked, as well as a further 120 trees in spot

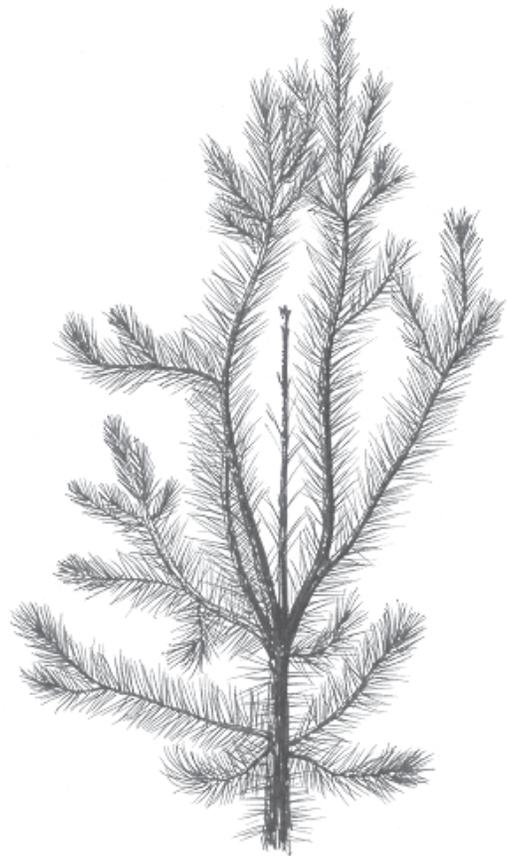
infestations. Most of the attack occurred along the Fraser River in the Texas Creek area, and in East Murray Creek.

Populations appear to be on the decline, with an average green to red attack ratio of 0.5 to 1 in 1998.

Spruce Beetle

Spruce beetle caused light to moderate damage in Tommy Creek, on the south side of Carpenter Lake. An infestation in the Spruce Lakes area was not mapped due to a lack of visible foliage fading.

Populations of this insect appear to be stable.



Dead leader, caused by lodgepole pine terminal weevil, with compensating lateral growth.



Western Balsam Bark Beetle

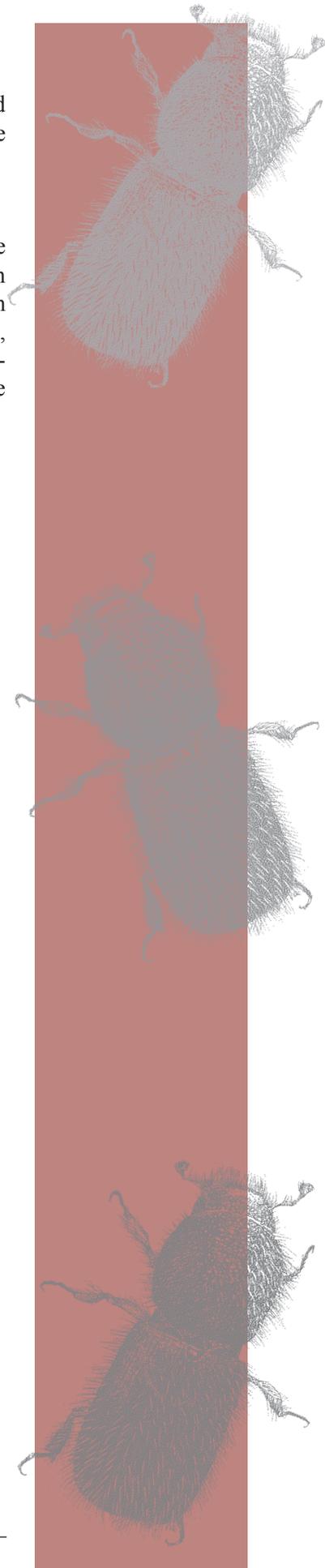
Significant mortality caused by this insect was mapped on 640 ha. Most of the damage occurred in the upper Bridge River, where activity by the beetle has been observed for two consecutive years, and in Kwoiek Creek and near Siwash Creek.

Western Spruce Budworm

Over 6,800 ha were lightly defoliated in 1998, up from 900 ha in 1997. Most of the damage was mapped along the west side of the Fraser River from Leon Creek north to Lone Cabin Creek (West Pavilion area). Smaller areas of defoliation were also observed in the Gillon Creek area, along the Fraser River near Kwoiek Creek, on the north side of Downton Lake, and along the upper Bridge River. Ground surveys showed more severe defoliation to understory trees. Egg mass sampling conducted in the fall of 1998 indicates that light to moderate defoliation will occur in much of the West Pavilion area in 1999.

For more information, and copies of 1998 aerial overview maps, please contact:

Lorraine Maclauchlan, Regional Entomologist
Kamloops Forest Region,
515 Columbia Street,
Kamloops, B.C.
V2C 2T7
Telephone: (250) 828-4179
Email: Lorraine.maclauchlan@gems3.gov.bc.ca





Acknowledgements:

Thanks to the following District Forest Health Specialists for supplying data for this report:

Stewart Pyper - Clearwater

David J. Piggin, R.P.F. - Kamloops

Wayne Anshelm - Salmon Arm

Rick Specht - Vernon

Margot Hollinger, R.P.F. - Penticton

Pat Byrne - Merritt

Ed Senger, R.P. Bio. - Lillooet