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Forest Insect and Disease Conditions

Kamloops Forest Region 1981

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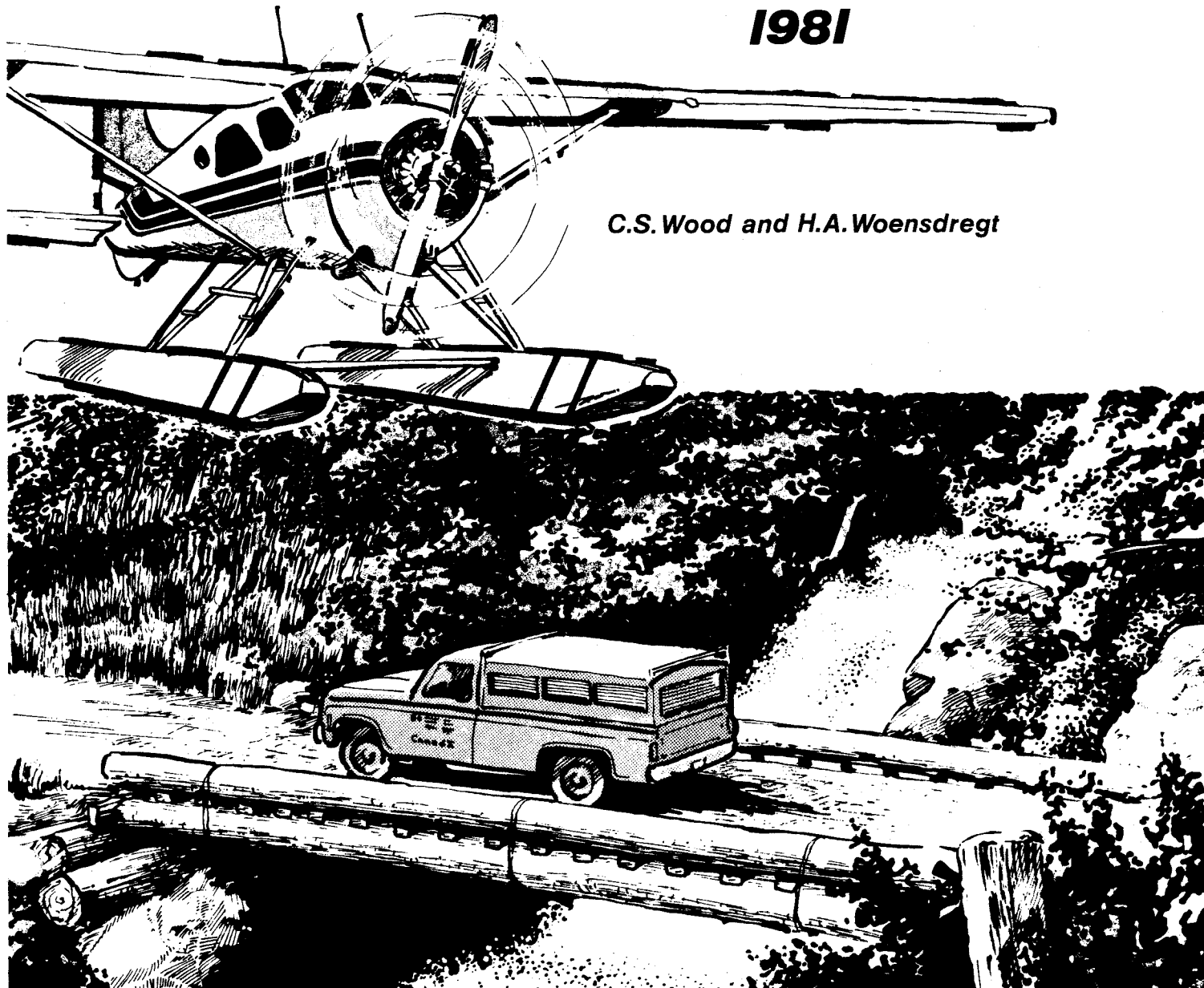


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SUMMARY

This report outlines THE STATUS OF FOREST PEST CONDITIONS in the KAMLOOPS FOREST REGION in 1981. Population trends are forecast and emphasis is given to pests which are capable of sudden damaging outbreaks.

Mountain pine beetle attacked and killed an estimated 2,705,000 pine trees in more than 350 infestation areas over 19 500 ha, with estimated volume losses of 1 358 million m³. Lodgepole pine dwarf mistletoe infected at least 50% of the trees on 250 ha in upper Izman Creek and other lower- and mid-elevation mature stands throughout the Region. Active Blackstain root rot infections killed 150 mature lodgepole pine over 50 ha in the Mail-Ivor creeks area in the Paxton Valley. The pine sheath miner populations collapsed in the Clearwater area. Elytroderma needle disease severely infected and killed up to 50% of the 1980 needles on ponderosa pine throughout much of the host range.

Douglas-fir tussock moth defoliated 1 050 ha in 14 outbreak areas near Hedley, to Carquile north of Cache Creek, the first recorded outbreaks since the 1972-1976 outbreak period. Western false hemlock looper outbreaks developed over 350 ha in five areas in the Shuswap area where outbreaks were last reported between 1972 and 1976. A special survey determined the presence of the native disease, Swiss needle cast on older needles of Douglas-fir stands associated with the Interior Wet Belt.

The number of Engelmann spruce trees recently killed by the spruce beetle remained low, due to improved monitoring and harvesting techniques. The two-year-cycle spruce budworm population in the North Thompson River drainage in the 'off' phase, did not cause any visible damage, where 13 800 ha of mature Engelmann spruce and alpine fir were defoliated in 1980. The number of alpine fir trees recently killed by the western balsam bark beetle increased to 2,435 trees over 1 870 ha in nine areas mainly in the Bonaparte Plateau area.

The Larch casebearer continued to defoliate stands east of Anarchist Mountain to the Regional border.

The Indian paint fungus infected at least 50% of the mature and over mature western hemlock stands in the Interior wet belt zone of the Region, particularly in the Clearwater River, Miledge Creek, Mud and Myrtle lake areas.

A total of 19 second growth stands, natural and managed, were examined to assess and record the incidence and extent of forest pest problems.

Cone and seed pest damage ranged from nil to light in the limited numbers of cones from the very light cone crop, sampled at 42 locations.

Pest of deciduous stands included Fall webworm, which severely defoliated a variety of hosts in localized areas throughout the region.

Pheromone traps were used to monitor male adult population levels and trends for Douglas-fir tussock moth; (67 traps at 33 locations); for western spruce budworm (24 traps at 8 locations). A single pheromone trap north of Osoyoos in the Okanagan Valley attracted 323 adult European elm bark beetles, the vector of Dutch Elm Disease; no beetle attacks or disease infected trees were observed. Single pheromone traps were located in 25 Provincial Parks to monitor adult male gypsy moth populations, with negative results, in a cooperative program with Canadian Forestry Service, Agriculture Canada, and B.C. Ministry of Parks and Recreation.

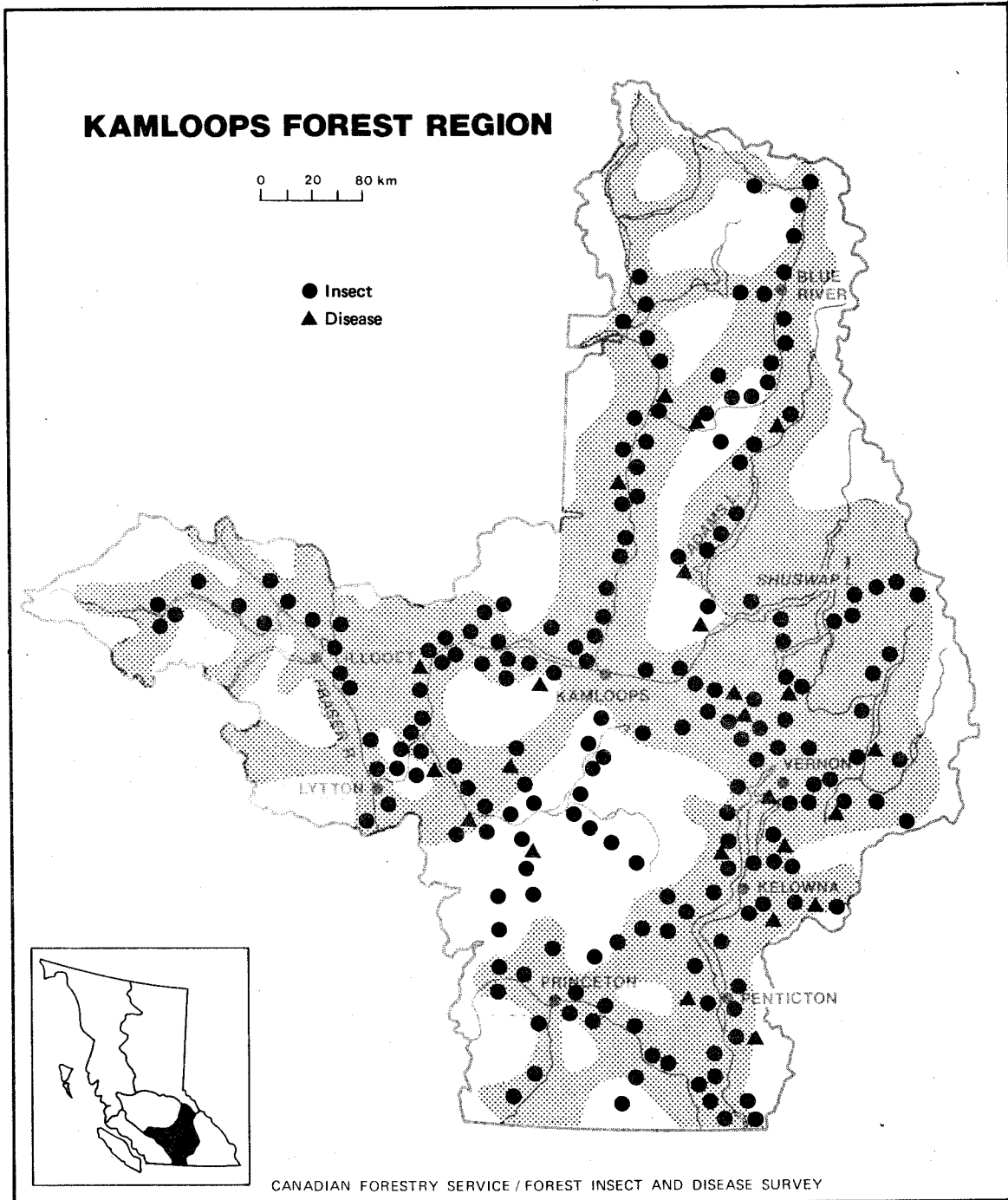
The pest survey field season extended from mid-May to late September during which time a total of 330 insect and 83 disease collections were submitted to the Pacific Forest Research Centre (in 1981) by F.I.D.S. survey technicians and B.C. Ministry of Forests, Protection Branch personnel and other agencies in the Kamloops Forest Region. Map 1 shows the location where one or more samples were collected.

The percentage of insect collections containing potentially damaging forest defoliators such as Douglas-fir tussock moth, Western spruce budworm and Western false hemlock looper was 76% compared with 83% in 1980 and 77% in 1979. Special collections were made of a variety of eleven forest pests for research personnel in Canadian Forestry service and Agriculture Canada research centres in Victoria, Sault Ste. Marie and Ottawa.

A total of 41.5 hours of fixed wing and 1.0 hours of helicopter time was provided by B.C. Ministry of Forests, Protection Branch, Kamloops, to map and photograph major pest problem areas throughout the Region, (Map 1).

More than 30 contacts and extension services with Industry, Provincial and Federal agencies and the general public were conducted during the report period.

The annual survey of Provincial parks identified three major insect pests and one major disease in nine of the 37 parks visited in five Park Districts.



Map 1

**Aerial Surveys and Collection Locations
1981**

Area Covered By Aerial Surveys
and
Locations Where One or More Insect and Disease Samples Were Collected

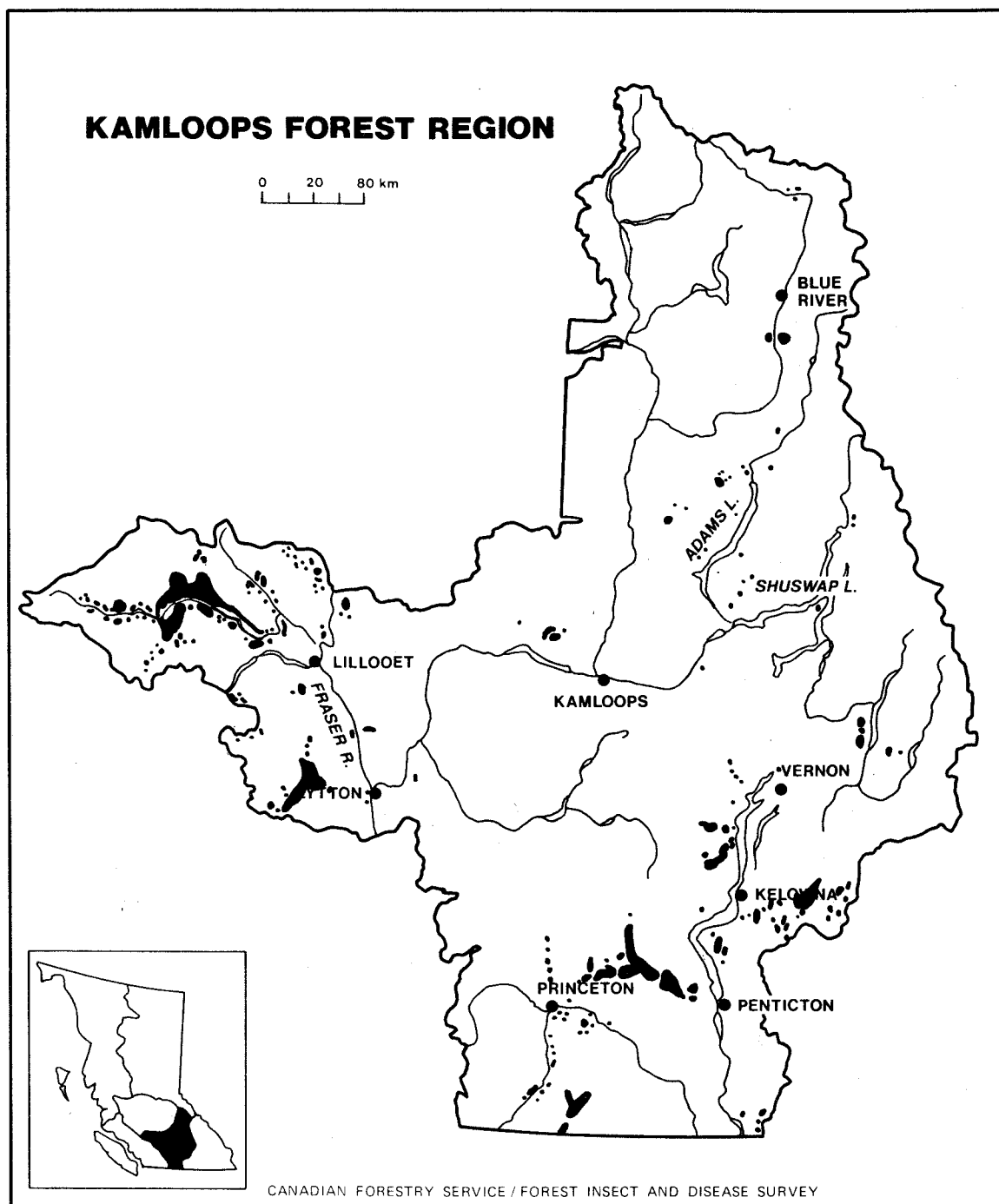
PINE PESTS

Mountain pine beetle, Dendroctonus ponderosae

Mountain pine beetle population attacked and killed an estimated 2,705,000 lodgepole, ponderosa and western white pine trees in 350 infestation areas over at least 19 500 ha throughout the Region in 1981, (Map 2), a volume loss at 1 360 million m³ (Table 1). This compared with 1,060 infestation areas over 37 000 ha in 1980.

Table 1. Area, number and volume of lodgepole, ponderosa and western white pine trees recently killed by mountain pine beetle, determined from aerial and ground surveys.
Kamloops Forest Region, 1981.

Timber Sale Area	Host tree species	Area (ha)	Number of trees killed	Volume of host killed (m ³)
Kamloops	Lodgepole pine	35	705	565
	Ponderosa pine	4	45	55
	Western white pine	177	1,550	2 325
		215	2,330	2 945
Lillooet	Lodgepole pine	16 515	2,639,500	1 319 750
	Ponderosa pine	127	3,565	35
	Western white pine	83	3,900	7 800
		16 725	2,646,965	1 327 585
Merritt	Lodgepole pine	400	8,385	3 355
	Ponderosa pine	15	275	410
		415	8,660	3 765
Okanagan	Lodgepole pine	2 050	46,310	23 155
	Ponderosa pine	35	215	260
	Western white pine	60	550	825
	TOTAL	2 145	47,075	24 240
All TSA's	Lodgepole pine	19 000	2,694,900	1 346 825
	Ponderosa pine	180	4,100	760
	Western white pine	320	6,000	10 950
	TOTAL	19 500	2,705,000	1 358 535



Map 2

**Mountain Pine Beetle
1981**

Areas of Recently Killed Lodgepole Pine, As Determined From Aerial Surveys

The outbreak areas, determined from both aerial and ground surveys ranged in number and intensity from 107 areas of light mortality (1% to 5% of host species recently killed), to 183 areas at moderate mortality (5% to 30%) and 61 areas of severe (31% or more), and one area of old dead grey near Gun Lake. (Table 2).

The largest outbreak areas persisted in the Carpenter-Gun-Downton lakes areas (2,560,000 lodgepole pine over 14 000 ha), in the Stein River valley (40,695 lodgepole pine over 880 ha), both in the Lillooet TSA; in Hayes Creek (6,220 lodgepole pine over 320 ha) in the Merritt TSA; in the Mission-Belgo creeks area (10,475 lodgepole over 630 ha); in Lambly Creek (3,800 lodgepole on 430 ha); in Terrace Creek (5,260 over 50 ha); and in the Ashnola River valley (6,800 on 150 ha) and Trout Creek (4,770 on 175 ha) drainage, all in the Okanagan T.S.A.

The decreases in numbers and total areas of the 1981 outbreaks (19 500 ha) compared with 1980 (37 000 ha) occurred largely in the lodgepole pine stands in the Okanagan T.S.A. (2 145 ha in 1981 from 19 810 in 1980). The decreases were attributed to harvesting of previously killed stands and more specific aerial estimation techniques.

The numbers and areas of recently-killed western white pine also decreased in 1981, to 6,000 trees in 65 infestation areas over 320 ha from an unspecified number of trees in 70 infestations over 6 700 ha in 1980. The largest decrease occurred in the Blue River area where previously persistent infestation areas have been reduced by harvesting to 760 trees on 3 ha. Localized outbreaks persist elsewhere in the Region; in the Kamloops TSA (15,509 trees on 177 ha): in Finn Creek (350 trees on 75 ha); near Saskum Lake (335 trees on 42 ha), Adams Lake (130 trees on 4 ha), E. Barriere Lake (300 trees on 12 ha). In the Lillooet TSA (3,900 trees on 83 ha): largely in Cayoosh Creek (1,510 trees on 37 ha), and the Stein River Valley (2,100 trees on 26 ha). In the Sugar-Mabel lakes area (525 trees on 54 ha) of the Okanagan TSA (550 on 60 ha).

Of the 4,100 recently killed ponderosa pine in the Region, 2,890 were recorded over 100 ha in the Carpenter-Gun lakes-Goldbridge outbreak area and 675 over 17 ha in the Stein River valley drainage. The other 535 trees were recorded in approximately sixteen scattered areas throughout the Region from Pass Lake (25 trees) in the Kamloops TSA to 180 in three areas near Lytton in the Lillooet TSA, and 140 in the Nine Mile creek area near Anarchist Mountain in the Okanagan TSA.

Ground examination of 15 beetle infested stands in the Carpenter-Gun-Downton lakes area were evaluated to determine the status of beetle populations in the area. Of 2,675 pine trees tallied in 15, 0.25 ha plots, the current (1981) attacks ranged from 7% to 50% of the trees and averaged 21%. The data predicts that continued tree mortality will occur in the area in 1981 precluding overwintering population mortality. (Table 3).

Table 2. Number of pine killed, area and number of mountain pine bark beetle infestation by severity.
Kamloops Forest Region, 1981

Timber Sale Area	Tree sp. ^{3/}	Number ^{2/} trees killed	Infestations							
			Area (ha)			Number				
			Light	Moderate	Severe	Grey	Light	Moderate	Severe	Grey ^{1/}
KAMLOOPS TSA	1P	705	5	30			2	5		
	pP	45	2	1			1	1		
	wwP	1 550	150	27			12	13		
		2 300	157	58			15	19		
LILLOOET TSA	1P	2,639,500	615	800	15 100		23	68	32	1
	pP	3,565	2	70	55		2	12	7	
	wwP	3,900	13	10	60		3	17	11	
		2,647,000	630	880	15 215		28	97	50	
MERRITT TSA	1P	8,385	26	365	9		10	16	3	
	pP	275	1	14			1	7		
		8,660	27	379	9		11	23	3	
OKANAGAN TSA	1P	46,310	520	1 405	125		42	40	8	
	pP	215	34	1			4	2		
	wwP	550	54	6			7	2		
		47,075	608	1 412	125		53	44	8	
SUMMARY ALL TSAs	1P	2,694,900	1 166	2 600	15 234		77	129	43	1
	pP	4,100	39	86	55		8	22	7	
	wwP	6,000	217	43	60		22	32	11	
		2,705,000	1 422	2 729	15 349		107	183	61	1

^{1/} L = Light: 1-5% of the host species red; M = Moderate: 6-30%; S = Severe: 31% or more; G = Grey: old dead trees.

^{2/} Related to last year's attack.

^{3/} 1P = Lodgepole; pP = Ponderosa; wwP = Western white pine.

Table 3. Status of lodgepole pine trees in plots in mountain pine beetle infestation areas near Goldbridge.
Kamloops Forest Region, 1981

Status of lodgepole pine trees					
Plot	Green		Red	Grey	Total
	Healthy	Attacked			
1	115	28	48	198	389
2	19	10	32	82	143
3	150	97	84	53	384
4	94	22	29	71	216
5	12	3	48	19	82
6	3	7	38	42	90
7	0	20	57	37	123
8	36	6	86	30	158
9	93	31	51	6	181
10	48	21	20	3	92
11	10	24	41	11	86
12	98	81	18	6	203
13	76	112	22	13	223
14	65	79	14	21	179
15	57	25	21	23	126
<hr/>					
TOTAL	885	566	609	615	2,675
<hr/>					
%	33	21	23	23	100

Limited ground checks in or adjacent to other outbreak areas indicate similar population trends. Since the currently widespread outbreak areas in the Region first developed in 1964, the numbers of mature pine trees killed annually have fluctuated. However the trend has been toward increasing numbers annually (Table 4).

The four current major outbreak areas in the Region, the Goldbridge area, around Kelowna, in Trout Creek and in the Ashnola River Valley reflect this trend since they were first reported in 1975, 71, 73 and 1975 respectively (Figure 1).

Table 4. History of mountain pine beetle outbreaks, Kamloops Forest Region 1964-1981.

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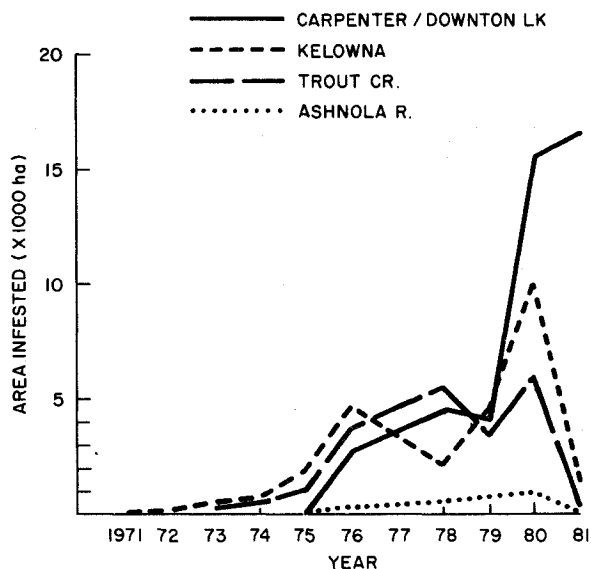


Figure 1

**Mountain Pine Beetle
Kamloops Forest Region
1971-1981**

Area of Mature Lodgepole Pine Killed On Four Major Outbreak Areas

Lodgepole pine dwarf mistletoe, Arceuthobium americanum

Mistletoe infection are major contributors to volume loss in mature lodgepole pine stands throughout the Region where infection often exceeds 50% of stands up to 250 ha or more.

Near Turnip Lake, in upper Izman Creek, 50% of the understory regeneration was infected. Similar levels of infection were common in lodgepole pine stands where infected overstory trees remain in selectively logged areas. In stands over 1 000 metres elevation infected overstory pine are often associated with understory alpine fir-Engelmann spruce.

As alpine-fir is resistant to infection from A. americanum, and Engelmann spruce is rarely infected there is little or no adverse impact from mistletoe infected overstory lodgepole pine.

Black stain root disease, Verticicladiella wagenerii

At least five active infection centres in mature lodgepole pine stands in the Mail-Ivor creeks area in the Paxton Valley east of Monte Lake, contained an average of 3 infected mature lodgepole pine per hectare over an estimated 50 ha. Ten infected trees were predisposed by the infection and attacked in 1980-81 by mountain pine beetle.

Tree mortality caused by both agents is increasing annually in the area, particularly in stands south of St. Laurent Creek opposite the Mail-Ivor creeks area.

Armillaria root rot, Armillaria mellea

In 1981 the root rot infected and killed an estimated 65 mature lodgepole pine trees per hectare over an estimated 400 ha between Hornet Creek and Mud River west of the North Thompson River north of Clearwater. Up to 25% of the infected stems were attacked by secondary engraver beetles, Ips spp.

Mature pine were also recently killed by the root rot in stands along the Mud River access road and in Wells Gray Provincial Park. In each of two localized 0.25 ha areas at each location, three infected trees were recently attacked by mountain pine beetle, D. ponderosae. Infection of mature pine stands by the root rot and attacks of infected trees by primary and secondary bark beetles are expected to persist in the North Thompson River area and have the potential for intensification and expansion.

The incidence of up to 23% infection of the area by the root rot, in mature lodgepole pine stands in the North Thompson River valley area, was established by cruises in the Clearwater-Vavenby area in 1980.

Atropellis canker, Atropellis piniphilla

The stem disease is common in many mature stands throughout the Region, often associated with dwarf mistletoe, A. americanum and high stocking densities. Infections exceeded 50% of the trees in areas of 2 to 250 ha or more in mature stands in the Dominic Lake-Greystone Mountain area; Logan Lake-Upper Highland Valley; in the Barriere-Bonaparte Lake region; along the Mud River access road; in Wells Gray Park and in Cahilty Creek.

The cankers range in length between 0.5 and 2 metres in heavily infected dense stands, resulting in discoloration of wood tissue and often premature breakage.

Pine needle sheath miner, Zellaria haimbachii

There was no evidence of larval population or damage in lodgepole and ponderosa pine stands in the North Thompson River valley, in the Princeton area or near Little Shuswap Lake, where this pest defoliated 5 400 ha in 1980.

The cause of the population collapse is attributed to undetermined causes.

European pine shoot moth, Rhyacionia buoliana

A cooperative survey by B.C. Ministry of Forests, the Federal and Provincial Departments of Agriculture and the Canadian Forestry Service, to locate pine shoot moth infested shoots in mature and ornamental pines throughout the Thompson-Shuswap-Okanagan region, initiated in 1976, was discontinued in 1981. No observation by F.I.D.S. were carried out in the Region in 1981.

Between 1976 and 1980 the number of infested trees in residences remained relatively unchanged in five major population centres in the region. No infections were reported in mature pine stands.

For the second year the pheromone attractant trap program to assess male adult population levels was not implemented due to pheromone difficulties.

Elytroderma needle disease, Elytroderma deformans

Infection of 1980 needles of ponderosa pine was evident throughout much of the host range in the Region in 1981. The intensity of infection killed between 1 to 50% of the 1980 foliage of up to 75% of the mixed age class trees in stands from 1 to 100 ha in area. Previously infected trees, particularly those with brooms caused by successive years of infection, were the most heavily infected. At least 20% of the stands were newly infected in 1980.

The intensity of infection was the severest recorded in the past decade. Similar levels of infection in 1981, due to wetter than normal conditions during the late summer infection period, will likely become visible in 1982.

White pine blister rust, Cronartium ribicola

More than 50% of the immature white bark pine in mixed higher elevation pine-alpine fir stands in the Mission Mountain summit access

road area were infected by the rust. However, there was no evidence of stem infection causing tree mortality, but highly visible branch mortality exceeded 25% in 85% of the infected trees.

The pine needle scale, Phenacaspis pinifoliae and the black pineleaf scale, Nuculaspis californica

Up to 50% of the 1980 and previous years needles of mature and immature ponderosa pine trees, adjacent to access roads in the Okanagan Falls to Oliver area, were infested by both pests. The severest damage was to immature trees along the Shuttleworth Creek access road east of Okanagan Falls where repeated damage has resulted in premature needle loss, stunted form and reduced vigor.

DOUGLAS FIR PESTS

Douglas-fir tussock moth, Orgyia pseudotsugata

Tussock moth defoliated a total of 1 050 ha of immature and mature Douglas-fir stands in 18 areas in the Region from Bromley Rock Park near Hedley to Carquile near Cache Creek, (Map 3).

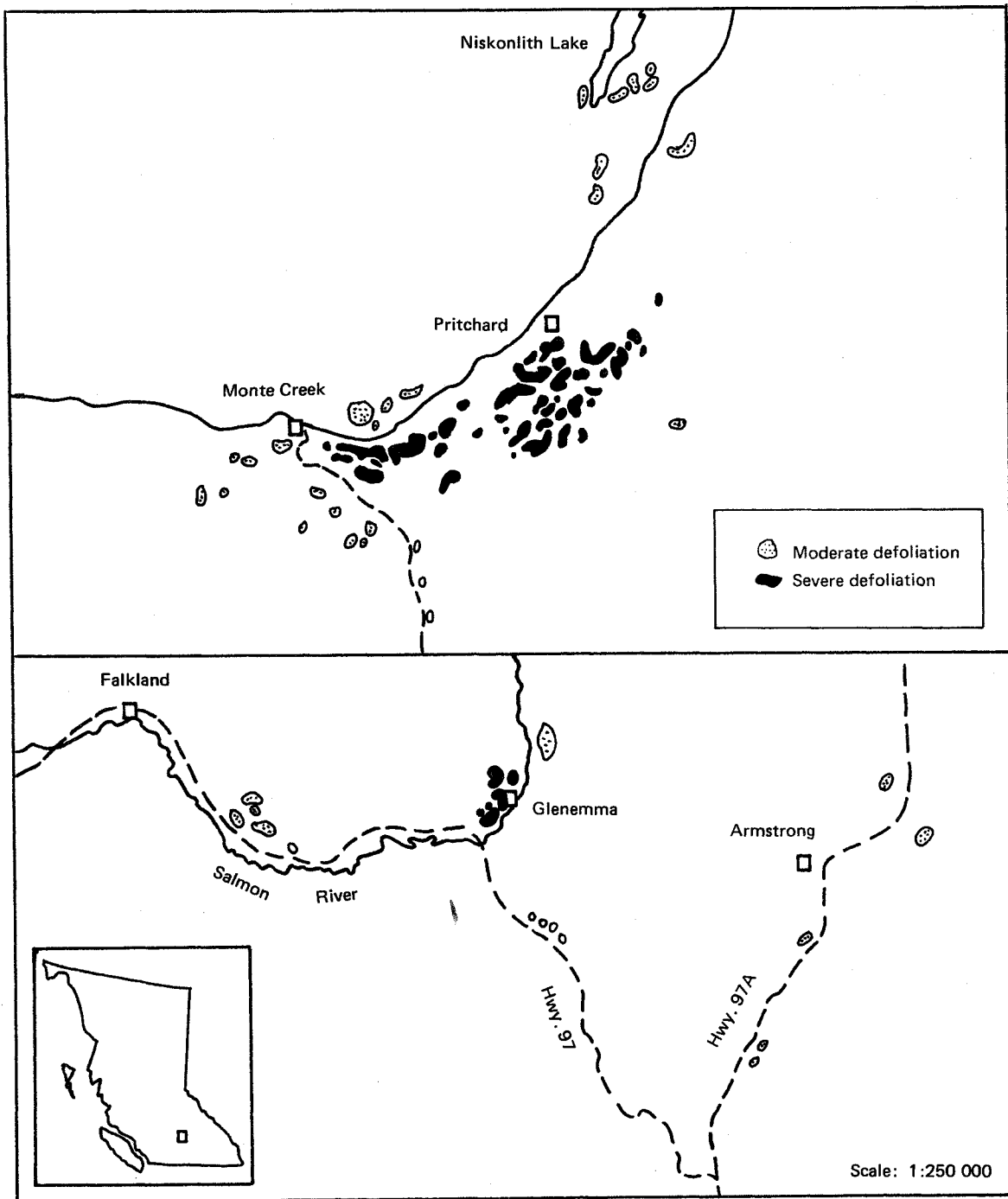
The outbreaks were the first recorded since the 1972-1976 outbreak period. Evidence of increasing population was reported in 1980 when 30 larvae per three tree beating samples were collected east of Kamloops, and the number of male moths in baited pheromone traps at 13 locations indicated "a population increase in population levels in 1981".

Of the total area defoliated, damage intensities ranged from 4 localized areas of 1 to 40 ha of light defoliation (less than 25%), totalling 55 ha, (5% of the total), to 11 areas of moderate defoliation (20% to 65%), between 10 to 125 ha totalling 380 ha (35% of the total); and 3 areas of severe defoliation (65% or more) between 20 and 535 ha, a total of 615 ha (60%) (Table 5).

Ten immature Douglas-fir trees and a Colorado spruce were severely defoliated in at least three suburban properties in the city of Kamloops.

There was no evidence of bud, branch or tree mortality at any of the severely defoliated stands examined.

Larval mortality from viral or disease infections was limited to a small collection of 25 viral infected larvae from three trees in a severely defoliated 50 ha stand near Armstrong. The immediate impact of the viral infections is currently not significant, but will likely increase in the next few years.



Map 3

**Douglas-Fir Tussock Moth
Kamloops Forest Region
1981**

Areas of Defoliated Douglas-Fir Determined From Aerial Surveys

Table 5. Location and area of Douglas-fir stands defoliated by
Douglas-fir tussock moth.
Kamloops Forest Region. 1981.

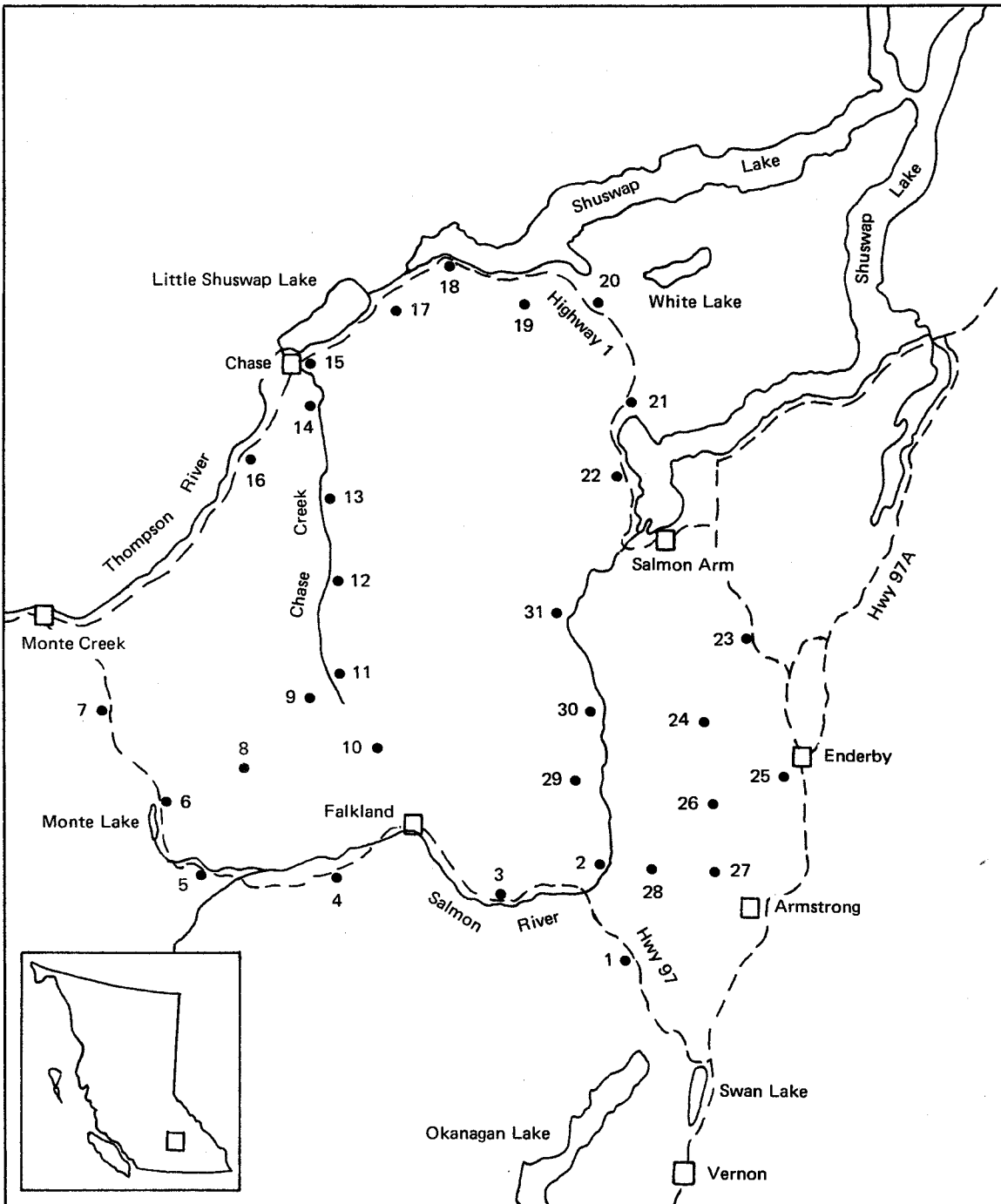
Location (T.S.A. and geographic)	Area of defoliation (ha)				
	Light	Moderate	Severe	Grey	Total
<u>KAMLOOPS TSA</u>					
Monte Cr.-Pritchard	-	125	545	-	670
Lions Head	-	50	-	-	50
Whiskers Hill	-	20	-	-	20
Niskonlith	-	45	-	-	45
Upper Buse Lake	10	-	-	-	50
Carquile	-	50	-	-	50
	10	290	545	-	845
<u>OKANAGAN TSA</u>					
Neskain	-	15	-	-	15
Salmon River	40	25	50	-	115
Deep Creek	-	30	-	-	30
Main Creek	-	10	-	-	10
Larkin	-	15	-	-	15
	40	80	50	-	170
<u>MERRITT TSA</u>					
Similkameen River Valley	-	10	20	-	30
Stemwinder Prov. Park	4	-	-	-	4
Bromley Rock Prov. Park	1	-	-	-	1
	5	10	20	-	35
<u>SUMMARY</u>					
KAMLOOPS TSA	10	290	545	-	845
OKANAGAN TSA	40	80	50	-	170
MERRITT TSA	6	10	20	-	365
TOTAL	55	380	615	-	1 050

A pheromone trap program monitored male adult populations at 31 locations in the North Okanagan-Shuswap area (Map 4). Five traps baited with 1% strength by weight, 2-6 Henie Cosen 11-1 pheromone were sited at each location. The average number of adult males per trap was between 1 and 58. (Table 6). The data indicated endemic populations (less than 25 adults per trap) in 13 locations and rising populations in 17 areas which ranged from 27 to 54 adults per trap.

Table 6. Location and number of adult male Douglas-fir tussock moths trapped in 0.1% pheromone traps.
Kamloops Forest Region, 1981

Armstrong	58	Hulicar	27
Glenemma	54	Enderby	25
Mt. Swanson	43	Mt. Chase	24
Mt. Rose	42	Charcoal Creek	23
Neskainlith I.R.	42	W. of Falkland	22
Chase	36	Elson	21
Duck Meadow	32	N. end Pillar Lake	20
Silver Creek	31	Tappen	17
Shuswap	30	Sweetbridge	15
O'Keefe	30	W. Pillar Lake	12
Monte Lake	30	Notch Hill	8
Hillcrest	29	Pillar Lake	7
Squilax	28	Balmont	5
Westwold	28	Gleneden	4
Yankee Flats	28	Gardom Lake	1
Blair Creek	28		

Five pheromone sex attractant traps, each of 0.1%, 0.01%, and 0.001% strength by weight of 2-6 Henie Cosen 11-1 pheromones, were located at each of 21 areas from Blue Lake near Osoyoos to Sixteen Mile Creek north of Cache Creek (Table 7). The average number of male adult moths trapped ranged from 1-39 in 0.001% traps; 13-67 in 0.01% and 18-71 in 0.1%. The data indicated endemic populations in eight of the areas and rising populations trends in four locations, Armstrong, Chase, Duck Range, Sixteen Mile Creek, where the average exceeded 25 moths per trap at 0.001% strength.



Map 4

**Douglas-fir Tussock Moth
Kamloops Forest Region
1981**

Locations Where Single 0.1% Sex Pheromone Attractant Traps Were Located
To Monitor Adult Male Population

Table 7. Location and number of adult male Douglas-fir tussock moth in pheromone traps, and average number of egg masses per tree, per trap area.

Kamloops Forest Region, 1981

Location	Avg. no. moths per trap ^{1/}			Avg. no. egg masses per tree per plot ^{2/}
	0.1	0.01	0.001	
Barnes Lake	50	31	9	3.3
Sixteen Mile Creek	71	67	36	9.0
Indian Gardens	35	39	12	0
Stump Lake	20	22	6	0
Duck Range	70	58	39	1.8
Blue Lake (Osoyoos)	22	13	1	0
Kaleden	26	25	4	0
Kelowna	18	14	8	0
Winfield	26	24	18	0
Vernon	20	21	12	0
Armstrong	58	66	28	0.2
Chase	36	38	28	0
Hillcrest	30	-	-	0.1
Glenemma	54		-	3.3
Sweetsbridge	15	-	-	2.0
Westwold	28			0
Yankee Flats	28			0
Silver Creek	31			0
Niskonlith I.R.	42			0.5
Enderby	25			0.1
Gardom Lake	1	-		0

^{1/} 25 or more male adults in traps baited with 0.001% strength pheromone, 2-6 Henie Cosen - 11 - 1 percent by weight indicates rising population levels.

A survey of 35 Douglas-fir stands was completed to determine: the average density of overwintering egg masses per tree per sample area, population trend; predict defoliation in 1982; and levels of defoliation intensity, (Table 8). Five pheromone traps, each of three pheromone strength by weight, (0.1%, 0.01%, 0.001%) were located at 12 of the 35 areas. Nine of the egg sample areas were adjacent to points where five single strength (0.1%) pheromone traps were located. However, comparison between the average number of adults per trap and egg mass density were inconclusive.

Table 8. Location and average number of Douglas-fir tussock moth egg masses on three lower crown branches per tree, per plot, and predicted defoliation intensity in 1982.

Kamloops Forest Region, 1981

Location	Avg. no. egg masses/tree/plot	Predicted 1982 ¹ / Defoliation
Bromley Rock Prov. Park (Princeton)	5.4	20% or more
Nendicks Campsite "	3.3	"
Sterling Road, Km. 0 "	2.0	"
Stemwinder Prov. Park (Hedley)	4.7	"
Highway 3-7 km. east of Hedley	0.3	Pre-outbreak
" 10 km. " "	2.1	20% or more
13.5 " "	2.8	
O'Keefe Ranch	0.10	Endemic
Glenemma	3.3	20% or more
Sweetsbridge East	2.0	
Mt. Connaught (Falkland)	12.9	" "
Westwold	0.0	Nil
Yankee Flats	0.0	Nil
Silver Creek	0.0	Nil
Eagle Rock Road (Armstrong)	1.5	20% or more
Armstrong (northwest)	0.5	Pre-outbreak
Armstrong	0.2	
South of Enderby	0.1	Endemic
Deep Creek (Hwy. 97B)	0.0	Nil
Barnes Lake	3.3	20% or more
Carquile Creek Km. 1.6	5.0	
" Km. 3.2	5.7	" "

Table 8. (Cont'd)

Location	Avg. no. egg masses/tree/plot	Predicted 1982 ^{1/} Defoliation
Sixteen Mile Creek	9.0	20% or more
Cache Creek Km. 7.4	1.0	" "
" " Km. 8.0	1.1	" "
Sabiston Creek (Savona)	<0.1	Endemic
Indian Gardens "	0	Nil
Stump Lake (Hwy. 5)	0	Nil
Campbell Creek (B'hartvale)	2.4	20% or more
Bamhartvale Rd.-Whiskey Jack	>0.75	
Larson Road	2.7	" "
"	5.3	" "
East End	2.8	" "
Hanna Road (Hwy. 97 S. of Duck Range)	2.3	" "
Duck Range	1.8	" "

^{1/} 0.10 egg masses per tree per plot - Endemic population
 0.10 - 0.75 egg masses per tree per plot - Pre-outbreak
 0.75 + egg masses per tree per plot - 20% defoliation or more

From: Preliminary sequential survey system for Douglas-fir tussock moth egg masses. R.F. Shepherd, I.S. Otvos, R. Chorney, C.F.S. Victoria, B.C. and B.C.M.F. Kamloops, B.C. Unpublished.

The results of the egg mass survey and historical data (Figure 2) indicated increases in extent and intensity of 1981 outbreak areas in 1982. The initial development and expansion of new outbreaks is expected in 1982, in at least 26 of the 35 areas from Olalla to Falkland, Barnhartvale west to Sixteen Mile Creek and nearby Cache Creek, and near Barnes Lake east of Ashcroft.

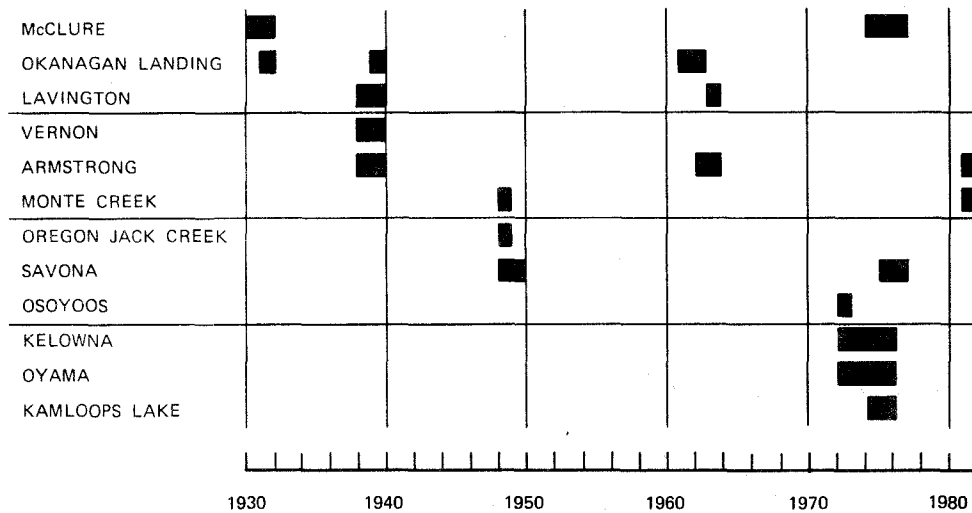
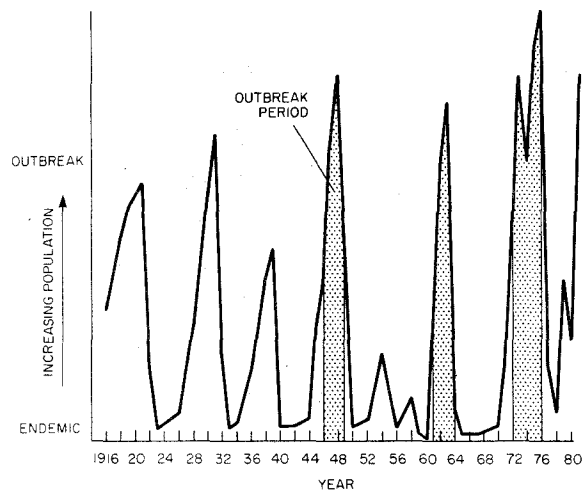


Figure 2

**Douglas-Fir Tussock Moth
Kamloops Forest Region
1930-1981**

History of Outbreaks

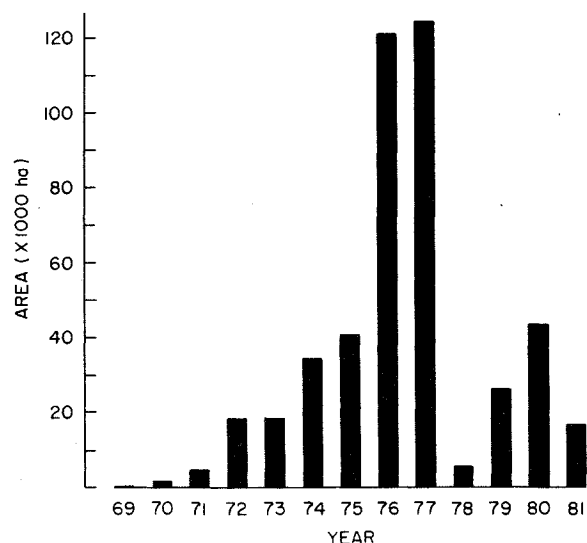


Figure 3

**Western Spruce Budworm
Kamloops Forest Region
1969-1981**

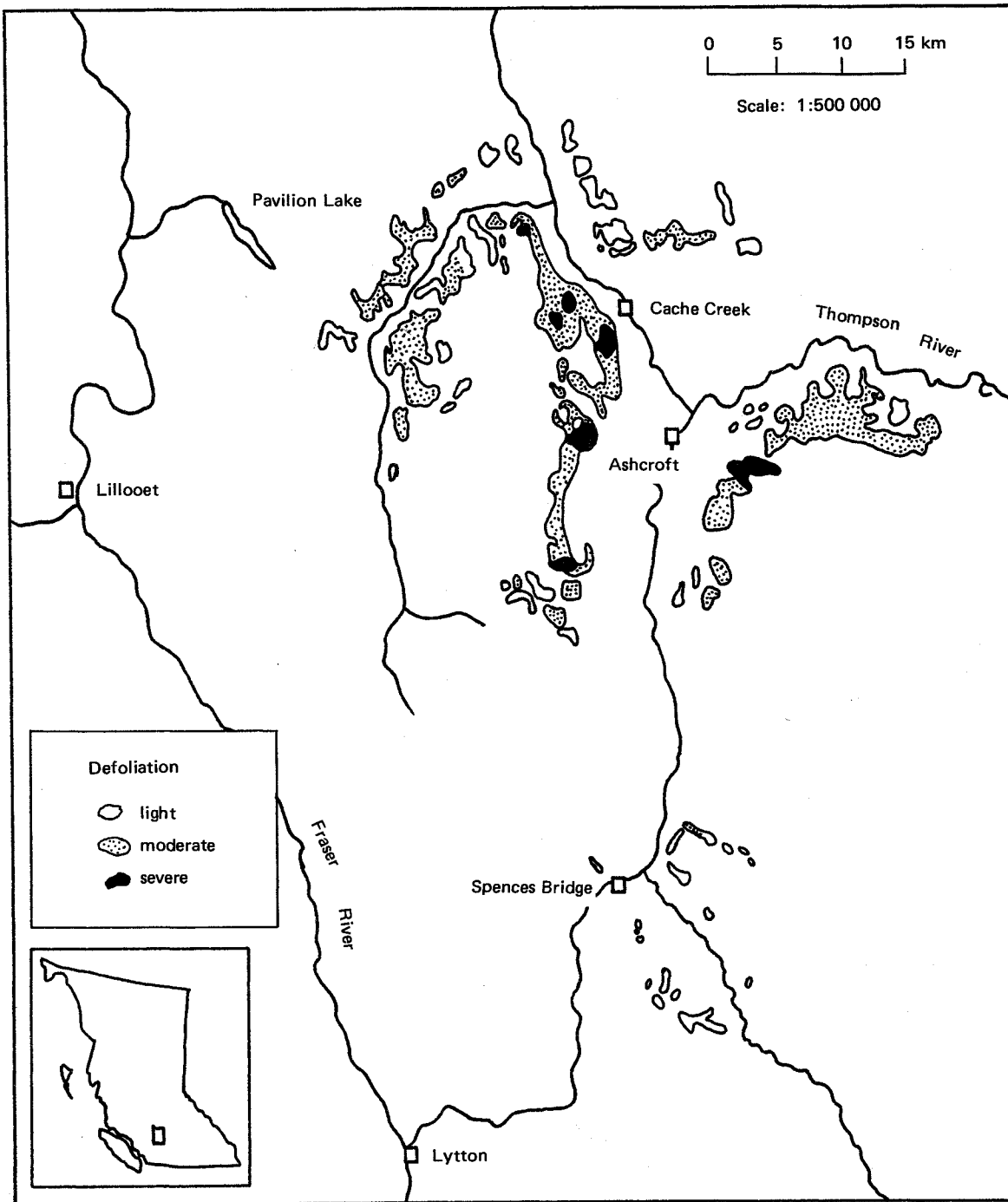
Area of Douglas-Fir Defoliated

Western spruce budworm, Choristoneura occidentalis

Defoliation of Douglas-fir stands by the budworm in the Region continued for the fourteenth successive recorded year, and covered 16 380 ha compared to 43 000 ha in 1980 (Figure 3).

The areas of defoliation determined from aerial and ground surveys extended from Soap Lake-Pimainus Hills in the Spences Bridge area to Marshall Creek on Carpetner Lake; from Murray Creek north to Oregon Jack-Cornwall creeks - Hat Creek-Carquille areas; from Sixteen Mile Creek east of Bonaparte Creek in the Cache Creek access road and from Barnes Lake - Highland Valley areas east to Indian Gardens Creek near Savona (Map 5).

Defoliation intensity was light over 4 745 ha (28% of the defoliated area), moderate over 11 135 ha (68%) and severe over 600 (4%) (Table 9). The areas of severe defoliation were localized in the Cache Creek-Campbell area (355 ha); in the Cornwall-Oregon Jack creeks area



Map 5

**Western Spruce Budworm
Kamloops Forest Region
1981**

Areas of Defoliated Douglas-fir Determined From Aerial Surveys

Table 9. Location and area of D-fir stands defoliated by western spruce budworm.

Kamloops Forest Region, 1981.

Location (T.S.A. and geographic)	Area of defoliation (ha)				
	Light	Moderate	Severe	Grey	Total
<u>KAMLOOPS TSA</u>					
Barnes Lk.-Brassy Creek	500	3 950	50	-	4 500
Bonaparte-Cache Creek	1 000	250	-	-	1 250
Carquile-Robertson Cr.	275	1 000	-	-	1 275
Hat Creek	250	1 575	-	-	1 825
Gallagher Lake	580	600	-	-	1 180
Cache Cr.-Campbell Hill	-	2 300	355	-	2 655
Cornwall-Oregon Jack Crs.	80	1 375	195	-	1 650
Pukaist Cr.	15	-	-	-	15
Indian Gardens	900	-	-	-	900
	3 600	11 050	600	-	15 250
<u>MERRIT TSA</u>					
Soap Lake	400	-	-	-	400
Pimainus Hills	135	-	-	-	135
" Creek	400	65	-	-	465
	935	65	-	-	1 000
<u>LILLOOET TSA</u>					
Marshall Creek	60	-	-	-	60
Murray Creek	40	-	-	-	40
	100	-	-	-	100
<u>SUMMARY</u>					
KAMLOOPS TSA	3 600	11 050	600	-	15 250
MERRITT TSA	935	65	-	-	1 000
LILLOOET TSA	100	-	-	-	100
TOTAL	4 639	11 115	600	-	16 350

(195 ha); and 50 ha in the Brassy Creek-Barnes Lake area. Unconfirmed reports indicated that trace defoliation was widespread in the Carpenter-Gun lakes regions, however, this was not discernible from aerial surveys.

The decrease in size of the outbreak areas in 1981 from 1980 occurred at widespread locations but the reason was not determined. The major areas where decreases occurred were south-west of Lytton; in the Stein River valley and along the south side of Carpenter Lake. Other areas where defoliation decreased included the Hat Creek-Carquille-Cornwall-Oregon Jack creeks and between Barnes Lake and Indian Gardens, and stands east of the Bonaparte River north west of Cache Creek.

Top-kill was limited to less than one metre, of less than 1% of understory trees in the severely defoliated areas, and in three 50 ha areas between Barnes Lake and Indian Gardens where moderate defoliation has persisted since 1978. In Marshall Creek, on the north side of Carpenter Lake, where defoliation was light in 1981, top kill of mature trees from the 1976-77 outbreak period is still evident.

Pheromone traps, baited with tussock moth pheromone: 96% trans-11-tetradecenol 4% cis-11-tetradecenol pheromone with 0.1%, 0.01%, 0.001% pheromone were located in eight non-defoliated stands at distances from the major outbreak areas. Results from five traps of each strength at each location indicated populations at endemic levels, with less than 25 adults per trap with 0.01% strength pheromone. (Table 10).

Table 10. Number of Western spruce budworm male adults trapped in pheromone sex attractant traps.
Kamloops Forest Region, 1981

Location	Avg. no. male adults per trap		
	0.1%	0.01%	0.001%
Fountain Valley	56	34	6
Botanie Creek (Lytton)	51	32	5
Raft River	36	12	0
Greenstone Mountain	45	46	6
Scotch Creek	54	11	0
Spius Creek (Merritt)	55	10	1
August Lake (Princeton)	69	24	4

Egg mass samples from four outbreak areas to determine the population trends in 1982 indicated continuing high populations and further defoliation of most of existing infestation areas in 1982 (Table 11).

Table 11. Number of Western spruce budworm egg masses per 10 m² of foliage and predicted 1982 defoliation of Douglas-fir stands.

Location	Branch area (cm ²)	Egg masses			Predicted defoliation ^{1/}
		Total	Avg/50 cm branch	Avg/10 m ² foliage	
Marshall Creek	9 500	9	0.75	95	Moderate
Highland Valley Road	15 245	45	2.0	296	Severe
Oregon Jack Creek #1	17 300	2	0.1	11	Light
Oregon Jack Creek #2	14 050	26	1.3	185	Severe

^{1/} Between 1-50 egg masses per 10 m² indicate light defoliation;
51-150 moderate and more than 150, severe defoliation.

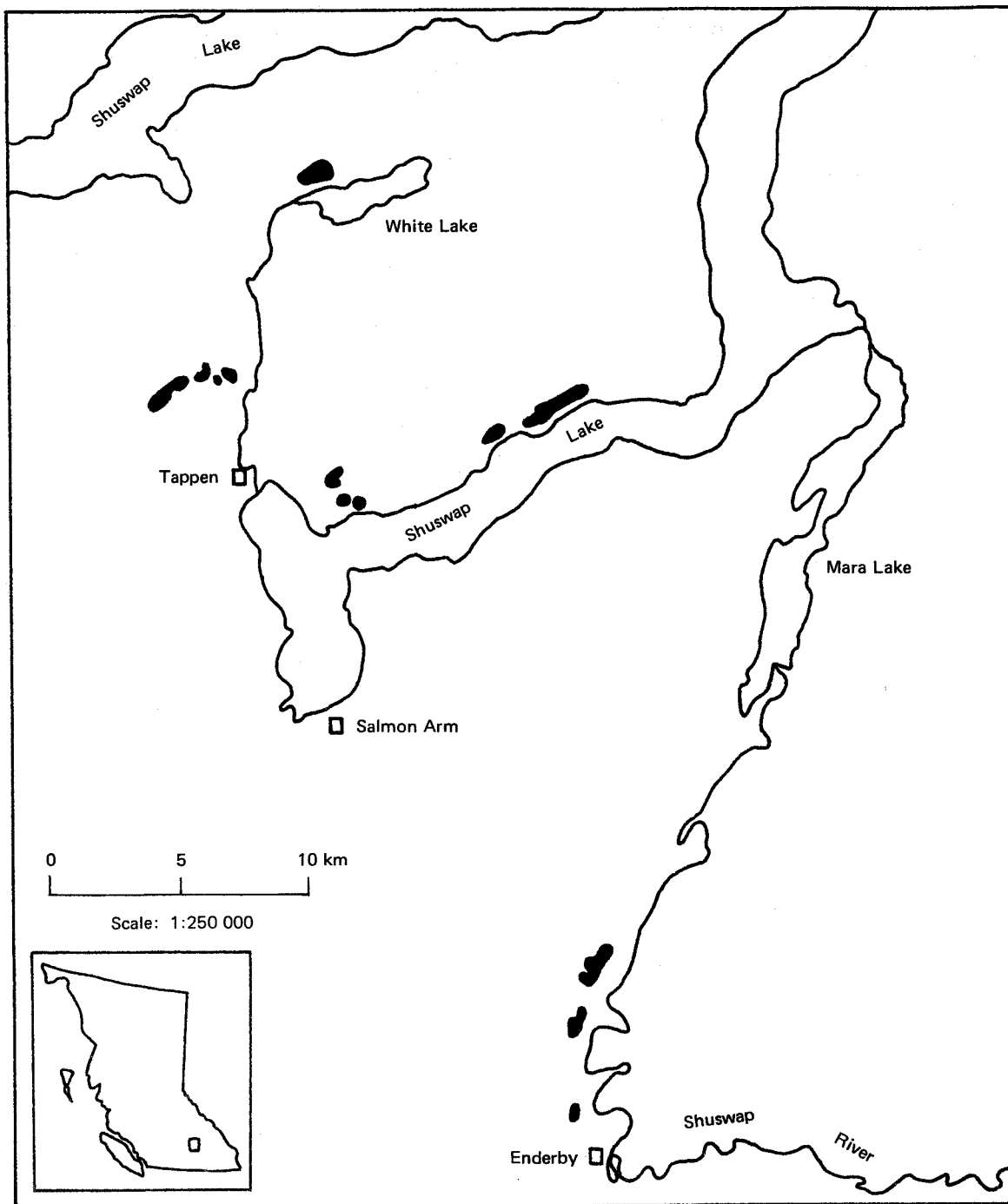
Predictions were based on the number of masses per 10 m² of foliage per sample area from two 50 cm branches from the mid-crown of each of ten dominant or co-dominant trees.

Western false hemlock looper, Nepytia freemani

Light defoliation of the upper crowns of mature Douglas-fir stands in five areas over a total of 350 ha, (Table 12), was recorded for the first time since the 1971-76 outbreak which defoliated 5 675 ha at its peak.

Table 12. Area and intensity of defoliation of Douglas-fir stands by Western false hemlock looper.
Kamloops Forest Region, 1981.


LOCATION	Area (ha) and intensity of defoliation			
	Light	Moderate	Severe	Total
Sunnybrae	25	-	-	25
Tappen	100	-	-	100
White Lake	25	-	-	25
Grinrod	100	-	-	100
Herald-Paradise	100	-	-	100
TOTAL	350	-	-	350



Map 6

**Western False Hemlock Looper
Kamloops Forest Region
1981**

Areas of Defoliated Douglas-Fir Determined From Aerial Surveys

 Light defoliation

Larval samples from three-tree-beating samples from the Sunnybrae, Tappen, White Lake and Grinrod areas, and overwintering egg sample data from two branches of each of ten trees per location from Sunnybrae and Tappen, (Table 13) indicated that defoliation will continue in 1982 in the areas of current defoliation, and in other areas in the North Okanagan-Shuswap region which has a long documented history of periodic outbreaks (Figure 4).

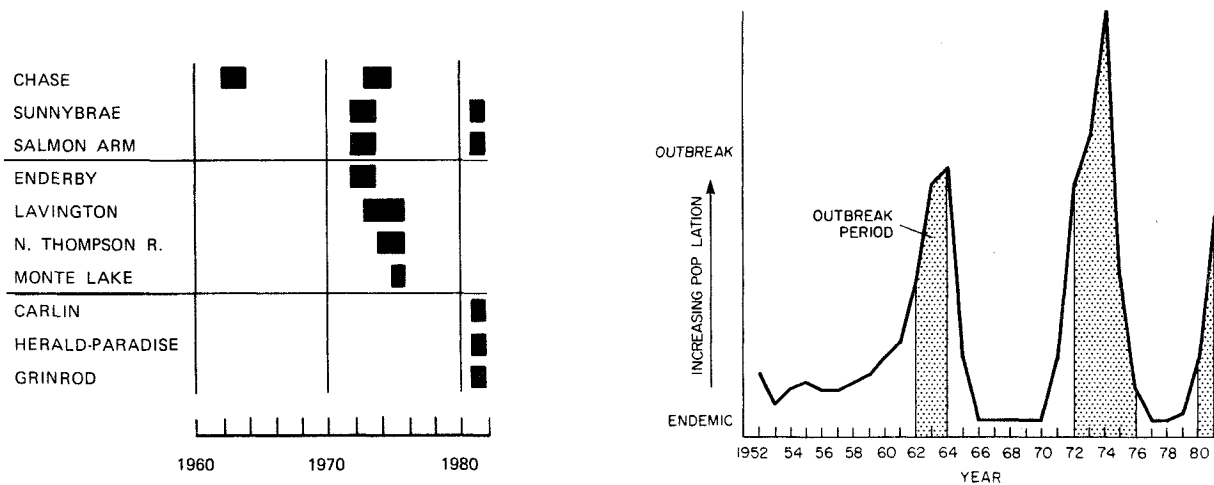


Figure 4

**Western False Hemlock Looper
Kamloops Forest Region
1960-1981**

History of Outbreaks

Armillaria root rot, Armillaria mellea

Mortality of mature and overmature Douglas-fir trees killed by the root rot was common at endemic levels throughout much of the host range particularly in pure Douglas-fir stands on poor sites.

The highest incidence of infection estimated at one tree per hectare per annum, was evident along major access roads in the Heffley-Louie creeks - Mt. Todd area; Mt. Adams - Little Shuswap-Niskonlith lakes - Loakum - lower McGillivray creeks; Lower Cahilty Creek; Deadman River valley - Vidette; Durard Creek - Tunkua Lake access; and Hamilton Mountain Lookout road.

Douglas-fir bark beetle, D. pseudotsugae is commonly found at currently endemic levels, in root rot infected overmature trees.

Table 13. Number of Western false hemlock looper overwintering eggs and predicted defoliation of Douglas-fir stands.

Kamloops Forest Region, 1981

Location	Branch No. ^{1/}	T r e e N u m b e r										Total No. eggs per branch	Avg. No. eggs per branch	Predicted ^{2/} Defoliation 1982
		1	2	3	4	5	6	7	8	9	10			
Sunnybrae	1	50	70	52	83	55	65	70	71	22	76	614	61	
(Bastion Mtn)	2	195	37	20	43	148	210	209	200	214	116	1422	142	
										TOTAL		2036	102	Severe
Tappan	1	88	106	137	166	131	261	150	235	47	149	1470	147	
(C.X.A.)	2	16	124	67	130	119	141	87	71	92	78	1025	102	
										TOTAL		2495	125	Severe

^{1/} 50 cm. long branch

^{2/} Average of 25 eggs or more per branch - moderate defoliation; 50 or more - severe.

Douglas-fir beetle, Dendroctonus pseudotsugae

The numbers of recently-killed Douglas-fir trees in the region totalled 700, a decline from 820 recorded in 1980. The majority of the trees killed, recorded from aerial surveys, were overmature and possibly predisposed by disease and site factors.

The decline in numbers of trees killed represents a trend evident since 1978 (Table 14).

Table 14. Numbers of Douglas-fir killed by Douglas-fir beetle
Kamloops Forest Region, 1976-1981

T.S.A. and Location	Year and No. of Trees					
	1976 ^{1/}	1977 ^{2/}	1978	1979	1980	1981
<u>KAMLOOPS TSA</u>						
Tranquille-Deadman-Jamieson creeks; Westsyde, Vinsulla, McClure, Paul Lake, Tunkwa	-	-	1,225	565	495	350
<u>LILLOOET TSA</u>						
Lytton, Spius Creek, Kanaka	-	-	700	65	-	-
Yalakem, Seton	-	-	270	400	10	105
Pavilion, Oregon Jack Cr.	-	-	545	150	265	-
<u>MERRITT TSA</u>						
Nicola River-Nicola Lake	-	-	40	10	-	5
Logan L. - Douglas L.	-	-	-	70	-	-
<u>OKANAGAN TSA</u>						
Whiteman Cr. - Glenrosa	-	-	20	-	-	240
Princeton - Tulameen	-	-	50	80	-	-
OTHER AREAS	-	-	65	10	50	-
ALL AREAS			2,915	1,350	820	700

^{1/} Light tree mortality
^{2/} Widespread red tops

Swiss needle disease, Phaeocryptopus gaeumannii

A survey to record the distribution and intensity of infection of the disease in Douglas-fir stands determined the presence of infected needles at four of fourteen sample areas (Map 7).

Intensity of infection varied, (Appendix 1); from 20 to 100% of 2 to 6 year old needles of three sample trees at Adams River; between 48% and 90% of 2 to 5 year old needles at Kingfisher Creek; 2% to 70% of 3 and 7 year old needles at Monte Lake and between 2% to 18% of 5 and 6 year old needles at Johnson Lake.

The absence of the disease at ten of the sample areas in the Dry Interior region indicates that the disease is associated with the higher precipitation levels of the Interior Wet Belt zone.

Although the disease is present in Douglas-fir stands in the Kamloops Forest Region it is not considered a serious problem. However, infection at older Douglas-fir plantations in New Zealand of British Columbia provenances often result in premature needle loss and some growth loss, where infection levels in younger stands can exceed 90%.

Conifer - aspen rust, Melampsora medusae

Infection of the 1981 needles of all age classes of Douglas-fir stands, resulting in premature needle loss, was common throughout much of the host range.

Infection intensities varied from 1% to 100% and occurred at significantly high levels (> 75%) in the Venables-Murray creeks area between Spences Bridge and Ashcroft; in the Vavenby - Adams Lake area; Bonaparte Lake and Barriere areas and in the North Thompson River valley.

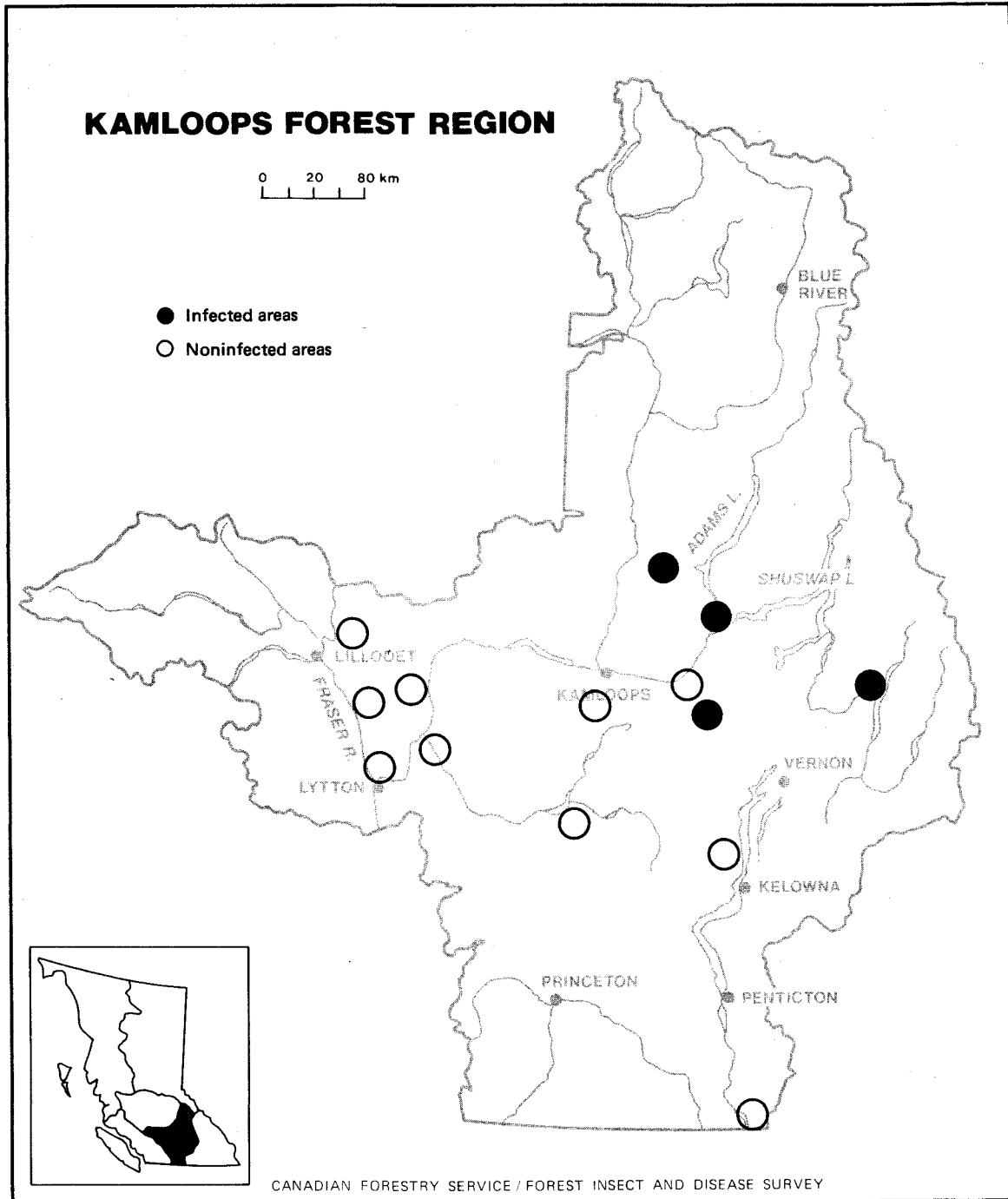
A Douglas-fir needle midge, Contarinia sp.

High populations infested more than 75% of the needles of immature trees in localized (0.1 ha) areas in many stands throughout the host range, most evidently in the Jamieson Creek area. The high levels of infestation resulted in discoloration and premature loss of needles.

SPRUCE PESTS

Spruce beetle, Dendroctonus rufipennis

A total of 70 recently killed Engelmann spruce trees over a combined area of 10 ha were recorded in 1981, compared with small areas adjacent to recent logged over 750 ha in 1980. Single and small groups of 2 to 5 standing trees, often adjacent to previously logged areas, were recorded at Miledge Creek; Hurley and Van Horlick creeks; Lambly and Shorts creeks and in Okanagan Mountain Park, (Table 15).



Map 7

**Swiss Needle Disease
1981**

Locations of Sample Points for Swiss Needle Disease on Douglas-Fir

Table 15. Location and number of Engelmann spruce trees recently killed by spruce beetle
Kamloops Forest Region, 1981

T.S.A. and Location	Number of trees killed	Light (1-5%)	Area (ha) Moderate (6-30%) Severe (31% or more)	
<u>LILLOOET TSA</u>				
Hurley Creek	10	1	.	.
Van Horlick Creek	22	2	.	.
	32			
<u>OKANAGAN TSA</u>				
Okanagan Mtn. Park	10	1	.	.
Lambly Creek	10	2	.	.
Shorts Creek	5	1	.	.
	25	4		
<u>KAMLOOPS TSA</u>				
Miledge Creek	15	2	.	
	15	2	.	.
TOTAL ALL TSA'S	72	10		

In the McGillivray and Cahilty creeks areas north east of Kamloops harvesting and sanitation programs have greatly reduced previously active beetle populations.

Near Kernaghan Lake in the Fly Hills a harvesting and trap tree program was developed to control a newly developing outbreak in a 300 ha area of old cut blocks.

In Kingfisher Creek near Mabel Lake, trap tree and salvage control programs were initiated by Industry to reduce beetle population in high stumps over 250 ha, left from 1980-81 winter harvesting.

Two-year-cycle spruce budworm, Choristoneura biennis

As expected in this 'off' year in the budworm cycle there was no defoliation of Engelmann spruce and alpine fir stands in the Region in 1981.

Data from 1980 egg sample locations indicated that defoliation is expected to occur in 1982 in the North Thompson River valley drainage including Lempriere Creek. The outbreaks were first recorded in the area in 1974 and by 1980 defoliated stands extended over 13 700 ha.

ALPINE FIR PESTS

Western balsam bark beetle, Dryocoetes confusus

The numbers of recently-killed mature and overmature alpine fir in higher elevation stands throughout the Region, recorded from aerial observation, totalled 2,435.

The major areas of tree mortality, of the total 1 870 ha was recorded in the Devick-Wentworth lakes area on the Bonaparte Plateau (1,450 trees over 1 800 ha); in upper Trout Creek (365 trees over 30 ha) and Upper Penticton Creek (375 trees over 23 ha).

The incidence of tree mortality is the highest since 1977 when 9 500 ha were recorded in four major areas including the Bonaparte Plateau. Where tree mortality has persisted for many years.

LARCH PESTS

Larch casebearer, Coleophora laricella

Defoliation of western larch stands by the casebearer persisted in the western limits of the host range in the Kamloops Forest Region.

East of Anarchist Mountain summit to the regional boundary defoliation was moderate to severe in mixed age class stands, with the severest damage to open growing immature trees. At Cherryville, trace defoliation was recorded in the limited range of the host in the areas. In Shuttleworth Creek, east of Okanagan Falls defoliation was trace to light in localized areas.

The incidence of parasitism was high in pupae from each of two locations. At Anarchist Mountain samples contained 135 Dicladocerus sp.; 3 Chrysocharis sp. and 1 Mesopolobus sp. parasites from 200 casebearer pupae. The Shuttleworth Creek contained 56 Dicladocerus sp. parasites in 134 casebearer pupae. The impact of the parasites on the Anarchist Mountain and Shuttleworth Creek areas have resulted in a low casebearer population, and only trace defoliation of larch stands is expected in both areas in 1982 (Table 16).

Table 16. Location and numbers of overwintering Larch casebearer larvae and predicted damage.

Kamloops Forest Region, 1981

Location	Tree No.	Number of			Avg. no. larvae /100 fascicles	Predicted 1982 defoliation ^{1/}
		50 cm. branches	fascicles	casebearer		
Shuttleworth Creek	1	4	34	904	4	Trace
	2	4	50	773	6	
	3	4	33	400	8	"
	4	4	34	604	6	
TOTAL			151	2,681	6	"
Anarchist Mountain	1	4	7	995	1	"
	2	4	32	1,390	2	"
	3	4	5	770	.5	"
	4	4	32	542	6	"

^{1/} 60 larvae per 100 fascicles results in 1-15% (light) defoliation.

WESTERN HEMLOCK PESTS

Indian paint fungus, Echinodontium tinctorium

The heart rot is common in mature and overmature western hemlock stands in the Interior wet belt areas in the Region. At least 50% of the mature or older stems were infected in stands along the Clearwater River, Miledge Creek, Mud Lake; lower Finn Creek and Myrtle Lake access roads. The external sporophores evident in all areas indicated 80% or more decay of the infected stems.

PESTS OF NATURAL AND MANAGED SECOND GROWTH STANDS AND PLANTATIONS

Squirrel damage:

Removal of patches of bark from the stems and branches of immature lodgepole pine trees by feeding squirrels was evident at two locations in the Region, (Table 19 Appendix 2).

In a B.C. Ministry of Forest Silvicultural research spacing study area approximately 5 km south of Lac Le Jeune, up to 50% of the approximate 15 year old trees had one or more patches of 2 cm² or more of stem bark chewed off by squirrels.

In an immature spaced stand on the Jamieson Creek access road up to 20% of the pine trees in a 25 ha area had 25 cm² or greater patches of bark chewed off.

Tree mortality resulting from basal girdling was less than 1% of the trees at both locations. The full impact of the damage is not fully understood, but the debarked areas of stems and branches would be suitable entrance courts for fungal infection. The damage was most evident in stands 15-20 years old with no apparent difference between spaced and non-spaced stands.

There was no evidence of previous rust cankers which may have attracted the squirrel feeding.

Lodgepole pine terminal weevil, Pissodes terminalis

Immature lodgepole pine stands were examined at eleven locations to determine the distribution and intensity of the pest in the Region. There was no damage observed at any of the locations examined where 100 trees were examined at: Albreda, Blue River, Hallam Lake, Spahats-Wells Gray road, Tunkwa Lake road, Cayuse Lake road, Cross Creek and Murray Creek access roads, near Tumiplake and in Jamieson Creek (Appendix 2)

Spruce weevil, Pissodes strobi

Immature Engelmann spruce stands were examined at four locations to determine the extent and intensity of damage by the pest in the Region. There was no damage evident to any of the 100 immature trees at any of the sites examined in Jamieson Creek, along the McGillivray Lake road and along the Johnson Lake road near Skwaam Bay.

Western gall rust, Endocronartium harknessii

More than 50% of the immature lodgepole pine trees in a 35 ha spaced stand near Aberdeen Lake, southeast of Vernon, were infected with at least one gall per tree. In plantations near Aberdeen Lake and Goldstream Creek single galls infected up to 10% of the lodgepole pine as young as ten years old.

The rust infections often result in stunting and deformation and branch-tip mortality but rarely mortality of lodgepole pine trees.

Sporulating rust cankers were examined at each of the above locations and approximately thirty other locations in the Region for the presence of a purple mould, Tuberculina maxima. The mould, a biological control agent of the gall rust and other rusts was not observed in any of the stands examined.

CONE AND SEED PESTS

The incidence of cone and seed pests of six major conifer species was nil throughout the Region in 1981.

Cone crops were evaluated in 42 stands (Table 21, Appendix 3), and ranged from nil to light with few if any cones available for quantitative analysis for pests.

DECIDUOUS PESTS

European elm bark beetle, Scolytus multistriatus

A single peromone sex attractant trap to monitor the adult beetle population, the vector of Dutch elm disease Ceratocystis ulmi, was located at Hwy. 97, 10 km north of Osoyoos in the Okanagan Valley. An estimated 320 adults were trapped, however there was no evidence of beetle-attacked or disease-killed elm trees in the area or elsewhere.

Hypoxylon canker, Hypoxylon mamatum

Stem infections were common in mature and over mature trembling aspen stands at widespread locations throughout the region. In the Cahilty-Louie creeks and upper Deadman River areas up to 25% of the stems were infected in 0.5 ha groves in both areas.

Fall webworm, Hyphantria cunea

Defoliation of a variety of deciduous trees and shrubs was common throughout much of the Region from Lillooet to Barriere and the Kamloops-Shuswap-Okanagan areas.

Defoliation ranged between 10% and 100% of single and small groups of hosts including western chokecherry, Manitoba maple, balsam poplar and apple trees, with little permanent impact to the damaged hosts.

Gypsy moth, Lymantria dispar

There were no male moths in many of the single pheromone traps located in 25 Provincial and private parks and campgrounds throughout the Region.

The trap program to monitor the annual adult population levels, a cooperative Canada Dept. of Agriculture and the Canadian Forestry Service program, was initiated in 1975.

Poplar and willow borer, Cryptorhynchus lapathi

The incidence of mortality of willow persists at endemic levels throughout the region. Up to 10% of the stems of willow clumps are killed annually; the damage was highly visible but of low forestry impact.

Birch Leaf miner, Bucculatrix sp.

Up to 100% of the foliage on 95% of the white birch were discolored by larval mining in the Forest Lake, Skwaam Bay; Johnson Lake areas west of Adams Lake. The damage to single trees, groves and stands up to 50 ha has occurred annually with little apparent impact.

Aspen leaf miner, Phyllocnistis populiella

Discoloration of trembling aspen stands was limited to 20% of the foliage at localized stands over 100 ha in the Lyons Lake area east of Vinsulla.

FOREST PESTS IN PROVINCIAL PARKS

The annual survey of Provincial parks in the Region, to identify major pest problems, determined the presence of three major insect pests and one major disease in 9 of the 37 parks visited in the five Park Districts. (Appendix 4).

Mountain pine beetle, Dendroctonus ponderosae outbreaks were recorded in lodgepole stands in or adjacent to Gun Lake Park in the Lac La Hache District and near Cathedral Lakes Park in the Okanagan District.

Douglas-fir tussock moth Orgyia pseudotsugata larvae and egg masses were evident in Douglas-fir stands in Bromley Rock and Stemwinder parks in the Okanagan District. Western spruce budworm, Choristoneura occidentalis lightly defoliated stands in Marble Canyon, Gun Lake, Kersey and Downing Lakes parks in the Lac Le Hache District. Armillaria root rot infections in mature lodgepole pine stands were common at endemic levels in the Helmcken Falls area of Wells Gray Park, (Wells Gray District), and killed two pockets of 10 trees.

Canada

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