Forest Insect & Disease Conditions 1979

KAMLOOPS FOREST REGION / R. J. ANDREWS, L. S. UNGER

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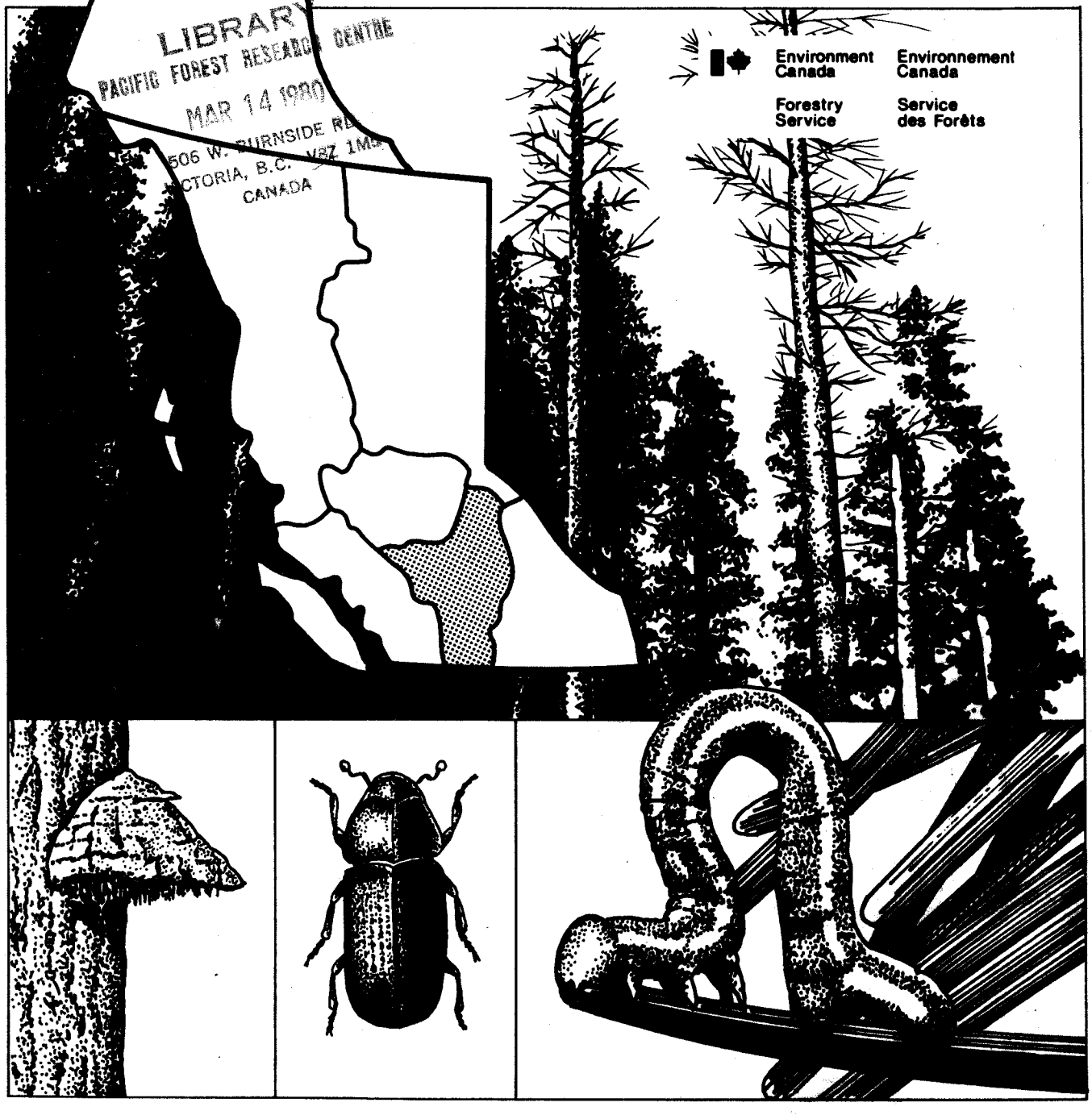

CANADIAN FORESTRY SERVICE • PACIFIC FOREST RESEARCH CENTRE

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SUMMARY

This report outlines forest insect and disease conditions in the Kamloops Forest Region in 1979 and attempts to forecast pest population trends.

Regular field work in the District began on May 1 and ended on September 26. Aerial surveys consisted of 30 hours flying time supplied by B.C. Ministry of Forests (Map 2).

Workshops were held again in the southern portion of the Region with slides and films and discussions of insect and disease problems of concern to local industries and Ranger Districts. A special survey of all Okanagan cities and Kamloops for European pine shoot moth damage was initiated and began with a workshop for seven crew members in which recognition of the insect and survey methods were presented by Canadian Forestry Service personnel. Summer students, funded by the B.C. Ministry of Forests and instructed by Canadian Forestry personnel were used by Forest Pest Survey technicians, research personnel and District Rangers for general collecting, bark beetle and other surveys.

A total of 393 beating collections were submitted from the Kamloops Region to the Pacific Forest Research Centre in 1979; map 1 shows collection localities. Numbers of larval defoliators in field collections decreased although 76 and 79% of the beating collections contained larvae in the north and south districts respectively.

Bark beetles continued to account for most of the tree mortality in the Region in 1979. Area of damage caused by mountain pine beetle increased near Trout Creek, Goldbridge, Mission-Belgo Creek, Stein and Ashnola rivers. The spruce beetle infestation in the upper Lambly Creek-Barton Hills area collapsed in 1979.

Western spruce budworm increased greatly in the Cache Creek-Ashcroft area but continued to decrease in the Fraser Canyon-Lillooet areas. The European pine shoot moth increased in occurrence in Kelowna and Summerland and decreased in Kamloops. Larch casebearer remained high at Anarchist Mtn and Shuttleworth Creek and decreased near Cherryville. A pine sheath miner caused moderate to heavy defoliation of current year's growth of lodgepole pine at three localities near Clearwater.

Black stain and shoe string root rots are extensive on lodgepole and Douglas-fir in the higher elevations of Nashwhito Creek while heavy infection by laminated root rot was prevalent at lower elevations. Larch needle blight discolored large areas of western larch near Cherryville, White Lake and upper Shuswap River. Winter damage of western red cedar was prevalent near Murtle and Barriere lakes; Little Shuswap Lake, Deep Creek and along Shuswap Lake.

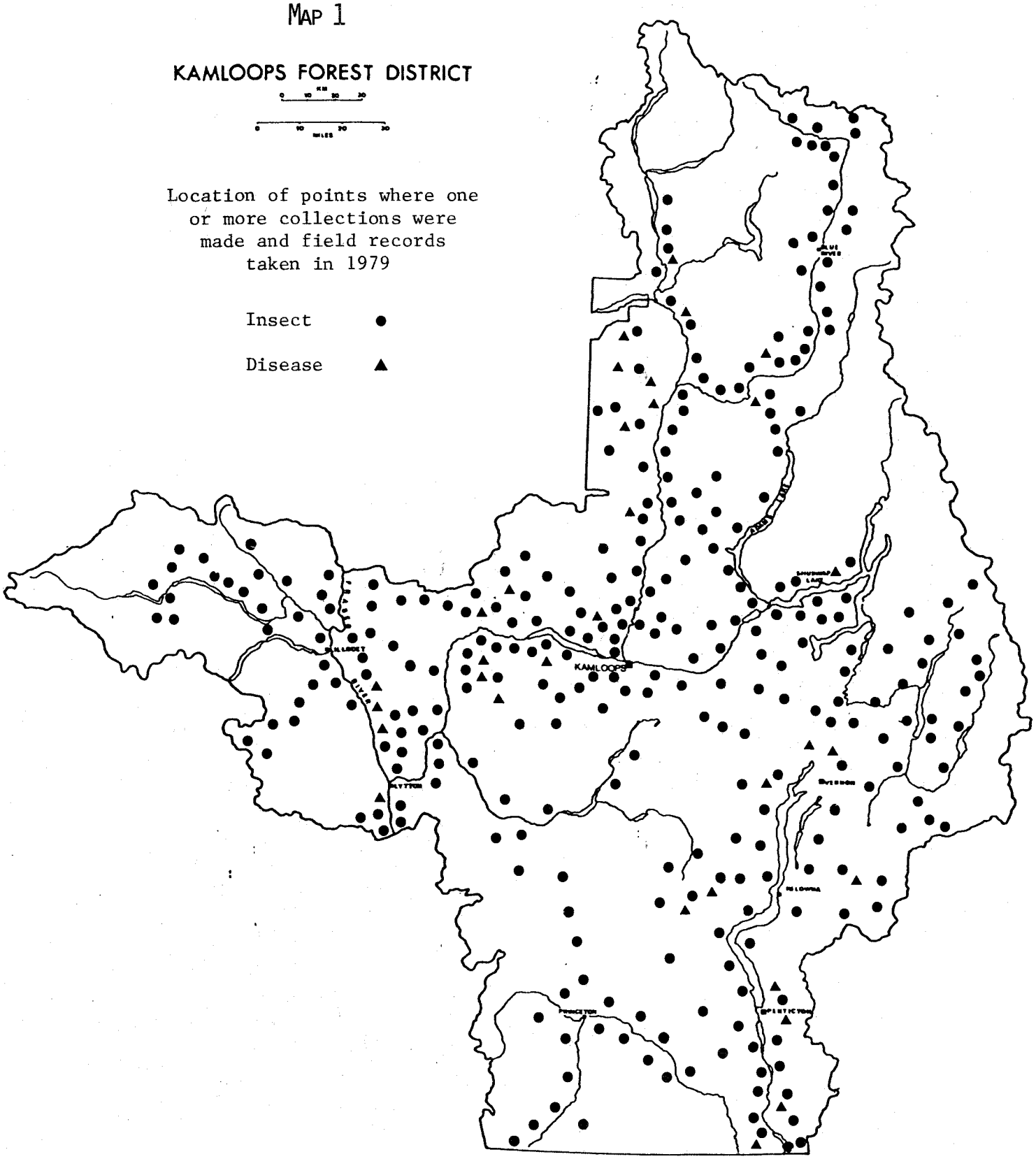
MAP 1

KAMLOOPS FOREST DISTRICT

Location of points where one or more collections were made and field records taken in 1979

Insect ●

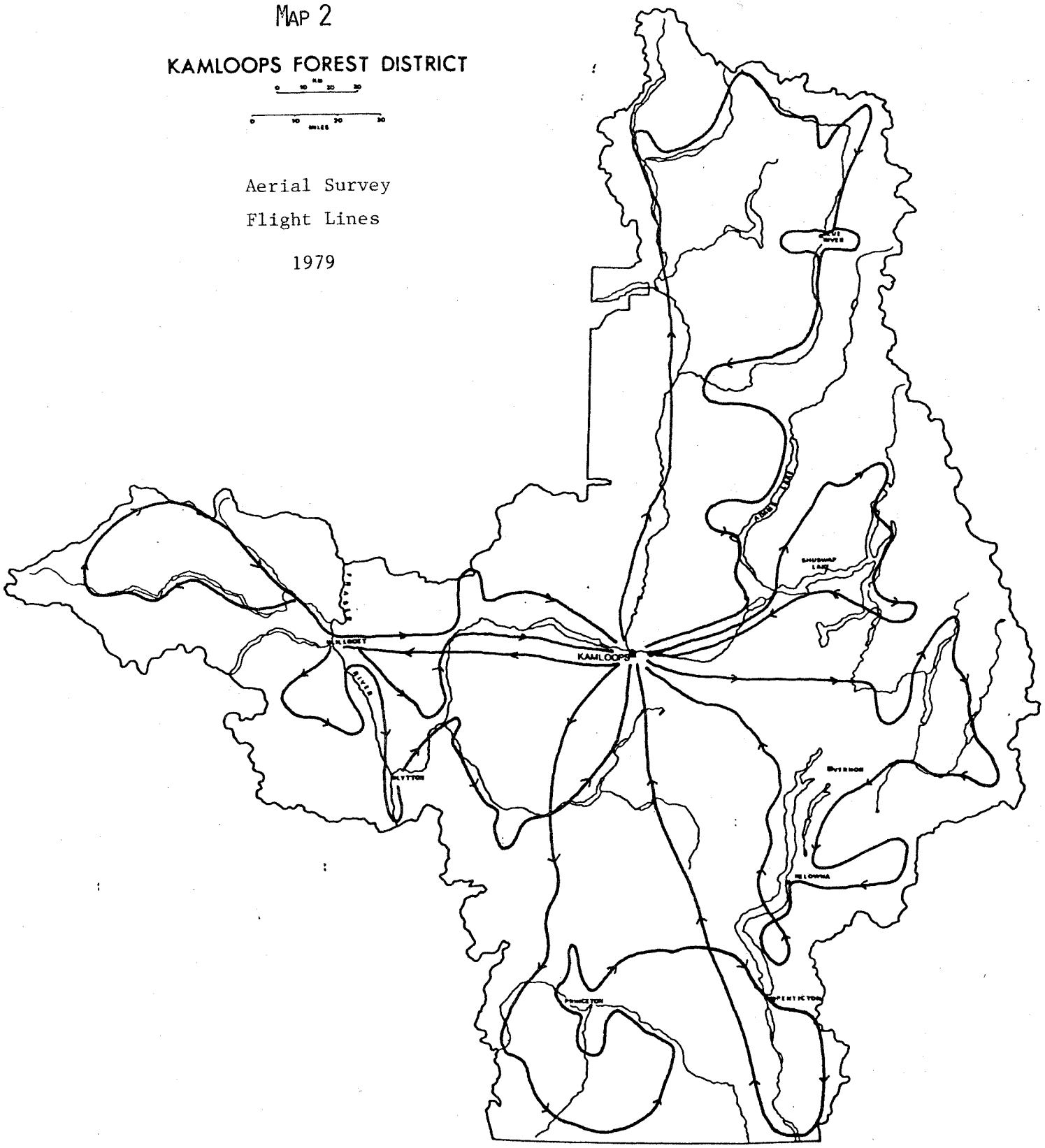
Disease ▲



MAP 2

KAMLOOPS FOREST DISTRICT

Aerial Survey
Flight Lines
1979



PINE PESTS

Mountain pine beetle, Dendroctonus ponderosae

The total area of mountain pine beetle infestations in the Kamloops Region increased from 17 000 ha in 1978 to 19 990 ha in 1979. Lodgepole pine mortality increased from near 8 000 ha to 11 500 ha; in mixed stands of lodgepole and ponderosa pine 7 292 ha were affected and in western white pine stands 1 065 ha (Map 3).

Unusually cold weather occurred in late December of 1978 and continued into January, 1979. Overwintering mortality studies were conducted at 14 locations near Penticton, Princeton, Lillooet and Blue River by the Pest Coordinator, B.C. Ministry of Forests in March and April to determine the extent of brood mortality caused by these colder temperatures. Similar studies were conducted by Canadian Forestry Service personnel in May at nine locations near Blue River, Lillooet, Princeton and Kelowna.

The method for determining brood survival was to select 25 trees at each location and remove 15 x 15 cm area of bark from each of the north and south sides of the tree. The number of living larvae, pupae and teneral adults and the number of entrance holes per sample were counted and averaged for the 25 trees. "R" value was computed as follows:

$$R = \frac{\text{avg. no. progeny per sample}}{\text{avg. no. entrance holes}}$$

Interpretation was as follows: R=0 to 2.5-population decreasing; R=2.6 to 4.0-population static and R=4.1 to 6.5-population increasing.

Table 1 shows the results obtained in March and May 1979 in Kamloops Forest Region.

MAP 3

KAMLOOPS FOREST DISTRICT

Mountain Pine Beetle
Infestations, 1979

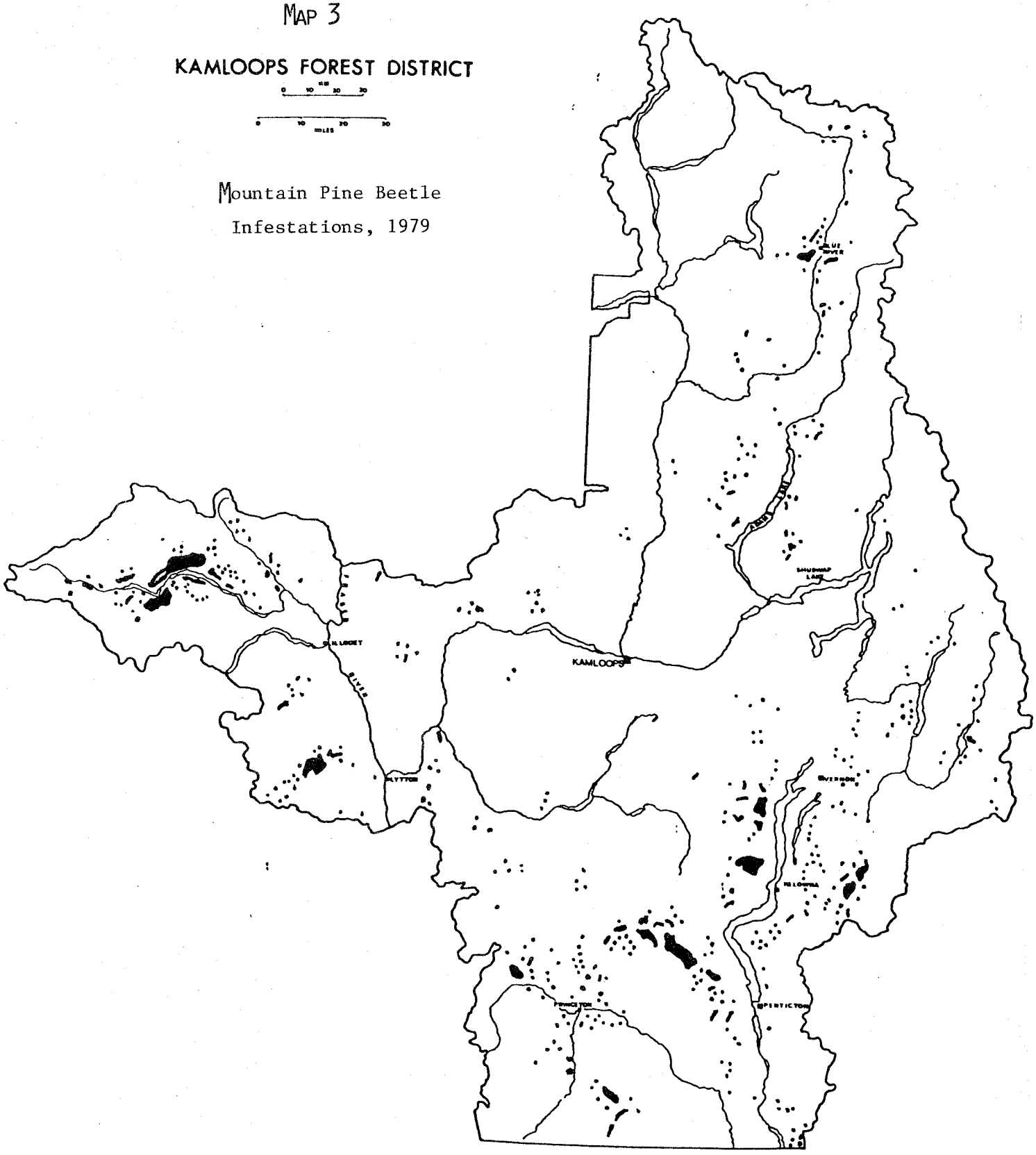


Table 1

Overwintering survival studies of mountain pine beetle broods
Kamloops Forest Region, 1979

Location	"R" values B.C.M.F.	F.I.D.S.	Population prediction
Lillooet			
Mowson Pond	6.5	6.1	Increasing
Brexton	14.3	12.0	"
Gun Lake	13.2	9.1	"
Blue River			
Mud Lake	0.0	2.15	Decreasing
Blue River	0.02	2.03	"
Finn Creek	11.3	-	Increasing
Foam Creek	8.6	-	"
Penticton			
Bull Creek	2.8	-	Static
Thirsk Lake	12.2	-	Increasing
O'Hagen Creek	5.2	-	Increasing
Trout Creek		3.2	Static
Princeton			
Chain Lakes	3.1	-	Static
Tulameen	7.1	-	Increasing
August Lake	13.9	-	Increasing
Hayes Creek	1.3	-	Decreasing
Áshnola River	-	10.0	Increasing
Summers Creek	-	8.0	Increasing
Kelowna			
Belgo Creek		5.5	Increasing

While some localities showed little or no increases of populations, broods in infested trees nearby were healthy and continuing populations are expected.

Aerial survey in late July showed increased areas of damage as a result of 1978 attack near Goldbridge, Stein River, Princeton, Ashnola River, Trout Creek, Mission-Belgo creeks, and Blue River. Table 2 shows location and area of infestations.

Table 2

Infestations of mountain pine beetle in Kamloops Forest Region, 1979

Map	Location	Tree species[1/]	Area infested (ha)
Ashcroft	Allen Cr	pP	10
	Spatsum Cr	pP	1
	Upper Hat Cr	pP	1
			12
Kamloops L	Durand Cr	pP	5
			5
Bridge R	Mt. Penrose-Downton L	lP	47
	Gun L east	lP	900
	Mt. Zola	lP	1 169
	Plateau Pond	lP, pP	410
	Goldbridge-Brexton	lP	363
	McDonald Cr	lP	174
	Girl - Truax Crs	lP	537
	Tyaughton Cr and Lake	lP, pP	4
	Marshall Ridge	pP	28
	Yalakom R	lP	30
			3 662
Pemberton	Stein R	lP, pP	366
			366
Taseko L	Yalakom R	lP	3
			3
Lytton	Stein R	lP, pP	73
	" "	lP, pP	142
	Kwoiek Cr	lP, pP	40
	Nicoamen R	pP	3
			258
Blue River	Blue R	lP, wwP	76
	Bone Cr	wwP	3
	Pyramid	wwP	1
	Moonbeam Cr	wwP	3
	Snookwa Cr	wwP	1
			84

Table 2 (Cont'd)

Map	Location	Tree species	Area infested (ha)
Seymour Arm	Messiter	wwP	8
	McMurphy	lP	15
	Burton Cr	wwP	3
	Adams R	lP, wwP	15
	Barriere R	wwP	85
	E Barriere L	wwP	20
	Kwikoit Cr	wwP	13
	Upper Scotch Cr	wwP	1
	McNomee Cr	wwP	5
			155
Princeton	Whipsaw Creek	lP	57
	Copper Mtn-Manning Park	lP	102
	Smelter lakes	lP	52
	Jameson Lake	lP	18
	Allenby-Wolfe lakes	lP,pP	230
	Asp Creek	lP,pP	14
	Young Creek	lP	288
	Ashnola Creek	lP	756
	Lakeview Creek	lP	2
			1 519
Penticton	Nine Mile Creek	pP,lP	460
	Inkaneep Creek	lP	20
	Wolfcub Creek	lP	20
	Cawston	lP	1
	Vaseux Creek	lP	2
	Olalla	lP	50
	Yellowlake Creek	lP	56
	Farleigh Creek	lP	320
	Matheson Creek	lP	2
	Ellis Creek	lP	1
			932
Tulameen	Otter Lake	lP,pP	290
	Manning	lP,lP	18
	Midday Creek	pP	1
	Thalia-Hasting lakes	lP	2
	Allison-Dry lakes	lP	10
	Allison Creek	pP,lP	70
	Summers Creek	lP	520
	Christian Creek	lP	24
	Hayes Creek-Thirsk L	lP,pP	2 920
			3 855

Table 2 (Cont'd)

Map	Location	Tree species	Area infested (ha)
Kelowna			
	Agur Lake-Deschamps Creek	lP,pP	780
	Isintok-Trout creeks	lP	1 332
	Darke Creek	lP,pP	680
	Peachland Lake	lP	8
	Trepanier Creek	lP	130
	McDougall Creek	lP	52
	Lambly Creek	lP,pP	656
	Penticton Creek-Okanagan Mtn.	lP	360
	Bellevue Creek	lP	16
	Hydraulic Creek	lP	280
	McCulloch	lP	656
	Mission-Belgo creeks	lP	2 416
	Scotty-Kelowna creeks	lP,pP	120
	Walby Lake	pP	1
			5 487
Upper Kettle			
	Mission Creek	lP	16
Vernon			
	Terrace-Bald Range creeks	lP	860
	Shorts creek	lP	360
	Whiteman Creek	lP	1 262
	Naswhito-Equesis creeks	lP	420
	Pinaus Lake	lP	16
	Glenemma	lP	2
	Hussard-Kendry creeks	lP	56
	BX Creek	lP	56
	Coldstream Creek	lP	30
	Deep Lake-Brewer Creek	lP	80
	Vernon Creek-Oyama Lake	lP	180
			2 322
Sugar Lake			
	Trinity Hills	wwP,lP	612
	Monashee Creek	wwP	20
	Outlet Creek	wwP	60
	Sugar Creek	wwP	16
	Sprockton Creek	wwP	4
			712
Shuswap Lake			
	Harland Creek	wwP	16
	Bolean Creek	lP	84
			100

Table 2 (Cont'd)

Map	Location	Tree species	Area infested (ha)
Revelstoke			
	Hidden-Mabel lakes	wwp,1P	92
	Kingfisher Creek-Wap River	wwP	22
	Owlhead Creek	wwP	2
	Craigellachie	wwP	2
			118
TOTAL			
lodgepole pine			11 541
mixed lodgepole pine, ponderosa pine			7 292
western white pine			1 065
GRAND TOTAL			19 898

1/ 1P = lodgepole pine
pP = ponderosa pine
wwP = western white pine

In September 15 cruise strips were run near Goldbridge, Princeton and Trout Creek to determine 1979 attack for prediction of 1980 damage (Table 3). Decreases of current attack were noted in some localized areas but were insignificant considering the large population over widespread area and the quantity of available host material yet uninfested. Unless abnormally low winter temperatures occur, populations are high enough to rebound from any decrease.

In summary, beetle caused mortality in lodgepole pine stands will increase in 1980. Near Goldbridge, damage in the pure pine stands along the valley bottom has been extensive for the past four years and populations are moving into mixed Douglas-fir - lodgepole pine stands at higher elevations. Pine in these areas is more scattered but of greater

volume. In the Kelowna, Penticton and Princeton areas the number of trees killed due to the 1979 attack (turning red in 1980) is expected to be less than the number of trees killed in 1978 and mapped in 1979. The population of the infestation along Trout Creek - Osprey Lake in the past two years has been toward the Hayes Creek drainage and this trend is expected to continue in 1980. Logging of infested stands near Ashnola River will remove much of the newly infested lodgepole pine and reduce the amount of suitable host in the infestation area.

Infestations in western white pine near Blue River are expected to decrease while increased numbers of newly infested groups of trees east of Enderby indicate an increase may be expected.

Table 3

Status of lodgepole pine at 15 localities, Kamloops Forest Region, 1979

Location	Percentage pine component	Average diameter (centimeters)	Percentage of stems				
			Healthy	Current	Red	Partial	Gray[1/]
Gwyneth L	93	33	24	56	14	3	2
Gun Cr	73	27	31	36	24	5	3
Pearson Ridge	49	30	29	38	23	3	6
Mowson Pond	69	25	53	17	17	2	3
McDonald Cr	100	21	58	34	1	1	6
McDonald L	99	16	36	48	12	4	
Truax Cr Rd	54	34	14	76	-	3	7
Pearson Cr	84	24	92	6	-	2	0
Agur L	93	20	63	18	12	5	2
Isintok Cr	87	25	46	29	6	4	15
Link L	100	25	90	3	5	0	2
Thirsk L	92	17	44	29	4	15	8
Trout Cr	17	16	48	4	22	0	26
Ashnola R	98	22	45	22	27	4	2
Summers Cr	58	27	62	18	12	4	4
Summers Cr	67	23	38	4	28	0	30

[1/] Current = attacked in 1979.
Red = attacked and killed in 1978.
Partial = successful 1979 on only one side of tree.
Gray = killed prior to 1978.

A pine sheath miner, Zelleria haimbachi

This defoliator which occurs commonly on ponderosa and lodgepole pine in the Kamloops Region heavily defoliated current year's growth of lodgepole pine on 628 ha near Vavenby, 251 ha along Reg Christie Creek, 188 ha near Trout Creek and 126 ha north of Clearwater River near Spahats Creek Provincial Park. Infestations in the past have lasted one year. No mortality as a result of feeding has been recorded.

European pine shoot moth, Rhyacionia buoliana

A survey of pine species for European pine shoot moth was made in all cities and towns of the Okanagan Valley and Kamloops by a B.C. Ministry of Forests student crew.

The number of infested trees increased in Kelowna, decreased in Kamloops and was detected in Summerland for the first time. A resurvey of areas in June revealed several infested trees that were not detected in the May surveys (Table 4).

Table 4. Location and number of residences where infested pines were found, Kamloops Forest Region 1976-1979

Location	1976	1977	1978	1979
Summerland	-	-	-	17
Kelowna	40	39	30	41
Peachland	-	-	3	-
Westbank	-	-	3	-
Vernon	10	-	-	-
Kamloops	-	21	15	2

The detection in June of infested shoots in areas surveyed in May indicated a shortcoming of detection methods. It was suggested by the crew foreman and adopted by the Plant Protection Advisory Council European pine Shoot Moth Sub-committee, that detection should be left until the latter part of May when damage is more discernible. In order to cover all areas at this time a greater number of crew members would be used for a shorter time. It was also suggested that when a number of infested shoots occurred on trees, they should, with owners' permission, be removed and replaced with a different ornamental tree species rather than clipping and burning individual infested shoots.

Pheromone baited traps were set out in Kelowna, Vernon and

Kamloops with negligible results. Numbers of male moths caught in traps varied from 0 in the Kamloops Region to 30 per trap in some coastal areas of infestation but catches were not consistant in the same areas. Further refinement of the pheromone may achieve a more reliable monitoring capability.

Pine scale insects, Phenacaspis pinifoliae and Nuculaspis californica

Ponderosa pine in the Oliver to Okanagan Falls area were severely infested by white pineleaf scale, Phenacaspis pinifoliae and black pineleaf scale, Nuculaspis californica. Scattered tree mortality has been noted and 50% of the trees have only 1979 foliage remaining.

Damage by scale insects is common in the ponderosa pine belt of the Kamloops Region, particularly along dry dusty logging roads. Scale insects thrive in these conditions while natural parasites find conditions unfavourable.

Winter drying

Winter drying of lodgepole pine occurred on 440 ha of predominantly lodgepole pine between 600-900 m elevation north of Clearwater River near Spahats Creek Provincial Park. The pine in the stand is pole sized and damage appeared to be limited to branch tips. Similar damage to lodgepole pine in the past indicates that if as little as 5-10 percent green foliage remains, new buds will form and the tree will survive the injury.

Damage by a needle cast, Elytroderma deformans was common on ponderosa pine throughout the host range and was noted on lodgepole pine on an estimated 200 hectares in the upper Deadmans Creek drainage.

Scirrhia pini caused severe needle loss in patches of lodgepole pine along the Ashnola River and near Cherryville. Lophodermella concolor infection was severe on roadside lodgepole pine along Jamieson Creek north of Kamloops and along the Mission Creek access road east of Kelowna.

Root rot diseases in conifers

In 1977, scattered mortality of small diameter lodgepole pine was noted near the headwaters of Naswhito Creek. Subsequent ground examinations and collections indicated heavy infection of the lodgepole pine by black stain root disease, Verticicladiella wagenerii. It was also determined that large areas of infection of Douglas-fir at lower elevations was caused by laminated root rot, Phellinus weirii and in higher elevations by shoe string root rot, Armillaria mellea. During 1979 aerial surveys, a much expanded area was noted extending into the

McGregor Creek drainage indicating similar damage both to high and low elevation conifers.

DOUGLAS-FIR PESTS

Douglas-fir beetle, *Dendroctonus pseudotsugae*

Counts of recently killed Douglas-fir were less in 1979 than in the past two years. Bark beetle attacks in previously infested Douglas-fir tussock moth and spruce budworm infested areas also decreased. Table 5 shows locations and numbers of red topped Douglas-fir counted in Kamloops Forest Region.

Table 5. Location and numbers of recently killed Douglas-fir trees, Kamloops Forest Region, 1979

Map	Location	Number of recently killed trees
Kamloops L	Tranquille Cr	100
	Calder L	5
	Red L	5
	Deadman Cr	35
	Tunkwa L	45
	Westsyde-Vinsulla	245
Ashcroft	Highland Valley	70
	Oregon Jack Cr	20
	Pavilion L	60
Lytton	Spius Cr	27
	Manning Cr	35
	Pimmainus Cr	4
Bridge River	Yalakom R	40
	Shalath (Bob Cr)	268
	Seton Portage	16
	Lost Valley Cr	5
	N Seton L	12
	N of D'Arcy	6
	N Carpenter L	51
Bonaparte R	opp. McLure	130
Princeton	Belgie Cr	15
	Hayes Cr	20

Table 5. (Cont'd)

Map	Location	Number of recently killed trees
Tulameen	Hoover Cr	20
	Allison L	3
	Gulliford L	5
	Gillis L	10
	Salem Cr	4
Kelowna	Daniels Cr	6
	Lapsley Cr	6
Merritt	Castillian Cr	4
	Pony Cr	10
	Nicola L	10
	Cougar L	3
	Dupuis Cr	5
	Logan L	34
	Douglas L	5
Shuswap L	Old Town Bay	3
	Haven Pt	8
	Total	1 350

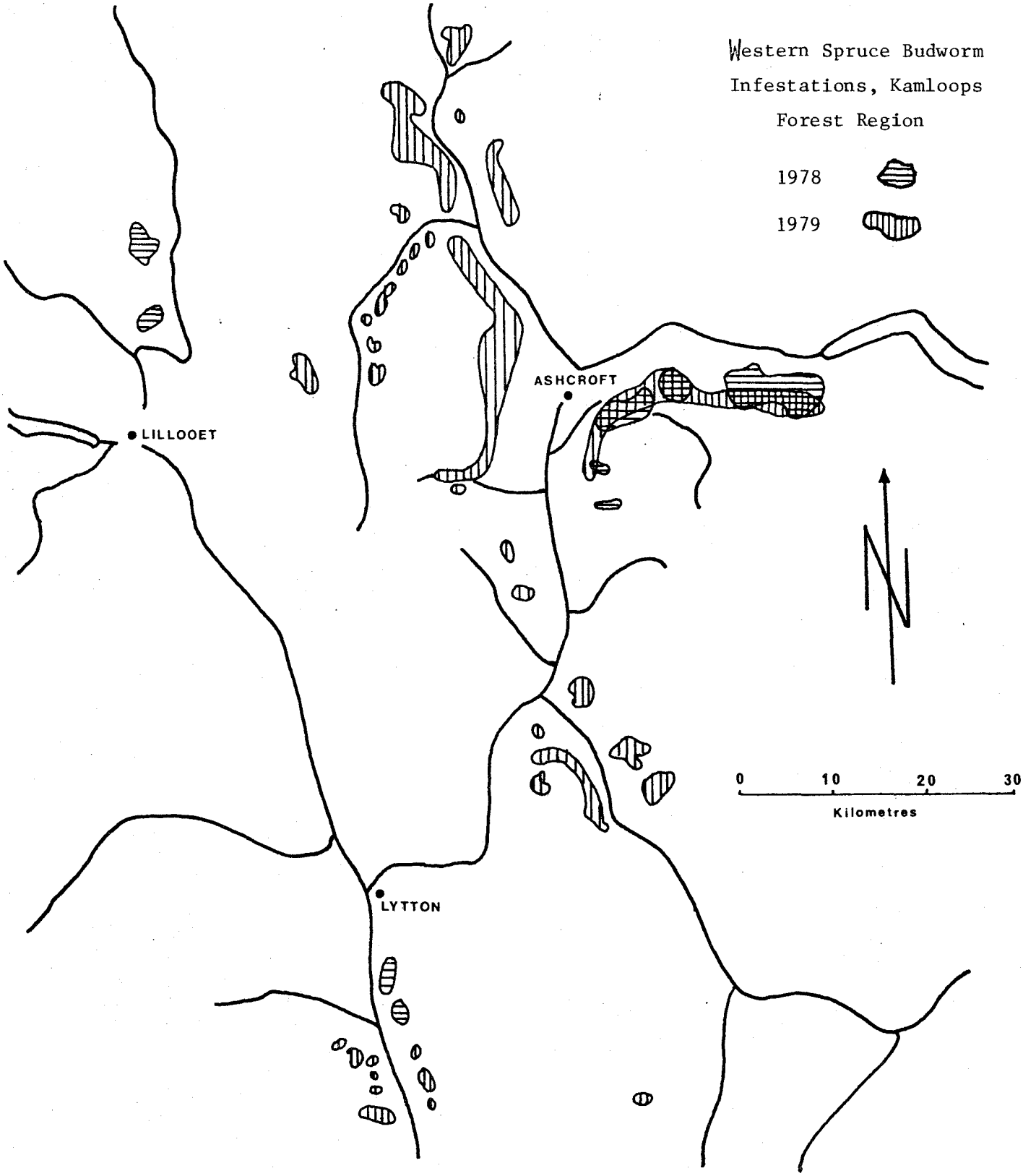
Spruce budworm, Choristoneura occidentalis

Area of mostly light defoliation sketch mapped from an aircraft was in excess of 26 000 hectares (Map 4). A band of defoliation from 550 to 900 metres elevation extended from Oregon Jack Creek north to near Carquille, from north of the Lillooet highway to the Regional boundary. Patches of defoliation, ranging in area from 47 to 400 hectares, were scattered along Hat Creek from near Carquille southwest to Medicine Creek. On the east side of the Thompson River defoliation began along Barnard Creek and extended north to Nesbitt and Penny lakes and east to Indian Gardens Creek. Near Spences Bridge light defoliation was observed from Squianny Creek near Soap Lake southeast to near Shakon Creek. North of the Nicola River defoliation was limited to patches along Papsilqua and Pimmainus creeks. South of Lytton, four small areas of defoliation were observed between Nahimp and Kamiak creeks.

Defoliation was mostly light, however along Cornwall Creek moderate defoliation extended over 1 548 hectares. Near Jimmies and Indian Gardens creeks, defoliation was mainly light but in pole sized patches defoliation ranged up to 50% of the canopy.

MAP 4

Western Spruce Budworm Infestations, Kamloops Forest Region



Examination of Douglas-fir buds in May at 14 locations (Table 6) indicated a continuing population of budworm at Marshall Creek and in tributaries along the South Thompson River.

Table 6. Locations and percentage of Douglas-fir buds infested by spruce budworm, Kamloops Forest Region, 1979.

Location	Percent buds infested	Location	Percent buds infested
Tyaughton L Rd	0	Pimmainus Cr	4
Marshall Cr	24	Spius Cr	17
Mission Pass	2	Marble Canyon	20
Fountain, Va	3	Jimmies Cr	66
Mowhokam Cr	5	Barnes L	75
Soap L	5	Barnard Cr	30
Clapperton	10	Cornwall Cr	66
Princeton	5	Anarchist Mtn	8

By June increased larval populations were evident over a widespread area near Ashcroft and Cache Creek. No disease was present in five collections of 100-200 larvae sent to Forest Pest Management Institute.

External parasites were common on late instar larvae. Ten collections of 75 to 200 young larvae and five collections of mixed late instar larvae and pupae were reared at Pacific Forest Research Centre to determine parasitism (Table 7).

Table 7. Results of rearing spruce budworm for parasite determination, Kamloops Forest Region, 1979

Location	Insects submitted larvae	pupae	Emerged adults	Emerged parasites 1[1]	2	3	4	5	6	7	8	Percent parasitism
Indian Gardens	200		146	1	-	-	3	-	3	-	-	4
Barnes L	173		65	1	-	-	-	-	-	-	2	4
Soap L	75		40	1	-	-	1	-	-	-	-	4
Oregon Jack Cr	101		77	1	-	-	4	-	-	-	1	7
Pavillion L	161		55	2	-	-	-	-	-	-	1	56
Bernard Cr	75		24	-	1	-	-	-	-	-	-	4
Cornwall Cr	91		31	3	-	-	2	-	-	-	-	14
Pavilion Mtn	160		107	6	-	-	-	-	-	-	3	7
Goldbridge	120		70	5	-	1	2	-	-	-	9	19
Marshall Cr	154		116	9	-	-	-	-	-	-	4	10
Carquille	51	78	36	36	3	1	-	1	9	-	15	62
Loon L Rd	9	174	113	1	-	1	-	5	5	-	23	23
Cornwall Cr	55	92	49	25	2	-	-	-	3	-	18	51
Jimmies Cr	14	18	5	9	1	-	-	1	2	-	3	72
Studhorse Cr		34	9	3	-	1	-	1	3	1	4	59
McLean L			35	6	2	-	-	1	5	-	4	34

[1] 1. Glypta fumiferanae
2. Madremyia saundersii
3. Apanteles fumiferanae
4. Zemiotes sp.
5. Phaeogenes hariolus
6. Ceromasia auricaudata
7. Apechthis ontario
8. Unknown

Spruce budworm parasite populations fluctuated greatly in the larval stages. However, the impact on the general budworm population was light judged by the high egg counts in September (Table 9).

In July sampling for larval population density was done at five locations. Two branch samples were taken from mid crown from each of ten trees at each plot: area of samples was measured, defoliation recorded and the number of larvae or pupae counted (Table 8).

Table 8. Western spruce budworm larval density, Kamloops Forest Region, July 1979

Location	Avg density per bud	Avg density per branch	Avg density per 10 m^2 of foliage
McLean L Rd	.4	15	362
2 mi. S of Six Mile Lake	.2	14	1,062
Cornwall Cr	.5	25	3,617
Studhorse Cr	.1	7	926
Jimmies Cr	.2	13	2,111

Based on counts of larvae on buds and branches and computed to 10 m^2 of foliaage, populations were high at the five locations sampled.

In August egg masses were counted on 2-50 cm branches from the mid-crown of each of ten trees at 16 locations. Predicted defoliation for 1980 was based on the number of egg masses per 10 m^2 of foliage (Table 9).

Table 9. Defoliation prediction for 1980 from egg counts, Kamloops Forest Region, 1979

Location	Egg mass density per 10 m^2 foliage	Expected level of defoliation in 1980
Wallachin		
Indian Gardens Cr	240	Heavy
Jimmies Cr	296	Heavy
Ashcroft		
Barnard Cr	186	Heavy
Cornwall Cr	518	Heavy
Studhorse Cr	310	Heavy
Pennie L	93	Moderate
Cache Creek-Carquille		
McLean L Rd	424	Heavy
Carquille	315	Heavy
4 mi.Pavilion L Rd	291	Heavy
Upper Hat Cr	322	Heavy
Spences Bridge		
Soap Lake	136	Moderate
Squianny Cr	168	Moderate
Pimmainus Cr	16	Light
Merritt		
Spius Cr	14	Light
Prospect Cr	16	Light
Princeton		
August L	8	Light

Fifteen pheromone-baited flight traps were set out at each of 10 locations where budworm damage has occurred in the past five years. Trans-11-tetra-decenal attractant was used at three concentrations: .05, .5 and 5% by weight to determine the level of pheromone strengths needed to attract male budworm moths (Table 10). While greater numbers were generally caught with the strongest concentration, any of these concentrations set out individually would adequately monitor the population at its present level. Further experimental traps will be set out in 1980 with greater variations of concentrations.

Table 10. Locations and average number of male moths caught in flight traps, Kamloops Forest Region, 1979

Location	Pheromone concentrations in percent by weight		
	0.05	0.5	5.0
Fountain Valley	31	38	42
Barnard Creek	33	31	40
Burton Creek	3	14	29
Mission Pass	18	29	20
Pennie Lake	32	26	34
Scotch Creek	22	28	48
Spius Creek	33	37	35
August Lake	27	37	39
Sicamous	9	17	38
Botanie Creek	33	29	26

A survey to determine top-kill incidence and severity as a result of spruce budworm defoliation was done in the Vancouver and Kamloops Regions in 1979. Twenty eight plots were examined in the Kamloops Region in sapling, immature and thrifty mature stands in areas defoliated from 1974 to 1978. One hundred randomly selected Douglas-fir trees were examined at each plot location in groups of 20 trees at 2-chain intervals within the defoliated stand. The occurrence of healthy trees and incidence of top kill were recorded, regardless of diameter, in six categories: healthy; less than 1.0 metre top kill; 1.0-2.9 metres; 3.0-4.9 metres; over 5.0 metres and dead trees on individual tree classifications of dominant, co-dominant, intermediate and suppressed. Table 11 shows the results obtained.

Top kill, generally less than 1/2 metre in length occurred at most locations with 4 to 5 years defoliation, although there was great variation in the amount of top kill between plots. Site class and age of stands were not indicative of the amount of damage. Tree mortality occurred at only three locations, relatively thrifty stands on medium and good sites (Table 12).

Five increment cores were taken from trees at each of the 28 plots for analysis. Figure 1 shows the yearly average increment loss through 1974-78 using the average increment growth through 1969-73 as a base.

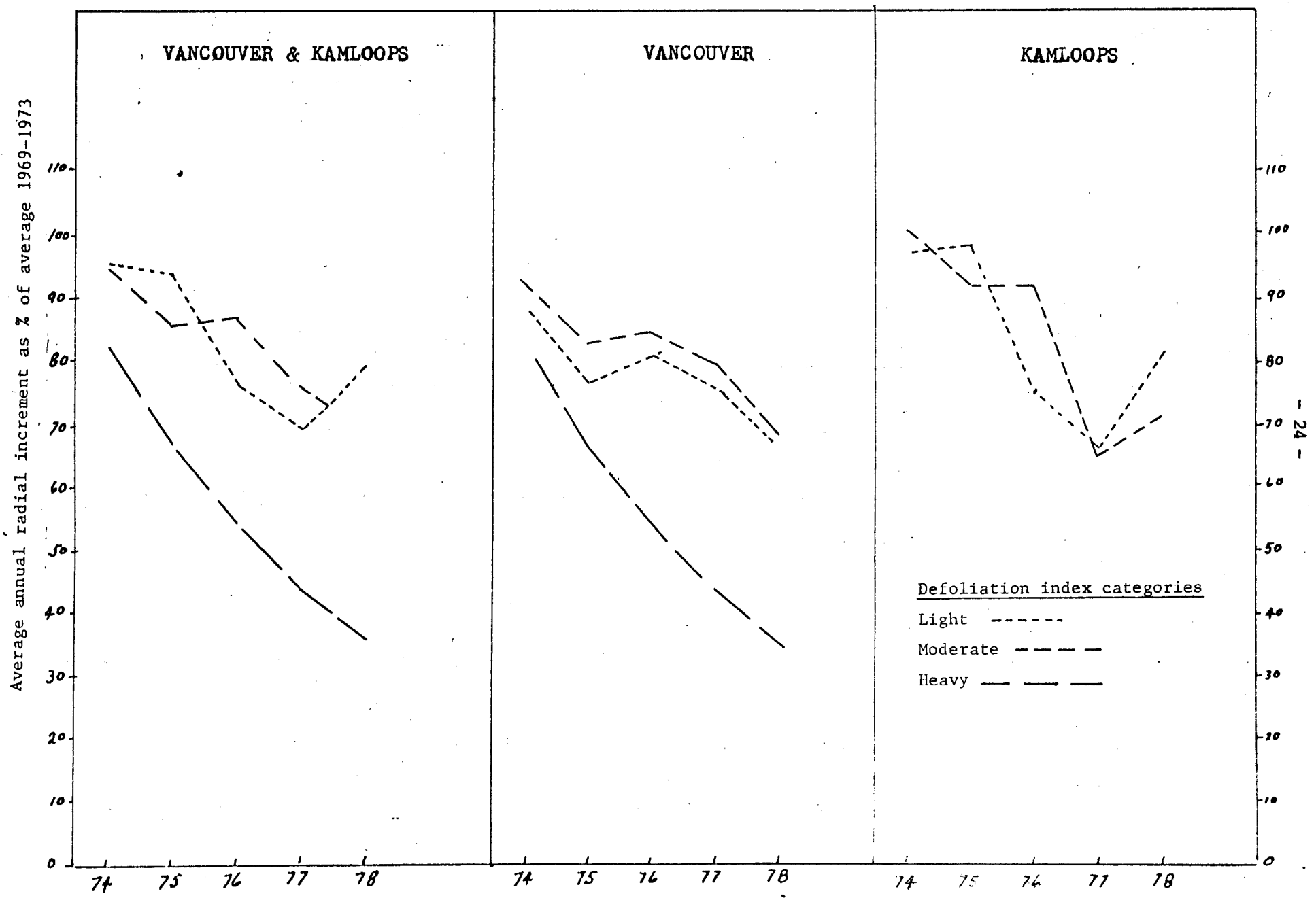
Table 11. Spruce budworm top kill survey, Kamloops Forest Region, 1979

Location	Elevation (m)	Slope (%)	Site class	Age	No. of years of defoliation	Percent top kill	Percent mortality
Mowhokam Cr	800	15	Good	85	5	26	0
Botanie Cr	600	2	Medium	89	5	51	0
Texas Cr	1000	20	Good	113	4	0	0
Cayoosh Cr	600	15	Good	112	5	26	0
Marshall Cr	800	10	Medium	58	5	0	0
Yalakom R	600	30	Medium	55	5	1	0
Goldbridge	600	15	Medium	78	4	16	0
Shulap Cr (Yalakom R)	900	Flat	Poor	89	4	7	0
Gun Lake	800	20	Good	80	5	0	0
Ore Cr (Yalakom R)	600	15	Medium	105	4	6	8
Tyaughton Cr	700	20	Medium	64	4	34	10
Cayoosh Cr	700	Flat	Medium	110	5	0	0
Slok Cr	600	10	Poor	64	3	0	0
Pavilion L	750	2	Medium	87	3	1	0
McKay Cr	700	10	Medium	84	3	12	0
Fountain Va	800	20	Medium	68	5	20	0
Pavilion Mt	1000	15	Poor	58	4	1	0
Cinquefoil Cr	700	5	Poor	101	4	37	0
Fountain Cr	700	5	Good	20	5	58	0
Soap L	700	5	Good	73	4	20	5
Cornwall Cr	800	10	Medium	53	3	18	0
Barnes L	800	Flat	Poor	50	3	1	0
McLean L Rd	900	25	Medium	68	3	52	0
Oregon Jack	700	2	Medium	73	4	49	0
Jimmies Cr	750	12	Medium	75	3	4	0
Pimmainus Cr	1000	12	Medium	41	4	0	0
W of Clapperton	900	5	Medium	32	4	24	0
Spius Cr	700	10	Good	53	3	15	0

Table 12. Summary of spruce budworm top kill and tree mortality survey, Kamloops Forest Region, 1979.

Healthy				Percent of trees with top kill																Percent trees dead			
				Less than 1.0 cm				1.0-2.9 m				3.0-4.9 m				over 5.0 m							
D	CD	I	S	D	CD	I	S	D	CD	I	S	D	CD	I	S	D	CD	I	S	D	CD	I	S
12	23	35	11	0.6	1.6	8.0	7.2	0.1	0.03	0.21	0.1	0	0	0	0	0	0	0	0	0.5	0	0.2	0.1
Total	81				17.4				0.4												0.8		

Figure 1 Average annual increment loss 1974-1978 in western spruce budworm defoliated Douglas-fir stands, Vancouver and Kamloops Forest Regions (Red lines = through 1974-1978 values).

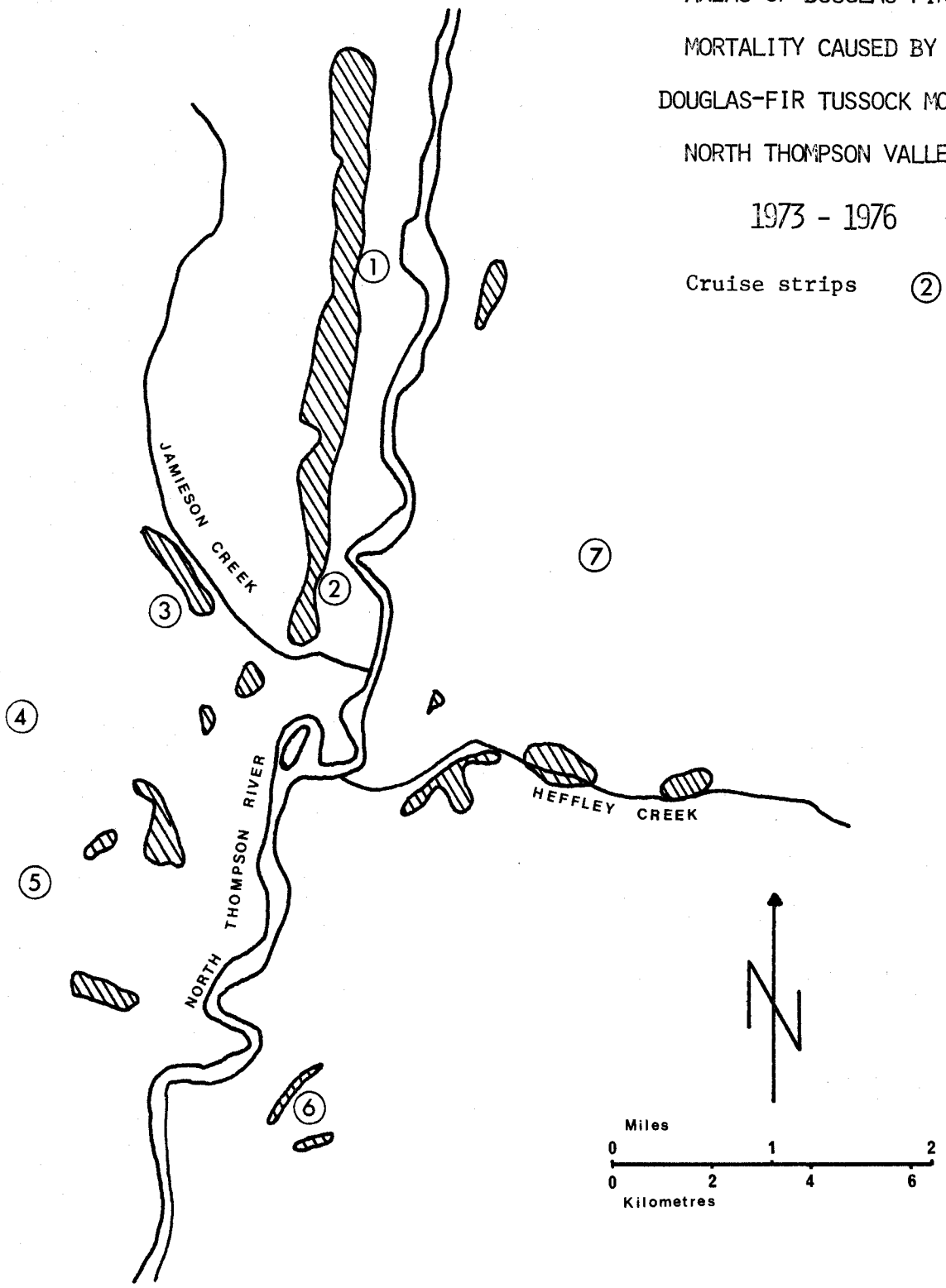


MAP 5

AREAS OF DOUGLAS-FIR MORTALITY CAUSED BY DOUGLAS-FIR TUSSOCK MOTH, NORTH THOMPSON VALLEY

1973 - 1976

Cruise strips ②



Douglas-fir tussock moth, Orgyia pseudotsugata

Tussock moth outbreaks have occurred seven times since 1916, lasting usually from 3 to 5 years and causing varying amounts of damage and tree mortality in the Okanagan Valley and near Kamloops. In 1971 an infestation began in the Okanagan and by 1975 had spread to encompass stands as far north as McLure on the North Thompson River. By the time the outbreak subsided as a result of natural factors and a control program, more than 10 000 ha were infested. Severe defoliation occurred on 5 700 ha along both sides of the North Thompson Valley from Westsyde to McLure and on 2 700 ha between Cherry Creek and Savona.

After allowing sufficient time for tree recovery and to insure better delineation of affected stands, an aerial survey in 1979 determined that significant tree mortality had occurred on 1 530 ha in the North Thompson Valley (Map 5). Between Cherry Creek and Savona tree mortality was limited to small groups of trees (1-5 ha). Seven cruise strips, totalling 1,372 trees, were established in stands of varying mortality intensity. Near Jamieson Creek, mortality on three strips ranged from 60 to 82%. Near Lanes Creek 8% of the stand was dead; at Dairy Creek 18%, Lyons Lake 20% and near Palmer Forsythe Creek 44%. The largest areas of mortality were on steep, east facing slopes ranging from 45 to 55%.

Populations were low in 1979. An infestation was detected near Kamloops in nursery trees, 35 to 45 feet high in May. Trees sprayed by the nursery owner with Sevin wettable powder prevented any noticeable defoliation.

SPRUCE PESTS

Spruce beetle, Dendroctonus rufipennis

Spruce beetle activity has decreased in Engelmann spruce stands in the Kamloops Region with only low numbers of current attack found this year. Scattered current attack was present in the Fly Hills area, however these trees are being logged. In the Tadpole-Esperon lakes area an abundance of recently felled material absorbed the beetle population and prevented significant current attack to standing trees. At Thynne Mountain and at Cathedral Provincial Park occasional partial attacks were found. Logging was initiated near Thynne Mountain to clean up the area.

In all other areas spruce beetle was found only in windfall and tree stumps. The B.C. Ministry of Forests assigned a student crew to examine all reported areas of blowdown and other locations where bark beetle hazard existed. Significant numbers of attacks occurred on windfall at Olivine, Lawless, and Minor creeks, in the south and in Wells Gray Park from Helmcken Falls to Clearwater Lake and near Monticola Lake in the north. These areas ranged from a dozen trees to two hectares with from 4 to 10 attacks per 0.1 square meter of bark. Heavy attacks on stumps, which can be just as dangerous as windfall for population buildup

were found at Thynne Mountain, Chase Creek and near Bolean Lake.

Lindane sprayed trees were baited with pheromone, (Frontalure - 33% Frontalin - 66% alpha pinene) at Tadpole Lake towards the end of May. The beetle flight was monitored by checking the screen around the base of the trees twice weekly (Table 13).

Table 13. Number of spruce beetles caught in pheromone baited trees, Kamloops Forest Region, 1979

Date	No. of beetles	Date	No. of beetles
June 4	18	July 5	11
7	0	17	9
11	26	24	1
14	28	Aug. 2	1
19	3	15	0
22	4		
28	47		

The number of beetles caught was insignificant. It is possible that the main flight was missed, however sampling of felled trap trees at the time of trap placement indicated no current attacks, yet by the end of June current attack was common on the same trees. Another reason for the small numbers could be the volume of downed material nearby, which may have been more attractive than the sprayed trees. Further, the attractant could have been inferior quality.

Two-year-cycle spruce budworm, Choristoneura biennis

Visible defoliation by two-year-cycle spruce budworm in the "off" year is seldom observed from an aircraft; however, damage was mapped in 1979 over an increased area observed in 1978 in the Upper North Thompson River Valley. The entire complement of the 1979 foliage was consumed in most areas. Along Lempriere Creek and near Gosnell additional feeding from the previous four years has left little foliage on the older trees and caused extensive top stripping of regeneration and pole sized trees.

Collections taken between July 9-13 yielded up to 125 third instar larvae per three tree sample, one week later, few larvae could be found; larvae had gone into hibernation.

Table 14. Location and area of defoliation by intensity classification, Kamloops Forest Region, 1979

Location	Defoliation in hectares		
	light	moderate	heavy
N Thompsons R west of Gosnell	410	---	---
Gosnell	---	379	---
Lempriere Cr	---	---	5148
Clemina Cr	172	---	---
Allan Cr	79	---	---
Chappel Cr	158	---	---
Total	819	379	5148
Grand Total			6346

WESTERN HEMLOCK PESTS

Hemlock sawfly, Neodiprion sp.

Hemlock sawfly populations increased in the Mabel Lake area. Near Kingfisher and Noisy creeks the number of larvae in beating samples increased from under 100 per collection in 1978 to 500 in 1979. Defoliation was light on overstory trees but was quite conspicuous on regeneration.

ALPINE FIR PESTS

Balsam bark beetle, Drycoetes-Ceratocystis complex

Areas in which beetle killed alpine fir were observed was less than in 1978. Attacked stems were usually the secondary stand component.They occurred in a scattered pattern, resulting in large areas being mapped (Table 15).

A needle rust of alpine fir, Pucciniastrum epilobii caused moderate damage to current year's growth near Helmcken Falls in Wells Gray Park and along the East Barriere Lake road.

Table 15. Location and area within which alpine fir trees were killed by balsam bark beetle Dryocoetes-Ceratocystis complex, Kamloops Forest Region, 1979

Map	Location	Area (hectares)
Taseko L	Yalakom Mt.	2
Princeton	Skaist R	20
	Kettle Mtn	81
Penticton	Tinhorn Cr	16
Tulameen	Tulameen R	48
	Fig L	48
	Brenda L	20
Kelowna	Munro L	16
	Eneas L	20
	Headwater L	32
	Peachland Cr	12
	Okanagan Mtn	8
	Greyback Mtn	202
Vernon	Roundtop Mtn	60
	Shorts Cr	40
	Stuart Cr	10
	Whiteman Cr	16
Shuswap L	Charcoal Cr	60
	Hunters Rge	808
Revelstoke	Hunters Rge	808
Total		2 345

WESTERN LARCH PESTS

Larch casebearer, Coleophora laricella

Damage to western larch by the larch casebearer decreased near Cherryville and Shuttleworth Creek and remained static along Anarchist Mountain. A prediction based on counts of hibernating larvae in September indicated light defoliation will occur in 1980 near Cherryville and Shuttleworth Creek and moderate defoliation along Anarchist Mountain (Table 16).

Table 16. Predicted larch casebearer defoliation
Kamloops Forest Region, for 1980

Location	No. of casebearers per 50 cm branch	No. of casebearers per 100 fascicles	Predicted defoliation 1980
Cherryville	38	24	light
Shuttleworth Cr	70	28	light
Anarchist Mtn	121	82	moderate

Foliar diseases

While foliar diseases may cause considerable loss of increment and at times heavy defoliation, tree mortality seldom occurs. Continued infection for a number of years tends to predispose larger diameter trees to secondary attack and suppress younger stands.

A larch needle cast, Hypodermella laricis was prevalent over large areas along the Monashee Range from Kelowna to Mabel Lake, Trinity Valley and near White Lake.

Light infection of western larch by a needle rust, Melampsora paradoxa was noted throughout the range of western larch. However, in the southern portion of the Region near Mica Creek individual trees and small groups had 100% of the foliage infected.

WESTERN RED CEDAR PESTS

Winter damage

Winter damage to western red cedar was extensive in most of the host range. Reddening of foliage was noticeable in May and by August foliage drop was severe in patches of from 30 to 1 350 hectares. Table 17 shows areas in which severe damage was noted during aerial surveys.

Table 17. Locations and estimated area of damage caused by winter drying, Kamloops Forest Region, 1979

Location	Area of damage (ha)
Revelstoke-Shuswap Range	930
Hiuihill Cr	1 236
Corning Cr	545
Reienecker Cr	28
E Barriere L	502
Kwikoit Cr	377
Mad R	314
Hummamilt L	126
Murtle L	1 355
Total	5 413

DECIDUOUS TREE PESTS

Forest tent caterpillar, *Malacosoma disstria*

Heavy defoliation of trembling aspen occurred on 565 hectares inside Wells Gray Park and 251 hectares immediately south of the Park. The larvae were heavily parasitized and decreased defoliation is expected in 1980. In the southern portion of the Region light defoliation was noted along Shingle Creek near Penticton.

Birch blotch miner, *Lyonetia salicifoliella*

Browning of western white birch foliage was widespread in the Johnson-Barriere lakes area and near Vavenby and Albreda in the North Thompson River Valley. The following table shows locations and estimated area of defoliation.

Table 18. Defoliation of western white birch Kamloops Forest Region, 1979

Location	Estimated area of defoliation (ha)
Johnson L	377
Barriere L	251
Vavenby	126
Albreda	190
Total	944

Fall webworm, Hyphantria cunea

Severe defoliation was noted on roadside deciduous shrubs from Kelowna to Enderby and near Sunnybrae.

Smaller European elm bark beetle, Scolytus multistriatus

For the first time in British Columbia, pheromone baited traps were used to determine the presence of elm bark beetles, which can vector Dutch elm disease. An average of 382 beetles per trap were caught near Osoyoos and Oliver in 6 traps; 128 beetles per trap in 2 traps at Soorimpt Park north of Penticton; 140 beetles per trap in 2 traps in Kelowna and 7 beetles per trap in 4 traps in North Kamloops. Similar traps used in Vancouver and Nelson Regions were negative. To date there is no evidence of Dutch elm disease in British Columbia.