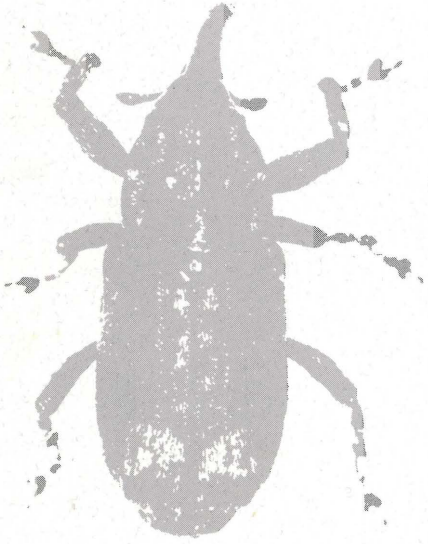
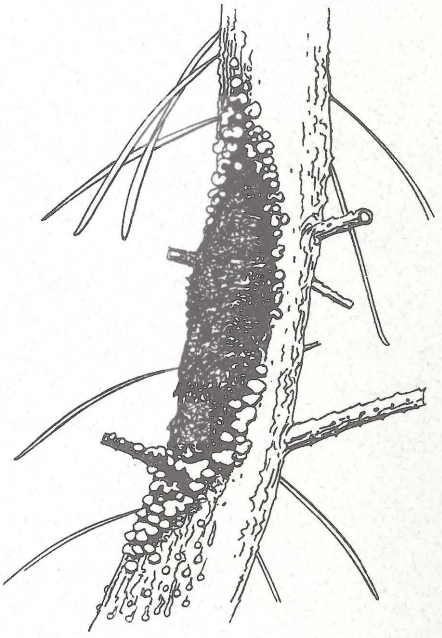
- Mountain Pine Beetle -
A history of outbreaks in pine forests in British Columbia, 1910 to 1995





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- Mountain Pine Beetle -
A history of outbreaks in pine forests in British Columbia, 1910 to 1995

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Natural Resources Canada
Canadian Forest Service
Victoria B.C.

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Contents

Summary

Since the first report of mountain pine beetle killing pine trees in British Columbia in 1910, outbreaks have been reported annually (Map 1, Table 1). Hosts include mature lodgepole pine (*Pinus contorta* Dougl. ex Loud), western white pine (*P. monticola* Dougl. ex D.Don in Lamb.), ponderosa pine (*P. ponderosa* Dougl. ex P.& C. Lawson), and white bark pine (*P. albicaulis* Engelm.).

The first reported areas of beetle-killed lodgepole and ponderosa pine were between 1910 and 1931 near Princeton and Peachland, and between 1917 and 1932 near Aspen Grove and Kamloops. From 1922 to 1932, beetle-killed pine were common along the east side of Okanagan Lake and in the Kettle River Valley, and from 1920 to 1932 from Lillooet to Kamloops and at Adams Lake.

From 1930 to 1936, outbreaks occurred in the Takla Lake area and killed up to 90% of the lodgepole pine over 650 000 ha. In 1930, an outbreak developed in Kootenay National Park and by 1943 had killed up to 90% of the pine over 65 000 ha. Between 1940 and 1943 beetle infestations in Yoho and Banff National Park killed pine in an area of over 4000 ha.

Large infestations developed between 1946 and 1965 in lodgepole pine around Babine and Takla lakes (1.4 million trees) and in western white pine stands in the Skagit River Valley and Manning Park. In the same period, mature western white pine were killed by the beetle over vast areas in the interior, and from 1955 to 1965, a high proportion of the mature white pine on Vancouver Island was killed in numerous widespread areas totaling 135 000 ha.

Rapidly increasing infestations were common throughout the southern Interior beginning in the early 1970's. In the Klinaklini River Valley, infestations which started in 1972, expanded annually, covering 65 000 ha in the west Chilcotin by 1980. The largest outbreak year recorded in British Columbia was in 1984, over 483 000 ha. This was nearly three times the area harvested of all conifer species in British Columbia in 1982-83.

Outbreaks declined in 1985, mainly due to temperatures of -40°C or lower in October 1984, which killed most unprotected overwintering broods. Populations were reduced further by cold temperatures in November 1985. Further declines continued, and by 1990 infestations were recorded on 41 300 ha, the smallest area recorded since 1978.

Mountain pine beetle is expected to continue to kill mature lodgepole pine in susceptible stands in British Columbia indefinitely. However, knowledgeable forest practices will reduce the impact in managed forests.

Introduction

Mountain pine beetle, *Dendroctonus ponderosae* Hopk., is the most destructive insect pest of mature pines in western North America. It is native to more than 30 million hectares of habitat of which lodgepole pine is a significant component. The beetle was first recognized as a problem when it came into direct competition with the forest industry and recreational land owners in the early 1900s.

Its impact in British Columbia includes annual losses averaging 7.8 million mature pine trees over the past 34 years, peaking at 80.4 million in 1983. It remains a continuing threat to mature pine forests.

Reports of outbreaks and tree mortality have been documented since 1910, and annually between 1936 and 1950 by the Forest Insect Survey, and from 1951 to 1995 by the Forest Insect and Disease Survey (FIDS) unit of the Canadian Forest Service, based in Victoria at the Pacific Forestry Centre. From 1995 to 1996 the role of the FIDS unit was redefined and the responsibility for forest pest monitoring in the traditional form was transferred to the provincial forest ministry (BCMoF).

The data in this report is compiled from annual ground and aerial surveys carried out by FIDS, in cooperation with the B.C. Ministry of Forests (BCMoF) and the forest industry. The data is presented to provide background information for input into integrated forest management practices. It's prime purpose is to provide an annual overview and trend of beetle activity, and a rough estimate of losses province-wide. This historical record should enhance the understanding of the threat of this pest, and through aware management, lead to the reduction of volume losses in mature pine forests in British Columbia.

Acknowledgments

The assistance of Drs. R.F. DeBoo, L. Safranyik, G.A. Van Sickle, and CFS/FIDS rangers in the compilation, editing, and review of data and text is appreciated.

Survey Methods

Annual surveys were carried out to detect and monitor developing and expanding infestations and populations, combining aerial and ground-based procedures.

Population assessments

Surveys of infested pine stands during May and early June determine the survival of overwintering populations and their potential to attack adjacent susceptible pine. Population trends are determined by sampling 20 trees in an area. From each tree, areas of bark, usually 0.1 m^2, or more recently 15 x 15 cm, are removed at breast height from the north and south side. The ratio of surviving overwintering progeny to entrance holes provides an "R" factor; values of less than 2.6 indicates declining populations, from 2.6 to 4.0 indicates static populations, and 4.1 or greater indicates increasing population trends.

Surveys of beetle-infested stands in September to October forecast population and damage trends in terms of the number and volume of mature pine killed by the beetle in current and previous years. Most surveys involve prism plots at 50 to 100 metre intervals through representative portions of the infestation.

Mapping outbreaks

The first outbreaks recorded in British Columbia were delineated from ground view points, often with the help of local knowledge from land owners and cooperators. These outbreaks were mapped on topographic maps of varying scales (1:50 000, to 1:250 000).

Since the 1960's, beetle-killed stands have been delineated, usually by two observers, from fixed-wing aircraft or from helicopters. Aerial surveys are occasionally supplemented by observations from ground vantage points. Mapping was traditionally done by FIDS personnel, but starting during the 1980's, some of the BCMoF districts have intermittently assumed responsibility of aerial surveys for beetle infestations. Due to the different objectives between agencies, mapping techniques varied, with a corresponding loss in annual comparability in the numbers of hectares and trees. Although the numbers may not be directly comparable throughout the documented period, the general trend of major infestations remains clear.

Aerial surveys were conducted usually from mid July to late August. Foliage of trees attacked by the beetle the previous year, usually changes from green to red by mid-July the following year. The foliage change allows the mappers to estimate the percent of pine killed the previous year for each polygon mapped. To confirm the beetle's presence and viability, and to check the boundaries of aerial sketch-mapped infested areas, ground spot checks in major outbreak areas have been conducted annually since the mid-1960's.

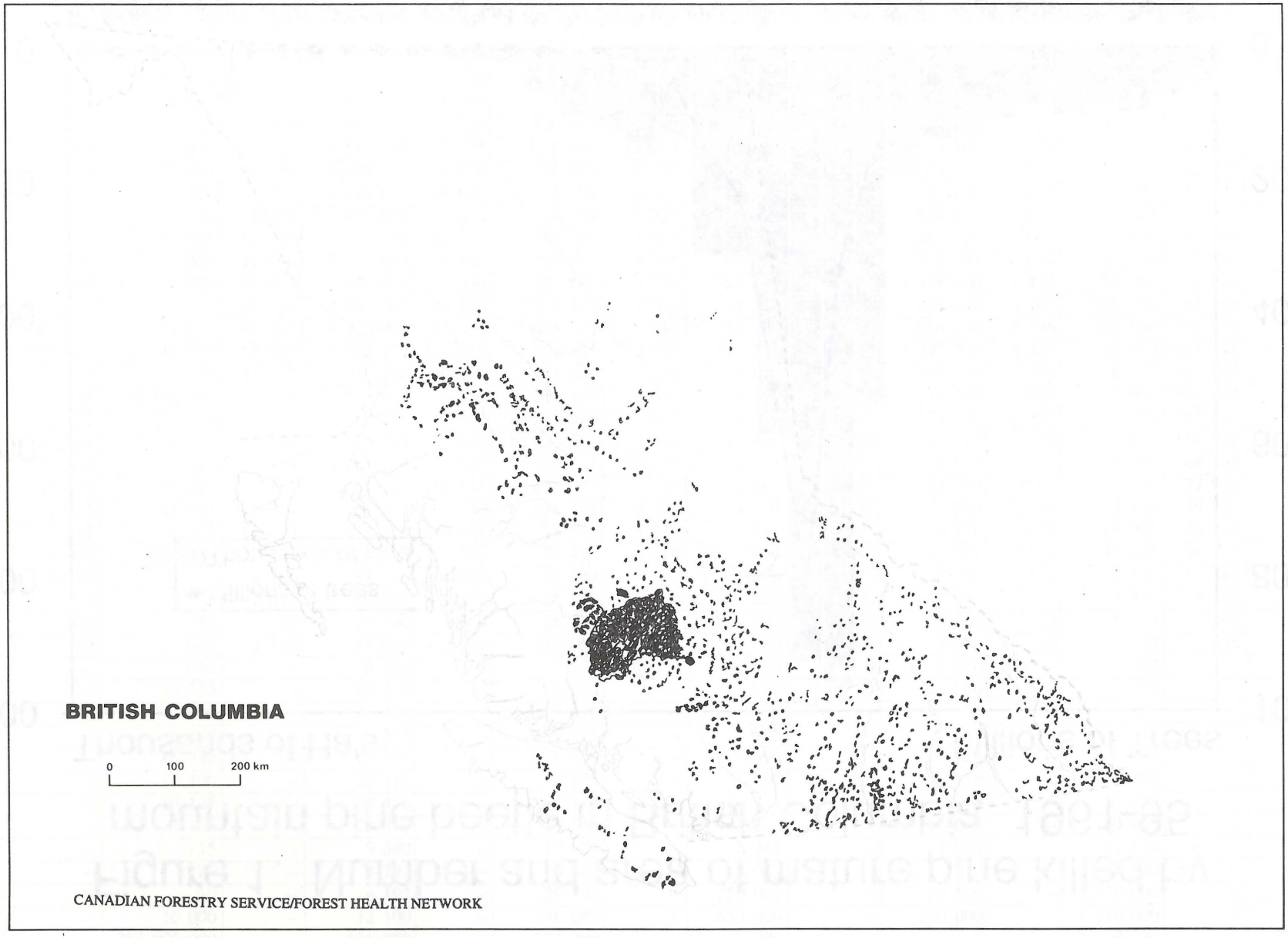
The areas of beetle-killed pine delineated on aerial survey maps was determined by the "dot-grid" system, or electronic planimeter until 1983. These systems were replaced by a computer-based digital mapping system "Geographic Information System" (G.I.S.), which became operational in the FIDS unit at Pacific Forestry Centre in 1984.

The volume and number of trees killed have generally been calculated from the area mapped, percent of trees discoloring during the year of mapping, and average number or volume of pine per hectare for the area. The later may be based on cruise data from currently infested stands, or more recently a general figure obtained from the BCMoF.

Aerial photography

Photographs of selected outbreak areas have been taken in some areas since the 1920's and throughout the province since the early 1970's. These have assisted in the estimation of the number of trees killed and the area of infestation as well as providing long-term visual records of outbreaks. Most were oblique color photographs; usually 35 mm slides and occasionally 70 mm prints. Photographs were usually taken at between 300 and 500 metres above the forest canopy from fixed-wing aircraft. Photographs of some areas surveyed by helicopter were taken less than 300 metres above tree top level.

Various experimental applications of remote sensing, infrared and high level photography have been used for recording mountain pine beetle outbreaks in British Columbia. Each has brought it's own unique features, but flexibility and reliability under varying circumstances has been limited and none have been fully implemented as a routine procedure for overview surveys of mountain pine beetle.



Map 1. Location where mature pine have been killed by mountain pine beetle, 1910-1995.

Figure 1. Number and area of mature pine killed by mountain pine beetle in British Columbia, 1961-95

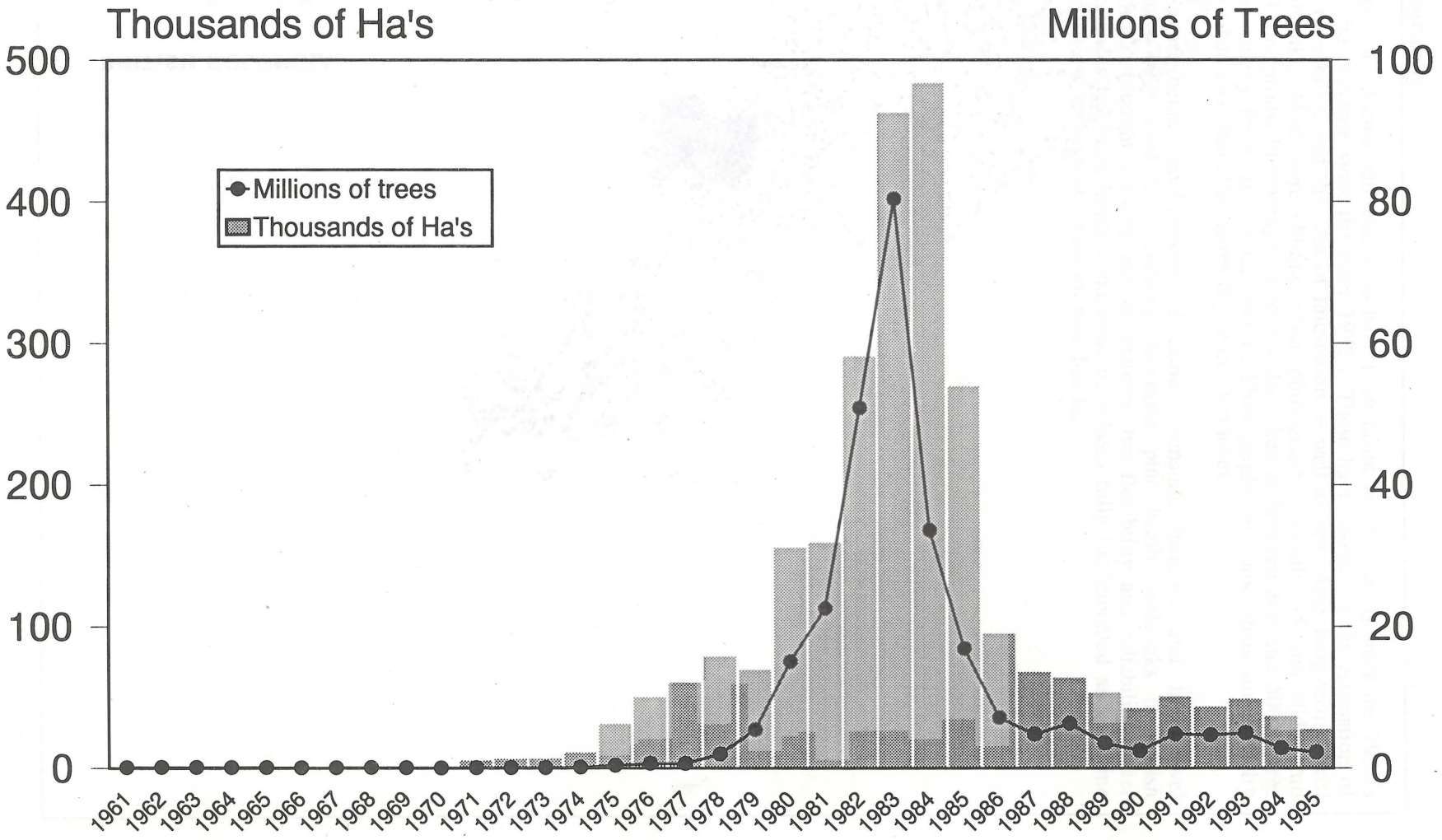


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TABLE 1. AREA AND NUMBER OF TREES KILLED BY MOUNTAIN PINE BEETLE IN BRITISH COLUMBIA

	CARIBOO		KAMLOOPS		NELSON		PR. GEORGE		PR. RUPERT		VANCOUVER		BRITISH COLUMBIA	
Year	Area	# of Trees	Area	# of Trees	Area	# of Trees	Area	# of Trees	Area	# of Trees	Area	# of Trees	Area	# of Trees
95	3 850	284 500	7 882	1 039 600	6 790	558 500	?? ???	??? ???	7 540	312 000	640	38 550	26 702	2 233 150
94	1 660	122 200	8 865	1 391 000	2 750	330 960	17 000	805 000	5 290	156 230	465	23 400	36 030	2 828 790
93	780	34 000	19 920	3 510 000	7 725	631 470	12 610	682 500	6 460	73 800	525	11 025	48 020	4 942 795
92	275	20 000	21 100	3 499 150	8 920	681 900	8 430	366 250	3 200	69 300	775	15 375	42 700	4 651 975
91	350	13 760	18 967	3 519 650	14 665	761 690	9 310	345 156	5 840	136 290	465	7 000	49 597	4 783 546
90	315	15 700	6 000	835 000	23 016	1 126 590	7 875	257 550	3 530	238 430	535	8 000	41 271	2 481 270
89	720	36 000	12 000	1 233 500	31 786	1 659 600	2 805	122 387	4 440	441 120	545	13 600	52 296	3 506 207
88	1 290	65 000	17 630	3 567 500	26 180	1 328 780	3 975	90 125	13 060	1 228 300	845	20 900	62 980	6 300 605
87	500	25 000	19 000	1 849 900	23 330	1 221 600	4 290	165 670	18 400	1 436 000	1 470	55 500	66 990	4 753 670
86	0	0	46 750	4 790 000	28 180	1 222 740	1 200	11 250	14 000	946 000	4 160	126 850	94 290	7 096 840
85	189 464	10 253 197	46 760	4 533 000	14 630	1 048 700	630	14 700	13 000	896 000	4 195	102 500	268 679	16 848 097
84	382 321	25 146 916	58 000	5 006 225	21 210	1 892 975	2 800	121 375	14 500	1 397 300	4 310	18 550	483 141	33 583 341
83	381 870	71 729 023	43 960	5 710 000	20 190	2 111 800	720	18 020	13 300	788 770	2 065	6 875	462 105	80 364 488
82	221 835	45 308 906	22 000	920 000	38 450	4 296 630	1 584	15 860	5 825	298 795	500	3 000	290 194	50 843 191
81	72 752	9 143 960	19 500	2 705 035	58 790	10 501 060	985	6 300	4 697	179 800	1 520	4 900	158 244	22 541 055
80	63 785	2 284 075	37 086	2 638 294	33 400	10 023 500	5 510	10 400	13 200	49 755	1 850	21 600	154 831	15 027 624
79	17 600	72 085	19 898	783 224	24 000	4 517 655	2 278	4 663	4 807	29 675	85	1 600	68 668	5 408 902
78	31 694	864 800	17 775	662 103	18 941	425 077	4 495	2 005	4 670	22 930	361	2 530	77 936	1 979 445
77	15 944	43 700	15 284	424 283	13 242	146 172	9 140	4 100	3 535	11 600	2 586	4 430	59 731	634 285
76	15 872	84 785	16 000	432 316	10 823	91 250	1 235	780	3 220	20 770	1 959	18 991	49 109	648 892
75	15 030	140 000	7 363	115 960	3 199	79 435	30	300	2 053	17 702	2 590	43 845	30 265	397 242
74	1 551	9 700	3 785	37 990	1 884	32 889	--	300	1 333	17 100	1 832	12 605	10 385	110 584
73	0	0	2 041	19 820	1 509	15 920	--	250	2 490	7 185	120	2 930	6 160	46 105
72	100	720	1 767	18 100	1 870	28 520	--	200	1 990	5 706	78	1 325	5 805	54 571
71	40	160	1 300	15 000	2 101	36 050	--	150	1 205	3 650	10	250	4 656	55 260
70	--	130	--	6 700	--	3 570	--	150	--	1 250	--	80	--	11 880
69	--	13 750	--	18 700	--	8 340	--	160	--	100	--	75	--	41 125
68	--	40 610	--	21 275	--	13 410	--	460	--	50	--	25	--	75 830
67	--	14 680	--	29 313	--	9 878	--	675	--	20	--	35	--	54 601
66	--	16 920	--	19 455	--	6 900	--	6 690	--	25	--	100	--	50 090
65	--	10 700	--	22 116	--	17 875	--	31 490	--	850	--	1 700	--	84 731
64	--	16 125	--	24 558	--	25 125	--	24 035	--	740	--	10 450	--	101 033
63	--	1 165	--	25 810	--	17 560	--	19 235	--	10 050	--	30 455	--	104 275
62	--	155	--	9 380	--	17 822	--	8 365	--	5 065	--	72 120	--	112 907
61	--	70	--	3 292	--	3 821	--	3 037	--	0	--	71 540	--	81 760
56-60	--	50	--	6 192	--	20 787	--	250 000	--	75 000	--	1 170 000	--	1 522 029
50-55	--	10 000	--	12 100	--	146 080	--	650 000	--	300 000	--	1 310 000	--	2 428 180
pre 50	--	250 000 000	--	181 000	--	274 000	--	15 000	--	0	--	1 500 000	--	251 970 000
Total		415 822 542		49 636 541		45 336 631		4 054 588		9 177 358		4 732 711		526 527 221

History of Mountain Pine Beetle in British Columbia

I. Cariboo Forest Region

Mountain pine beetle outbreaks were first recorded in the Cariboo Forest Region in 1930 in the Tatla Lake area, where between 1930 and 1936, 60% to 90% of the infested pines were destroyed over an area of approximately 650 000 ha (Map 2).

Beetle-killed pine were next reported in 1948 in the Bella Coola River Valley and Tweedsmuir Provincial Park. This infestation expanded into the Atnarko River Valley in 1949 and continued until last reported in 1958. Small scattered groups of beetle-killed trees were reported in the Narcosli Creek area in 1955, Bowron Lake in 1956, and Joe's Lake in 1958. Patches of affected ponderosa pine east of 70 Mile House were the only records of beetle activity in the region until 1963.

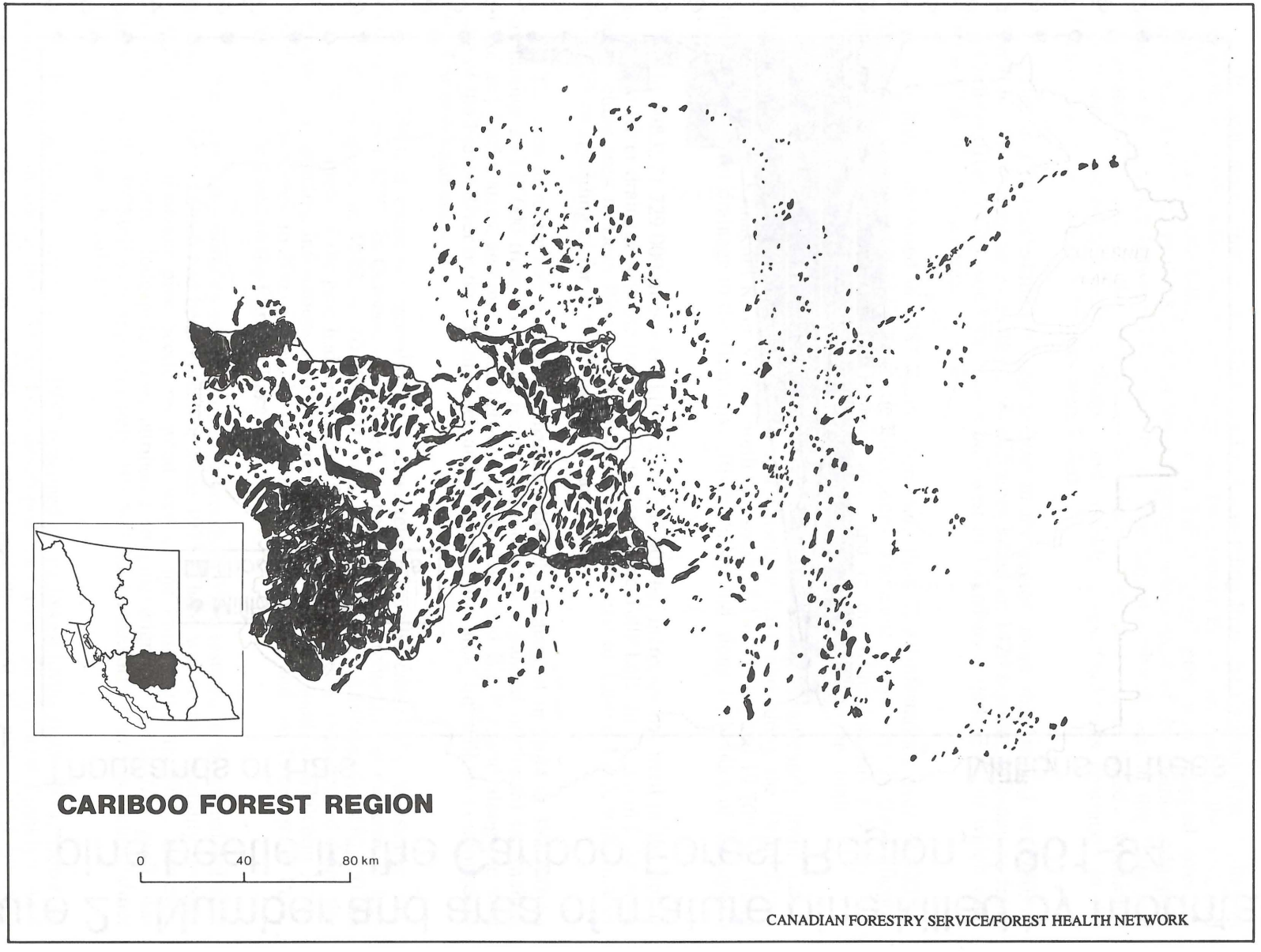
The number of mature lodgepole pine killed by the beetle increased in the region in **1963** and totaled 840 m^3 at Narcosli Creek (Figure 2). In **1964,** infestations developed in the Bull Mountain area and near Tyee Lake, where 5000 trees were killed in each area, and at Cuisson Lake where pine were killed over 10 ha. These infestations continued in **1965**, when over 10 000 trees were killed at Bull Mountain, Cuisson Lake, south of Quesnel and northwest of Alexandria. The Bull Mountain, Tyee, Cuisson and Williams Lake outbreaks totaled close to 17 000 trees in **1966**, but declined to 15 000 trees, including 10 000 at Bull Mountain, in **1967**. These outbreaks expanded again in **1968** to 40 000 trees, including a new outbreak containing 20 000 beetle-killed lodgepole pine near Williams Lake airport. Infestations declined significantly in area and intensity in **1969** due to extremely low temperatures (-43°C) during the winter of 1968-69, which killed all of the overwintering adults and 78% of the larvae in stands near Williams Lake. The number of trees killed at Bull Mountain declined to only 200, and near the airport to 7500. However, new infestations near Cariboo and Tyee Lake contained 3000 beetle-killed trees each. The full impact of the 1968-69 winter low temperatures became apparent in **1970** and **1971**, when only a few beetle-killed trees were recorded, including 160 at the north end of Cariboo Lake.

Following little activity in **1972-73**, 9700 trees were killed in the region in **1974.** It was the start of a major infestation in the Klinaklini River drainage.

An estimated 140 000 mature lodgepole pine were killed by the beetle in **1975**; over 15 000 ha in six major infestations. These included 74 500 trees in the West Chilcotin, 14 600 in the Williams Lake area, (including 13 400 at Bull Mountain and 1200 at Hawks Creek), 6700 at Tyee Lake, and 6200 near Cariboo Lake. Infestations of 100 to 600 beetle-killed trees, totaling 13 650 trees, were scattered elsewhere throughout the region, including 6900 in the Dog Creek and Jesmond areas.

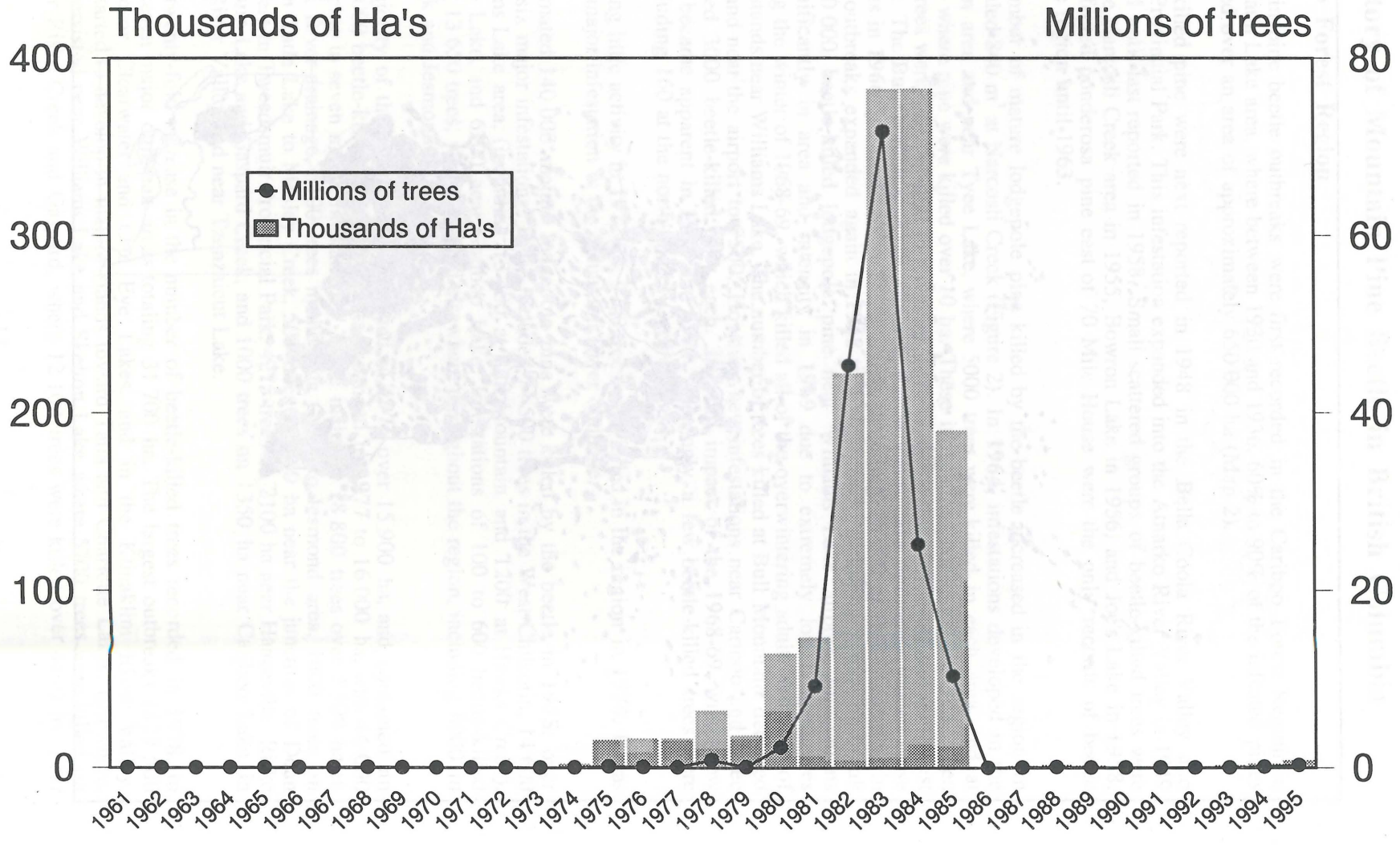
The majority of the infestations continued in **1976** over 15 900 ha, and contained an estimated 85 000 beetle-killed trees. Outbreaks expanded in **1977** to 16 000 ha, with 44 000 beetle-killed pine in seven major infestations. These included 18 800 trees over 7 500 ha in the Klinaklini River drainage, 5100 trees in the Dog Creek to Jesmond area, 1600 trees on 1600 ha from Tatla Lake to Mosley Creek, 500 trees on 350 ha near the junction of Dean and Takia rivers in Tweedsmuir Provincial Park, 4275 trees on 2100 ha near Hanceville, Riske Creek, Meldrum Lake and Gaspard Creek, and 1000 trees on 1350 ha near Cariboo Lake, in the Cariboo River Valley and near Tzenzaicut Lake.

There was a twenty-fold increase in the number of beetle-killed trees recorded in **1978**, to 864 800, in seven major outbreak areas totaling 31 700 ha. The largest outbreaks (829 500 trees) were near Clearwater and One Eye Lakes, and in the Klinaklini River Valley. Infestations started to develop in mature stands toward Tatla and Charlotte Lakes. Elsewhere, infestations persisted near Williams Lake and Skelton Lake where 5700 trees were killed on 1100 ha, near Riske Creek and Gaspard, where 12 100 trees were killed over 4470 ha, near



Map 2. Location where mature pine have been killed by mountain pine beetle, 1930-1995.

Figure 2. Number and area of mature pine killed by mountain pine beetle in the Cariboo Forest Region, 1961-94



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Cariboo Lake, where 6300 trees were killed on 1500 ha, and at Konni Lake where 900 trees were killed on 260 ha.

Infestations declined to 17 600 ha in **1979**, extending from the Cariboo River Valley in the northeast, to the Klinaklini River Valley and Tweedsmuir Provincial Park in the west, and contained 72 000 beetle-killed trees. Previously killed "grey" pine were mapped over an additional 17 000 ha in the Klinaklini River drainage, where most of the mature lodgepole pine had been killed between 1972 and 1976. The largest outbreak was in the Tatla and Clearwater lakes area of the west Chilcotin, where 30 000 trees were killed. Additional infestations occurred at Charlotte, Nimpo, and Aktaklin lakes. Outbreaks continued in the Cariboo Lake area, where 5750 trees were killed.

The area of beetle-killed lodgepole pine in the region more than tripled in **1980**, to 63 800 ha. There were an estimated 2 284 075 trees killed on 1420 separate infestations from the Cariboo River Valley, south to Clinton and west to Tweedsmuir Park, 70% of which were in the Chilcotin plateau area.

Outbreaks increased in **1981** again, when more than 1700 infestations over 72 800 ha contained an estimated 9 143 900 beetle-killed trees. The most severe were in the Chilcotin plateau area west to Charlotte and Kappan lakes and in the Klinaklini River Valley, the Cariboo Lake area in the northeast, and near Dog Creek and Jesmond in the south.

By **1982**, 45 308 900 trees were killed over 222 000 ha, up significantly from 1981. Major increases occurred over 45 630 ha near Charlotte Lake and along the Dean River, 72 840 ha in the Klinaklini River Valley, north and south of Tatla Lake, and 19 760 ha, along the Morley River drainage to the Homathko River Valley and along both sides of Tatlayoko Lake.

In **1983**, 71 729 000 trees were killed over 382 000 ha. Increases occurred in the upper Chilcotin River drainage with the main concentration in the Tatla Lake to Chilcotin Lake area, but reaching west to Dean River and Charlotte Lake, and east to Taseko Lake, with smaller infestations spreading as far as the Fraser River area.

The area of recent tree mortality remained relatively unchanged in **1984** at 382 300 ha containing 25 147 000 trees. However, recent tree mortality expanded northward in Anahim Lake and Nazko areas, and intensified between Chilko Lake and Big Bar, and along the west side of the Fraser River in the Churn Creek and Gaspard Lake area. Infestations continued in the Cariboo Lake area.

In 1984, a extensive mortality of overwintering broods, caused by unusually low temperatures (-42°C) in October, contributed to the significant reduction in the area of tree mortality mapped in **1985**, to 10 253 000 trees on 189 500 ha. Additionally, 470 000 ha where 30% or more of the pine had been killed for two or more years were deleted from the inventory. Expanding infestations were recorded west of the Fraser, south of Chilcotin River, in the Alexis Creek to Nazko area, in the Big Bar Lake area, and in Tweedsmuir Park. Infestations declined in the Cariboo Lake area.

Pitch-outs and mortality of overwintering broods in **1986** resulted in the virtual collapse of the population which had been epidemic since 1975. There was no tree mortality directly attributable to mountain pine beetle recorded west of the Fraser River in 1986. However, recently killed mature lodgepole pine, attributed to pine engraver beetle, (*Ips pini*), was mapped by the BCMoF over approximately 107 500 ha, particularly near Chezacut, Palmer Lake, Gaspard and Kloakut.

Pine mortality in the region in **1987** remained at the lowest levels since 1974. However, a new infestation containing 25 000 trees developed over about 500 ha near Franklyn Arm on Chilko Lake. Additionally, 7250 widespread pockets contained pine killed by pine engraver, *Ips pini*, over 3400 ha in the western part of the region. The infestations continued

to expanded in **1988** to 1290 ha and 65 000 trees, primarily in the Chilko Lake area. Small groups of 2-20 pine were widely scattered throughout the Chilcotin and Palmer lakes areas. The largest and newest was over 7 ha at Zencaco Creek, near Alexis Creek.

Infestations declined in **1989** to 206 separate pockets of beetle-killed pine totaling 720 ha, (36 000 trees) and again in **1990** to 155 pockets totaling 315 ha (15 700 trees), mostly in the Chilko Lake area. A further decline occurred in **1991** when 295 infestations totaled 350 ha (13 800 trees). While the Chilko Lake infestations continued to decline, numerous new patches of less than four hectares totaling 135 ha were mapped from Clinton to Quesnel.

In **1992**, 20 000 trees were mapped over 265 ha. The Chilko Lake infestation continued to decline to 45 infestations totaling 115 ha. Elsewhere in the region, increasing infestations included 195 separate patches totaling 95 ha east of Williams Lake to Horsefly, 65 patches (40 ha) from 100 Mile House to Canim Lake and 25 patches (15 ha) in the Narcosli and Quesnel river valleys.

Infestations increased to 34 000 trees on over 700 ha in **1993**, in widely scattered patches from Clinton to Quesnel. Increases occurred again to 122 200 trees over 1650 ha in **1994**, especially near the Chilcotin Military Block near Riske Creek. The area of beetle-killed pine more than doubled to 3850 ha (284 500 trees) in **1995**. The main infestations remain in the Chilcotin Military Block.

History of Mountain Pine Beetle in British Columbia

II. Kamloops Forest Region

The primary host of mountain pine beetle in the Kamloops Region and the most widely distributed of the pine species in the region is mature lodgepole pine. Secondary hosts, ponderosa and white pine, are often killed by mountain pine beetle and occasionally western pine beetle, *D. brevicomis*.

The first reported mountain pine beetle infestations in the Kamloops Forest Region and in British Columbia, were near Princeton and Peachland in 1910 when lodgepole and ponderosa pine stands were killed over large unspecified areas (Map 3). These infestations continued until 1919. Outbreaks developed in the Coldwater and Nicola river valleys and at Spius Creek in 1917, at Fly Hills in 1921, and in the Chase area by 1928. On the east side of Okanagan Lake, small outbreaks were reported between 1917 and 1922, and by 1928 between 10% and 90% of the pine in many areas throughout the Okanagan Valley were killed. This included 35 000 ha of mature lodgepole pine southeast of Penticton which extended into the Kettle River Valley. Outbreaks covered undetermined areas between Lillooet and Adams Lake between 1920 and 1932, and an infestation near Barriere expanded to 34 000 ha between 1925 and 1930.

There were no infestations in lodgepole pine stands recorded in the region between 1933 and 1948, and only a few localized infestations between 1949 and 1960. These were mainly near Marshall Creek in the Bridge River Valley during 1949-1950, near Naramata in 1953 (over 40 ha), and near Penticton in 1956 (over 240 ha). An estimated 820 lodgepole and some ponderosa pines were killed at Douglas Lake from 1959 to 60.

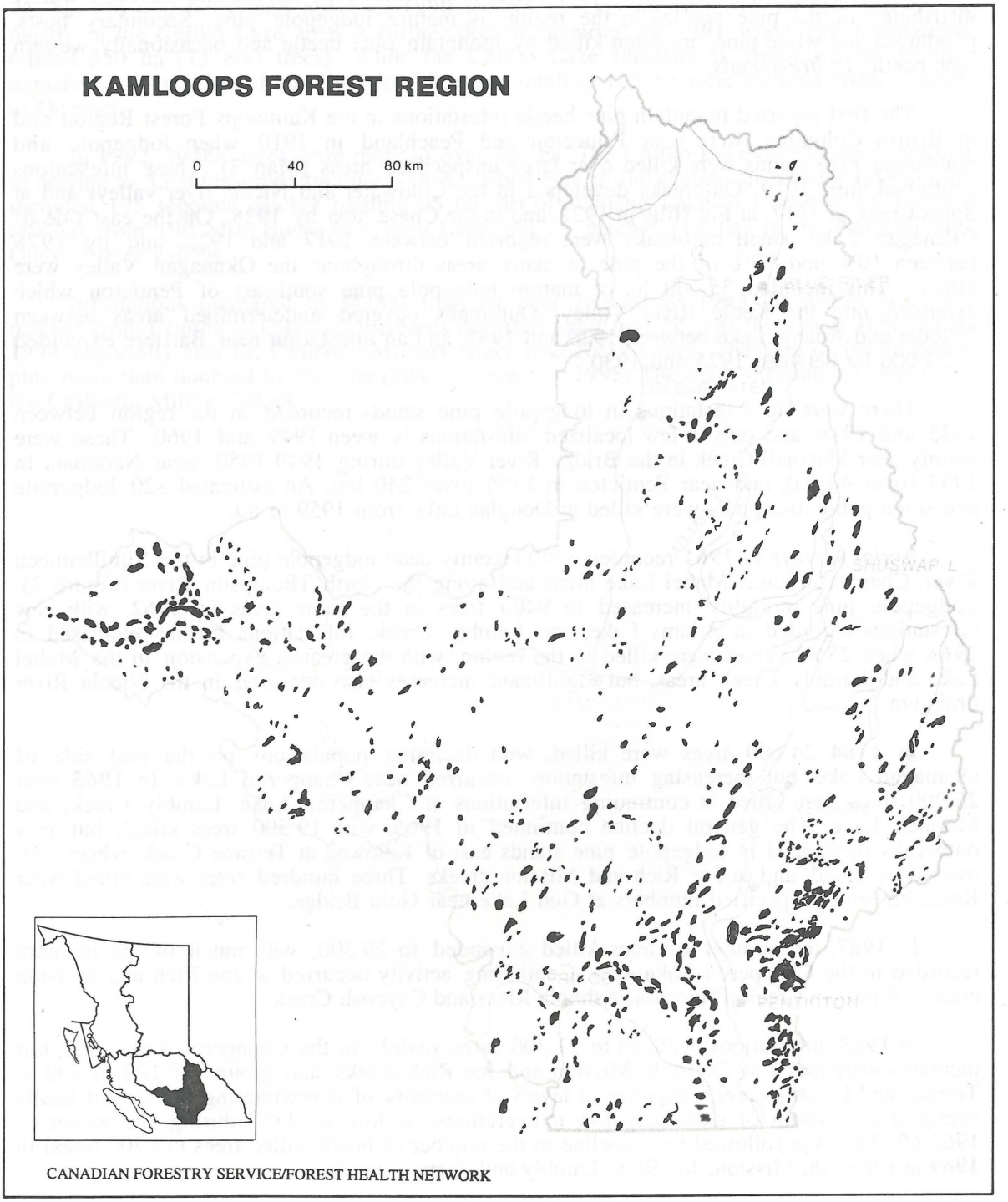
Aerial surveys in **1961** recorded 3300 recently dead lodgepole pine in the Similkameen River, Chapperon Lake, Mabel Lake areas and along the North Thompson River (Figure 3). Lodgepole pine mortality increased to 9400 trees in the same areas in **1962**, with new infestations recorded at Adams Lake, and Lambly Creek. Infestations further increased in **1963** when 25 800 trees were killed in the region, with the greatest expansion in the Mabel Lake and Lambly Creek areas, but significant increases also occurred in the Nicola River drainage.

In **1964** 24 600 trees were killed, with declining populations on the east side of Okanagan Lake, but increasing infestations occurred near Chapperon Lake. In **1965** over 22 000 trees were killed in continuing infestations at Chapperon Lake, Lambly Creek, and Momich Lake. The general decline continued in **1966**, with 19 500 trees killed, but new outbreaks developed in lodgepole pine stands east of Kelowna at Terrace Creek, where 250 trees were killed, and at Joe Rich and Mission creeks. Three hundred trees were killed Near Keremeos and unspecified numbers at Gun Lake near Gold Bridge.

In **1967**, the number of trees killed expanded to 29 300, with much of the increase recorded in the Chapperon Lake area. Continuing activity occurred at Joe Rich and Mission creeks, Whitman Creek, Princeton, Ashnola River and Cayoosh Creek.

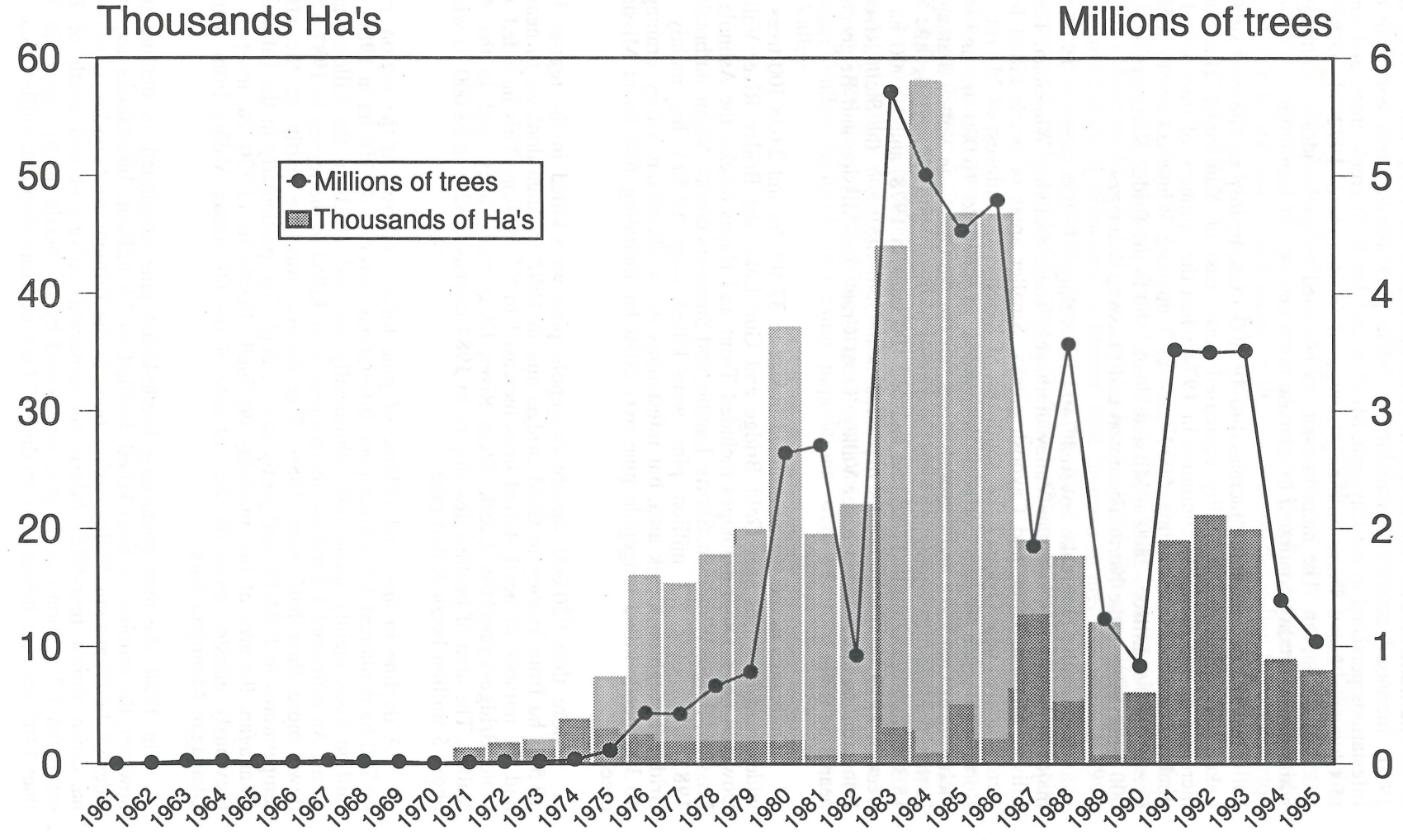
In **1968**, infestations declined to 21 300 trees, mainly in the Chapperon Lake area, but increases were noted at Cayoosh, Mission and Joe Rich creeks, and groups of 100 to 500 at Terrace and Lambly creeks. Significant levels of mortality of overwintering larvae and adults occurred as a result of extremely low temperatures; as low as -43°C during the winter of 1968-69. This was followed by a decline in the number of beetle-killed trees (18 700 trees) in **1969** at Cayoosh, Mission, Joe Rich, Lambly and Terrace creeks.

The full impact of the low winter temperatures in 1968-69 became more apparent in **1970** when only 6700 beetle-killed trees were mapped throughout the region. Most were in Cayoosh, Mission and Joe Rich creeks, Blue River and Sugar Lake. Elsewhere, scattered groups of 5 to 100 trees were recorded at widespread locations.



Map 3. Location where mature pine have been killed by mountain pine beetle, 1910-1995.

Figure 3. Number and area of mature pine killed by mountain pine beetle in the Kamloops Forest Region, 1961-95



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The number of beetle-killed trees in the region in **1971** was 13 400, double that of 1970. Increased activity was mainly in white pine stands north and east of Kamloops. Infestations persisted in the Cayoosh, Mission and Joe Rich creek areas, and on the west side of Okanagan Lake. These outbreaks continued to increase in **1972** when 18 100 trees were killed in the region. The main infestations persisted on both sides of Okanagan Lake, and white pine mortality continued to increase north and east of Kamloops.

In **1973** tree mortality increased to 19 800 trees, mainly on the west side of Okanagan Lake, while whitepine mortality decreased north east of Kamloops. The trend of annual increases of tree mortality continued in **1974** when the numbers of trees killed in the region doubled to 38 000, including 5000 each at Trout and Whiteman creeks, 6500 at Lambly Creek, 1800 at Ellison, 2800 at Mission Creek, 850 in the Bridge River drainage, and over 15 000 white pine in the North Thompson and Shuswap drainages.

Regionally, outbreaks covered 7400 ha, killing 116 000 trees in **1975,** mostly in six major outbreaks in Okanagan Valley drainages. These included Whiteman, Terrace, Lambly, Ellison, Mission, Trout, and Cayoosh creeks. Smaller areas of beetle-killed lodgepole pine were scattered near Oyama Lake, southwest of Keremeos, southwest of Merritt, and along the North Thompson River. Outbreaks expanded in **1976** to 16 000 ha and 432 300 trees, including at Gun Lake and Cayoosh Creek, and in the Okanagan Valley drainages. Outbreaks in the Okanagan, Downton and Gun Lake areas persisted in **1977,** killing 424 300 trees over 15 300 ha, expanding to 17 800 ha and 662 100 trees in **1978**, and 19 900 ha with 783 200 trees in **1979**. Major outbreaks expanded near Gold Bridge, in the Stein River Valley, near Princeton, in the Ashnola River Valley, Trout Creek, the Mission and Belgo creeks area and near Blue River.

Outbreaks in the region doubled in size to 37 100 ha and 2 638 300 trees in **1980**, with widespread increases near Gold Bridge and Gun Lake, the Bridge River Valley and along Downton Lake. Other drainages included Trout and Hayes creeks, the Ashnola River Valley, Mission, Belgo, Whiteman, Shorts, Lambly and Summers creeks. Major outbreaks persisted in **1981** when over 2.7 million pine were killed over 19 500 ha, mainly in the Gold Bridge-Tyaughton Creek area, but infestations in the Okanagan Valley drainages contained 46 300 beetle-killed lodgepole pine over 2050 ha, including 630 ha at Mission and Belgo creeks.

More than 920 000 mature lodgepole pine were killed in the region in **1982**, over 19 500 ha from Hedley to Gold Bridge, and in **1983** the area doubled to nearly 44 000 ha and the number of beetle-killed trees increased to 5.7 million. This included infestations at Gold Bridge-Tyaughton Creek, Stein River, Okanagan Valley, and in the Ashnola River Valley. The area of beetle-infested pine in **1984** increased 32% to 58 000 ha which contained about 5 million beetle-killed pine.

A decline in area and volume of pine killed occurred in the region in **1985** when 46 760 ha contained 4.5 million pine. Infestations covering 46 750 ha in **1986**, contained 4.8 million trees, mainly throughout chronically infested stands in the Lillooet and Okanagan areas. An estimated 1.8 million mature pine were killed in the region in **1987** over 19 000 ha, down more than half from 1986. The decline was due partly to the effects of cold temperatures in 1984-85, and partly to host depletion, particularly in the Lillooet area. In the Okanagan, the area of tree mortality declined slightly to 11 330 ha, most of which was in previously infested areas on the east side of the Okanagan Valley from Vernon south to Okanagan Mountain Park.

In **1988**, the area containing beetle-killed pine continued to decline to 17 630 ha; however, the number of trees killed doubled to 3.6 million. Infestations expanded on both sides of the Okanagan Valley. Infestations in the Lillooet area continued to decline to 1260 ha, down almost four-fold. Infestation remained active east and south of Princeton. An estimated 1.2 million mature pine were killed by the beetle in the region in **1989** in more than 1465 separate infestations totaling 12 000 ha. More than one million pine were killed in

the Okanagan Valley in more than 1030 separate patches, from the international border north to Vernon. The decline in area was mostly east and south of Kelowna.

Beetle activity continued to decline in the region in **1990**, to 6000 ha and the number of beetle-killed trees declined by a third to 835 000. The declines were mostly on the west side of the Okanagan Valley in the Trout, Vaseux, and Saunier Creek drainages. The increase in the number of infestations was in drainages on the east side of the valley from Penticton north to Highway 33 and east to the regional boundary, where groups of 5-30 newly-killed trees more than doubled to 2160.

Following six years of decline, the area of pine killed by the beetle increased threefold in **1991** to 19 000 ha, which contained about 3.5 million trees. Over 2600 ha of this was in the Penticton Creek drainage to near Lebanon and Hydraulic lakes, and over 3800 ha in the Saunier, Vaseux, and Inkaneep drainages. A further 10% increase in area occurred in **1992** when 3.5 million mature pine were killed over 21 100 ha. Most occurred in the Okanagan Valley drainage over 18 500 ha, including about 2300 ha in Okanagan Mountain Provincial Park.

In **1993**, infestations declined in area by 5% to 19 925 ha. Most of the 3.5 million trees were in the Okanagan Valley drainage over 16 250 ha, including about 1750 ha in Okanagan Mountain Park. Infestations declined twofold in area in **1994** to 8860 ha in 2911 pockets, including 1550 ha in Okanagan Mountain Park. Most of the 1.4 million beetle-killed pine were in the Okanagan Valley drainage over 6500 ha. Beetle activity continued to decline to 1 040 000 trees on 7880 ha in **1995**. While large infestations in the Princeton and the east side of Okanagan Valley declined, increasing populations were recorded in the Chase Creek-Paxton Valley.

History of Mountain Pine Beetle in British Columbia

III. Nelson Forest Region

Mountain pine beetle infestations have occurred in mature lodgepole pine stands in the Nelson Forest Region almost annually since first reported in 1913 (Map 4). Infestations were reported north of Yahk from 1919 to 1923, along the Beaver River in 1928, near Connell Creek southeast of Cranbrook from 1929 to 1931, in the Kootenay River Valley including Kootenay National Park and in Banff National Park between 1930 to 1945, near Lumberton from 1933 to 1935, and in Yoho National Park between 1943 and 1951. Infestations were common in the Invermere area and in the White river drainage from 1949 to 1956, and in the Upper Elk River Valley from 1949 to 1952. Outbreaks occurred in the Kootenay and Columbia river drainages through to the Arrow Lakes between 1953 and 1965, including near Redgrave in 1964 and at Coyote Creek in 1965 (Figure 4). Widespread infestations were recorded in the Kettle River Valley from 1959 to 1965.

In **1966**, 6900 trees were killed in infestations at seven localized areas from Harvey Pass near Fernie, north to the Bush River near Golden, near Redgrave, and at Coyote Creek. An estimated 9900 trees were killed in **1967** in infestations including Elk Creek in the Kootenay River drainage, Redgrave, and Trout and Upper Arrow lakes. In **1968**, 13 400 trees were killed from Roosville in the south, to the Bush River drainage in the north. This included increases near Redgrave, along the White River, in the West Kettle River and Trout Lake areas. In **1969**, 8300 pine were killed in the region, the largest areas were near Redgrave, in the White River drainage and in the West Kettle River Valley. Infestations declined at Trout Lake.

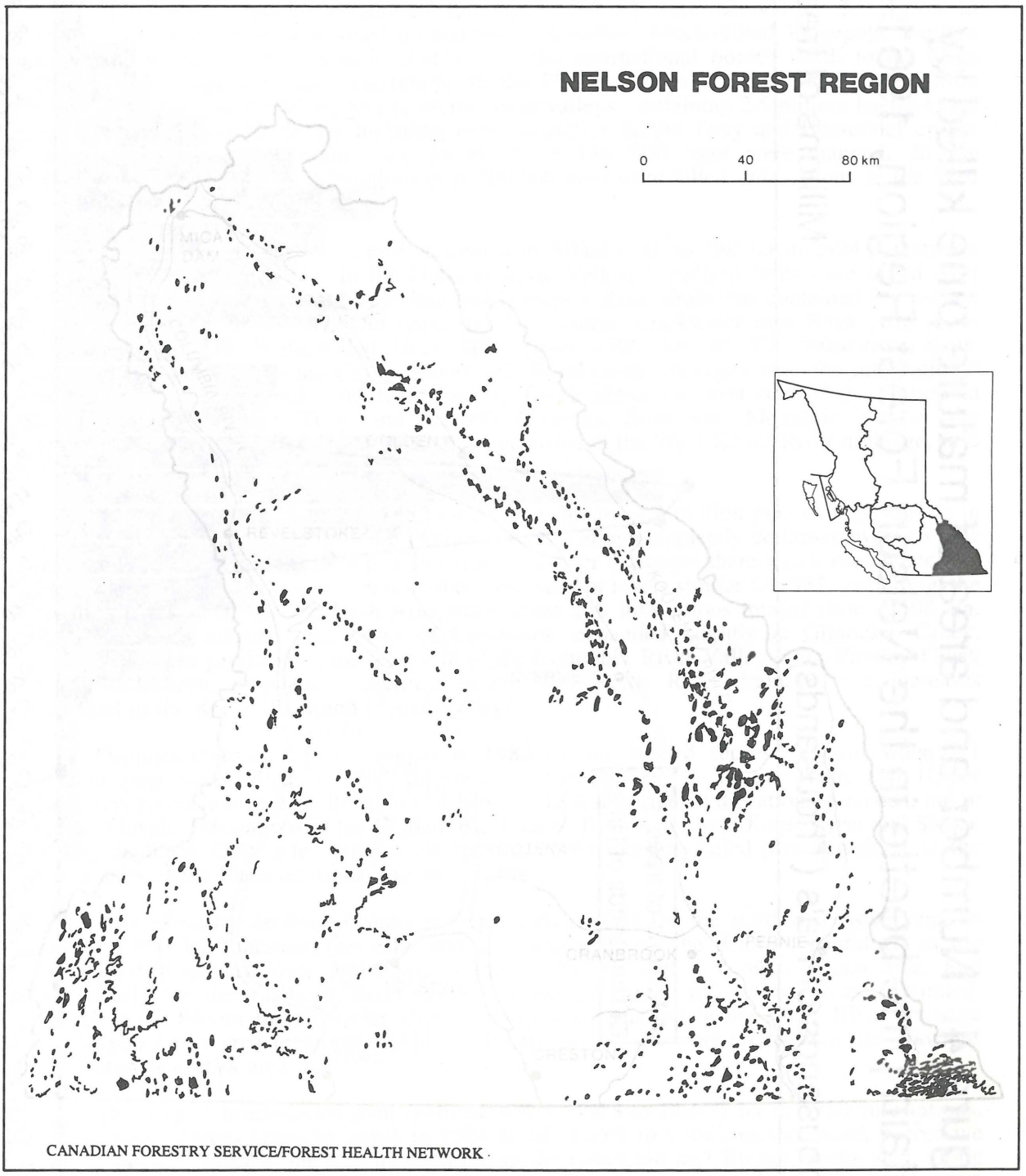
The number of beetle-killed trees recorded in the region in **1970** declined to 3600 trees, in infestations in the White River System, Redgrave and West Kettle River. Increasing populations were noted along Upper Arrow and Trout lakes. In **1971**, over 36 000 trees were killed, with major increases occurring in the Trout and Upper Arrow lakes and Erie Creek areas, but increases also occurred in the White River drainage, Redgrave, and West Kettle River areas. In **1972**, more than 28 500 trees were killed at Redgrave, West Kettle River, Upper Arrow Lake, Trout Lake, and White River.

Infestations continued in the region in **1973**, when more than 15 900 trees were killed, mostly in the White River System, at Blackwater Ridge near Redgrave, and Trout Lake. In **1974**, the number of beetle-killed trees doubled to more than 32 900 trees. The highest counts were in the White and West Kettle river systems, and Blackwater Ridge.

Outbreaks in the region continued to expanded in **1975**, when 79 400 trees were killed in the White River, Blackwater Ridge-Redgrave and Bush River areas and in the main Kettle River Valley. These outbreaks continued in **1976**, when 91 200 trees were killed over 10 800 ha. New infestations developed at Sage Creek and in the nearby Flathead River Valley, adjacent to a major outbreak in Glacier National Park in Montana, USA.

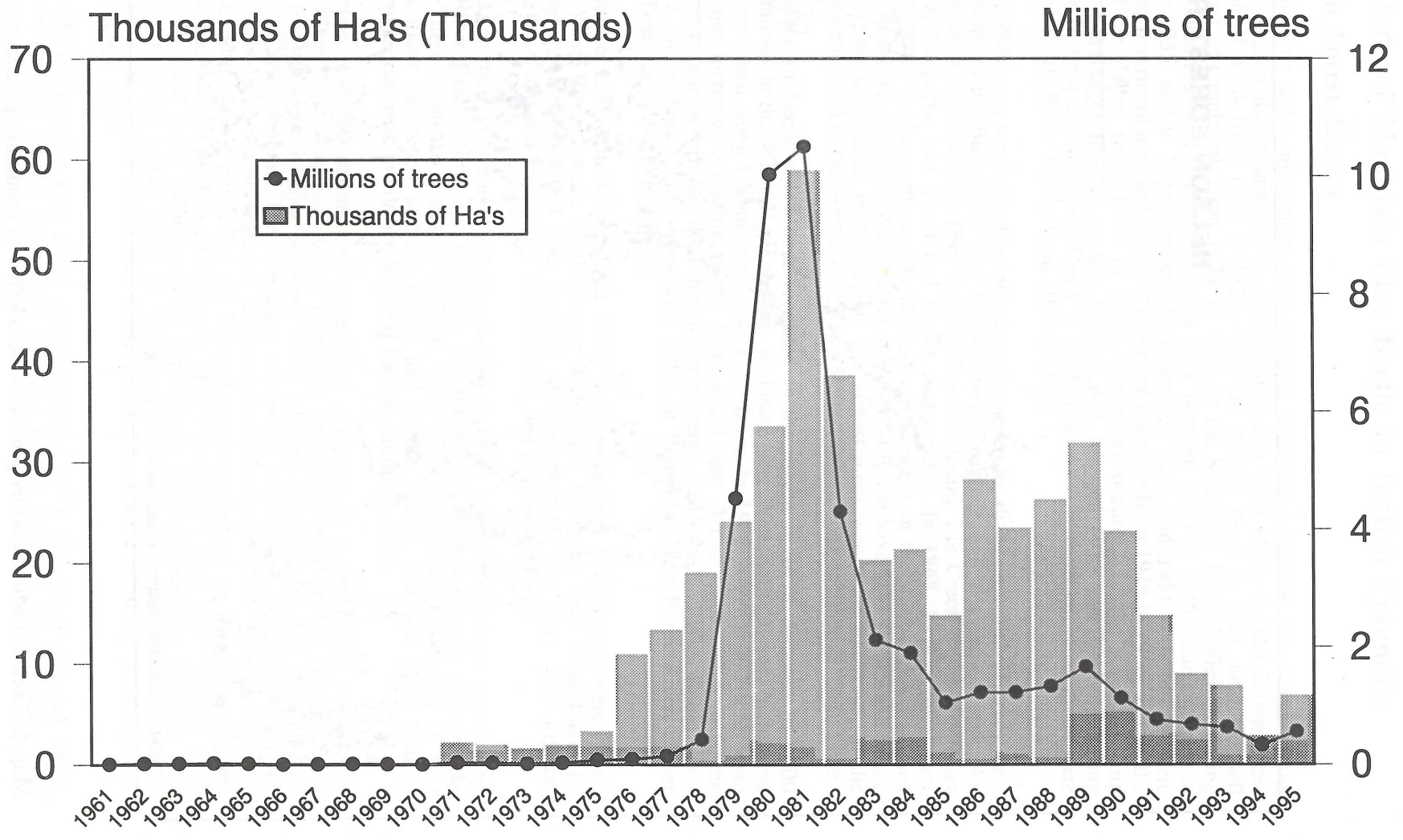
An estimated 146 200 mature pine were killed in the region in **1977** over 13 200 ha. The Flathead River Valley and Sage Creek outbreaks increased ten-fold to 4500 trees. This resulted from the spread of a major outbreak in the adjacent lower Flathead River Valley in Glacier National Park, Montana. This expanded northward into mature lodgepole stands in British Columbia and into nearby Waterton Lakes National Park in Alberta. Elsewhere in the Nelson Region, infestations expanded in the White River drainage and on Blackwater Ridge. The number of beetle-killed pine in the region in **1978** increased to more than 425 100 over 18 900 ha. The Flathead River Valley outbreak expanded to 100 000 trees over 1880 ha, and 265 000 trees were killed in the White River drainage. Infestations expanded west of the Columbia River in the Findlay Creek area to Steamboat Mountain, and along McNaughton Lake and West Kettle River.

An estimated 4.52 million pine were killed in the region in **1979**. The major outbreak areas included an estimated 2 million trees over 8000 ha in the Flathead River Valley, and



Map 4. Location where mature pine have been killed by mountain pine beetle, 1913-1995.

Figure 4. Number and area of mature pine killed by mountain pine beetle in the Nelson Forest Region, 1961-95



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7800 ha containing 1.77 million trees in the White and Kootenay river drainages. In the Blackwater, Waitabit and Blaeberry River infestations, 77 000 trees were killed and 12 000 trees were killed in the Horsethief Creek and Steamboat Mountain outbreaks. Infestations continued in the West Kettle River drainage.

About 3600 separate infestations totaling 33 400 ha were mapped in the region in **1980**. These infestations contained an estimated 10 million beetle-killed lodgepole, western white, and white bark pine trees in stands from the international border north to the Mica Dam on McNaughton Lake. Infestations in the Flathead River drainage totaled 7 million trees. Infestations in the White and Kootenay river valleys, containing 2.5 million beetle-killed trees, extended over 10 600 ha, including most tributaries. In the Toby and Horsethief creeks and the Steamboat Mountain area, an estimated 149 000 trees were mapped. In the Blackwater and Bush Arm infestations over 300 000 trees were killed. Infestations in the West Kettle River killed 12 700 trees.

In 1981, an estimated 10.5 million trees were killed over 58 790 ha in 2424 infestation areas in the Region in **1981**. In the Flathead River Valley, 6 million trees were killed over 21 000 ha in 345 infestations. The White and Kootenay River drainages contained 3.5 million trees killed over 20 560 ha. Outbreaks in the Golden, Blackwater and Bush Arm areas contained 359 000 beetle-killed trees killed over 4700 ha in 203 infestation areas. Infestations expanded in the Caven, Bloom and Ward creek drainages near the international border south of Cranbrook, and from Findlay Creek along the west side of the Columbia River, including Dutch, Toby and Horsethief creeks, Steamboat Mountain and in the Spillimacheen River Valley areas. Infestations persisted in the West Kettle River drainage, and increased in the Grand Forks area.

Infestations in the region in **1982** killed an estimated 4.3 million pine over 38 450 ha in 2600 outbreaks. The outbreak in the Flathead River Valley completely collapsed with no new tree mortality recorded. In the White and Kootenay river drainages there was a minor decline. Elsewhere in the East Kootenay, infestations continued at levels similar to 1981, including the Golden, Blackwater, and the Bush Arm areas where 250 infestations totaled about 5500 ha. Areas of newly-infested pine south of Cranbrook expanded slightly at Gilnockie Creek. Major outbreaks persisted on the west side of the Columbia River Valley from Findlay Creek to Spillimacheen. Infestations declined in the West Kettle River drainage, but increases occurred in the Kettle River and Slocan Valleys.

Declines continued in the region in **1983** for the second successive year, when 2.1 million pine were killed in 1700 infestations over 20 200 ha. In the White and Upper Kootenay rivers and in the Gilnockie and Bloom Creek drainages, infestations persisted, but at reduced levels. Infestations in the Golden, Blackwater, Bush Arm, west Kettle River and Slocan Valley declined. Only a few small scattered pockets of recently killed pine remained at the headwaters of the Flathead River Valley.

Pine mortality declined overall in the region in **1984** for the third successive year, to about 21 000 ha containing an estimated 1.9 million trees. The declines continued in the White and Kootenay river drainages, in the Bush Arm and Columbia Reach area, and particularly in the Flathead River Valley. However, some infestation areas expanded, including the Bloom and Gilnockie Creek drainages. Infestations in the Kettle River drainage and Grand Forks area remained stable, while new infestations were recorded in the Hawkins and Freeman creeks area.

The area of beetle-killed pine declined 30% in **1985** to 14 600 ha in 1780 infestations. The number of trees killed by attack in 1984 declined 45% to 1 million, the fourth successive year of decline. Most of the activity occurred in the Gilnockie and Bloom creeks area, along Frances Creek, on Steamboat Mountain, near Christina Lake and in the Grand Forks area. Infestations generally receded in the headwaters of the Kootenay and White river systems.

In **1986,** about 3323 separate infestations covered 28 000 ha, and contained 1.2 million recently killed pine. Following four consecutive years of region-wide decline, infestations increased in the Granby-Christina Lake, Boundary Creek, West Kettle River, and Steamboat Mountain areas.

Infestations declined 18% overall in **1987** to 23 300 ha containing 1.2 million trees in about 4367 separate patches. Populations continued to increase in the Granby and Christina Lake, Steamboat Mountain, Columbia Lake and Lower Arrow Lake areas, while infestations decreased in most white pine stands in the northern part of the region.

More than 1.3 million pine over 26 000 ha were killed in the region in **1988**. Infestations occurred from Christina Lake to the West Kettle River, at Gold Mountain south of Cranbrook, from Columbia Lake to Steamboat Mountain, Nancy Greene Lake, Lower Arrow Lake and Kootenay National Park.

The number of infestations increased for the third consecutive year in **1989**, to 5315 containing 1.7 million beetle-killed pine on 3180 ha. Infestations continued to increase from Christina Lake to the West Kettle River, and at Gold Mountain, Moyie Lake, and Elk River, while remaining stable in other infestation areas.

Following three years of increases, the area containing beetle-killed pine declined in **1990** to 23 000 ha in 4685 separate infestations. These contained 1.1 million pine, mainly in the Kettle and West Kettle rivers, south Rocky Mountain Trench, Elk and Bull rivers, Moyie Lake, east of Columbia Lake, Steamboat Mountain, Lower Arrow Lake and Nancy Greene Lake.

Declines continued in **1991** to 14 700 ha in 4293 separate infestations containing 763 000 trees. Declines occurred in the Granby River area, while increases occurred south of Cranbrook, Elk River, and Kootenay National Park. Infestations in the region declined in **1992** to 8900 ha in about 6485 infestations, containing 682 000 attacked trees. Declining infestations in much of the East Kootenay was offset by increasing beetle activity in the Kettle River area, Kootenay National Park, and in the Lower Arrow Lake area. Most of the decline was attributed to declining host availability and significant mortality of overwintering broods.

Infestations continued to declined in **1993** to 7700 ha in about 4350 infestations, containing an estimated 631 500 mature beetle-killed pine. The decline was most evident in the Kettle River drainage and south of Radium Hot Springs in the Rocky Mountain Trench. Increasing populations occurred in the northern Rocky Mountain Trench, at the southern end of Lower Arrow Lake, and Kootenay National Park. A further decline occurred in **1994** when 331 000 mature pine were killed in about 3320 infestations totaling 2750 ha. Most of the decline was in the southern part of the region, while increasing populations occurred in the Golden area, and the national parks.

In **1995,** tree mortality climbed to 558 500 over 6800 ha, following five years of declining populations. There was an increase along Lower Arrow Lake, northern Rocky Mountain Trench, southeast of Cranbrook and in Kootenay National Park.

History of Mountain Pine Beetle in British Columbia

IV. Prince George Forest Region

The earliest records of mountain pine beetle outbreaks in lodgepole pine stands in the Prince George Forest Region were in the Takla Lake area in 1948 (Map 5). By 1955, infestations were widespread around Takla, Natowite and Tochcha lakes, and by 1956 it was estimated that 65 000 mature lodgepole pine had been killed in the area since 1948. Infestations covered 6000 ha in 1957. By 1960, the infestation had covered 11 200 ha and had killed an estimated 916 000 trees.

Populations remained active at Takla Lake in **1961**, killing 3000 trees, and increased near Takla and Tezzeron lakes in **1962**, killing about 6250 mature pine (Figure 5). Tree mortality continued to increase to 19 200 in **1963**, 24 000 in **1964**, and 31 500 in **1965**. There was a significant decline in **1966** to 6700 trees in the Takla Lake area, due to extensive larval mortality and poor egg-laying weather in 1965. Populations continued to drop in 1967 to less than 700 trees, and remained low until 1975.

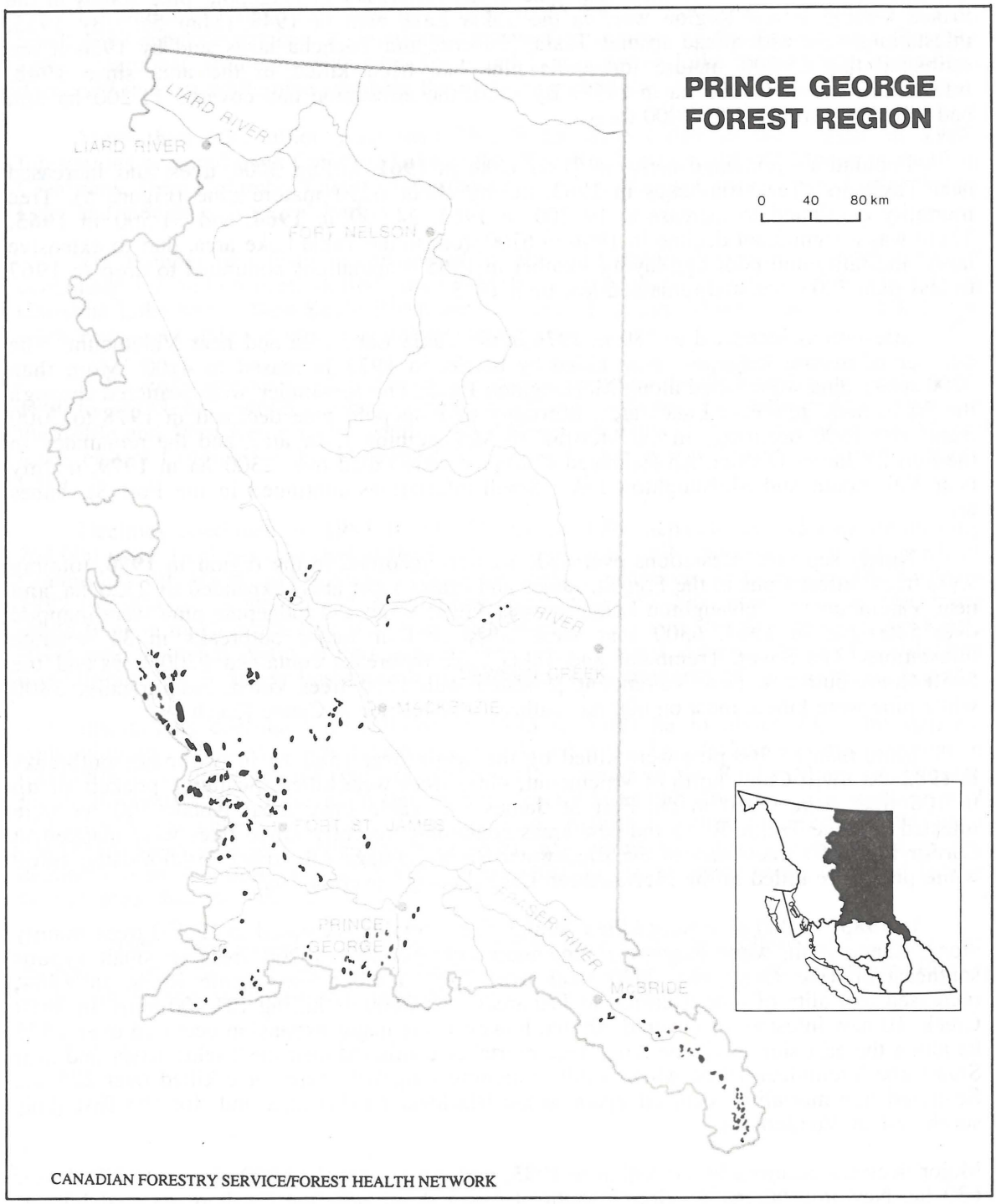
Infestations increased to 780 in **1976** in the Takla Lake area and near Valemount. The number of mature lodgepole pine killed by beetles in **1977** increased to 4100. More than 3200 white pine were killed along McNaughton Lake. The remainder were scattered through the Stuart and Trembleur Lakes area. Mortality of lodgepole pine declined in **1978** to 2000 trees, with 1800 occurring in the McBride to McNaughton Lake area, and the remainder in the Fort St. James District. An estimated 4700 pine were killed over 2300 ha in **1979**, mainly near Valemount and McNaughton Lake. Small infestations continued in the Fort St. James area.

Ninety separate infestations over 8500 ha were recorded in the region in **1980**, totaling 9300 trees. Infestations in the Fort St. James and Fraser Lake areas expanded to 2320 ha, and near Valemount to McNaughton Lake, recently killed white and lodgepole pine were mapped over 5200 ha. In **1981**, 6300 pine were killed in four major outbreaks in 34 separate infestations. The Stuart, Trembleur and Takla Lake outbreaks contained 1200 trees and the Swift Creek outbreak near Valemount persisted with 1300 trees killed. Additionally, 3800 white pine were killed, most on 600 ha southeast of McBride at Canoe Reach.

More than 15 860 pine were killed by the beetle over 1580 ha in two major outbreaks in **1982**. At Swift Creek north of Valemount, 4600 trees were killed. Scattered pockets of up to 100 trees were killed in the Fort St. James and Takla Lake area. About 100 ha were infested near the Tachie River and new areas containing recently killed trees were mapped at Carrier Lake (50 trees) and in the Blackwater River drainage (30 trees). Additionally, 6860 white pine were killed in the McNaughton Lake drainage over 410 ha.

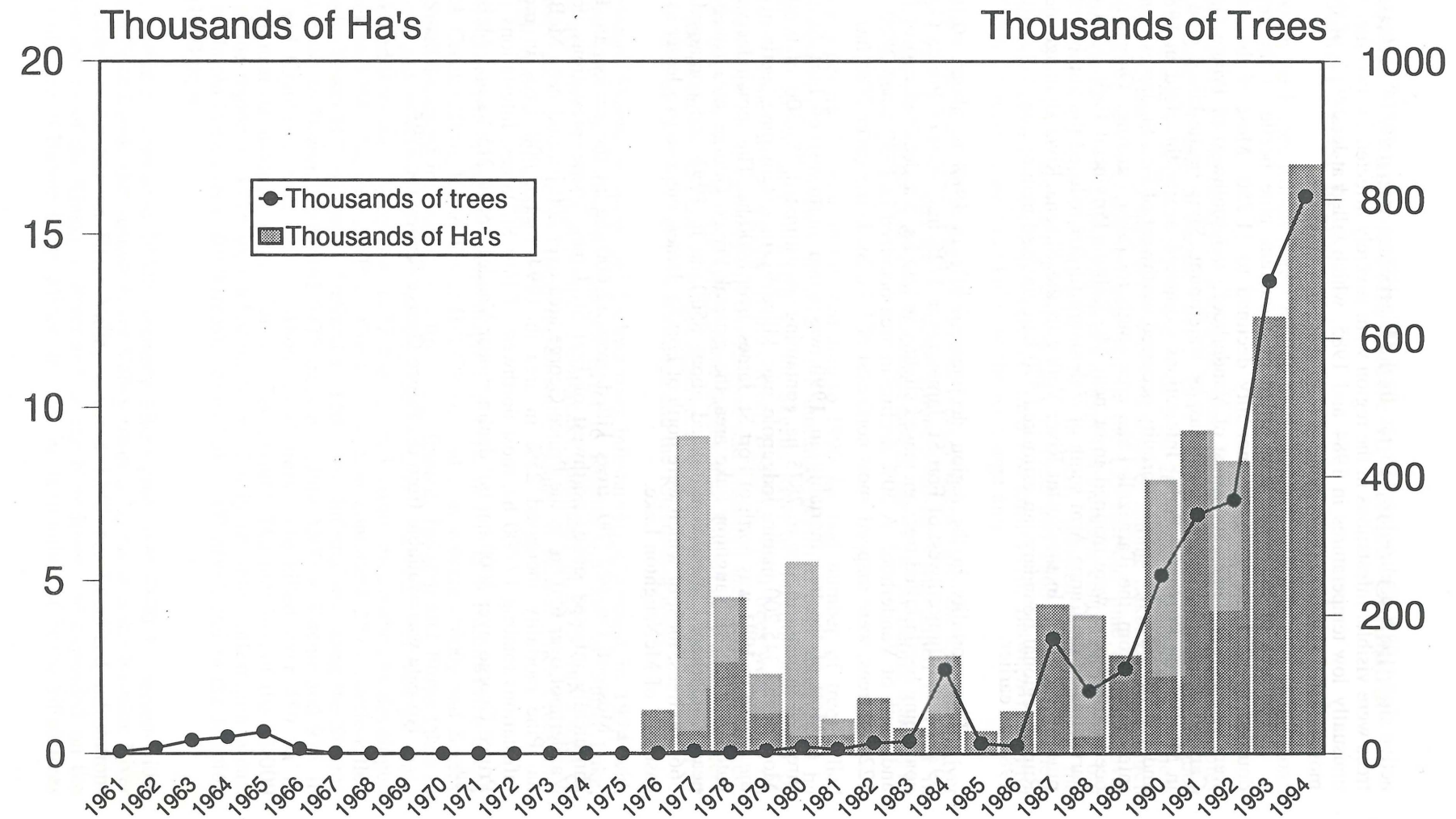
In **1983**, 18 000 pine were killed. White pine mortality increased to 15 400 trees mainly along Canoe Arm, while lodgepole pine mortality declined to 200 trees in small groups southeast of Tete Jaune and 2620 trees over 200 ha along the Tachie River. In **1984,** increased mortality of pine occurred in 170 areas over 2800 ha killing 121 400 trees. In Swift Creek, 10 new infestations covered 200 ha; however, the major expansion occurred over 2575 ha along the east side of Canoe Arm. Tree mortality continued near the Tachie River and near Stuart and Trembleur lakes, where 7200 of mature lodgepole pine were killed over 225 ha. Scattered tree mortality occurred again in the Blackwater River area and, for the first time, southwest of Vanderhoof.

Major declines occurred in the region in **1985**, with an estimated 14 700 pine were killed over 630 ha. New infestations developed south of Vanderhoof near the Cariboo regional border, totaling 5000 trees. An additional three small pockets of 110 trees were mapped for the first time in and near Mt. Robson Provincial Park. On the east side of Canoe Arm, 10% of the trees on 150 ha were killed. Infestations near the Tachie River north of Fort St. James,



Map 5. Location where mature pine have been killed by mountain pine beetle, 1948-1995.

Figure 5. Number and area of mature pine killed by mountain pine beetle in the Prince George Forest Region, 1961-95



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active since 1982, declined to 125 ha. In the Blackwater area, only 14 pockets of 1 to 5 red trees were visible. Infestations in the region were severely affected by two successive years of unusually low temperatures in 1984 and 1985, which killed at least 90% of the progeny in most infested stands in the region.

The area of lodgepole pine killed by mountain pine beetle in the region in **1986** doubled to 1225 ha, while tree mortality declined to 11 250. Most of the 440 infestations were near Fort St. James, southwest of Vanderhoof, and southwest of Prince George near the Cariboo regional border, and southeast of Valemount. Sixty beetle-killed pine were mapped in Mt. Robson Provincial Park. Infestations expanded nearly threefold in **1987** to 4300 ha and 165 700 trees. Most tree mortality occurred northwest of Fort St. James in more than 200 infestations from the Tarnezell Lake area south to Takla Landing. Only small groups of beetle-killed pine were mapped in or near Mt. Robson Provincial Park. Host depletion and harvesting in the Canoe Arm south of Valemount further reduced the number of beetle-killed pine over 220 ha. In the Sustut River Valley in the Skeena River drainage near the Prince Rupert regional boundary, an estimated 570 ha contained mature pine killed by the beetle in 1985 or earlier.

Tree mortality in the region declined slightly in **1988** to about 90 100 trees over 3975 ha, mostly northwest of Fort St. James (over 3425 ha). West of Prince George, the area containing beetle-killed trees increased slightly to 255 ha, but declined east of Prince George and south of Vanderhoof. A 30% decline in area occurred in **1989** when 2800 ha containing 122 480 trees, were mapped, most northwest of Fort. St. James (over 2485 ha).

Most of the tree mortality in **1990** was again northwest of Fort St. James, with a threefold increase in area to 7875 ha, containing an estimated 257 500 of beetle-killed pine. Most of the 345 200 mature lodgepole pine killed by mountain pine beetle over 9300 ha in the region in **1991** was north of Fort St. James, over 8900 ha. The remainder was in scattered patches in the McNaughton Lake area, the general Prince George area (over 165 ha), and near Vanderhoof. Infestations totaled about 8500 ha in **1992** and contained an estimated 366 200 trees, most of which were north of Fort St. James, but also to a lesser extent along the east side of McNaughton Lake.

Most of the 682 500 trees killed over 12 600 ha in the region in **1993** were in chronically infested stands northwest of Fort St. James. New infestations developed near Vanderhoof over 650 ha, in the Prince George area over 400 ha, and near McBride over 400 ha. Pine mortality increased 25% in area in **1994** to 805 000 trees in more than 280 infestations totaling 17 000 ha, most northwest of Fort St. James. Infestations increased near Prince George over 3000 ha, but declined near Vanderhoof to 215 ha and McBride over 150 ha.

No data was available from the Prince George Region for **1995**.

History of Mountain Pine Beetle in British Columbia

V. Prince Rupert Forest Region

Outbreaks in the Prince Rupert Forest Region have occurred primarily east of the Coast Mountains.

The first reports of beetle-killed lodgepole pine in the region were near Topley Landing on the southwest slope of Babine Lake in 1947 (Map 6). These populations subsided by 1949, but increased at Augier Lake. Pockets of 5 to 20 beetle-killed pine were next reported in 1952 in overmature stands on the northeast slope of Babine Lake. By 1953 much of the area around the lake was infested, and half of the 135-year-old pine in stands over 2600 ha at Morrison Lake were killed. Outbreaks around Babine Lake continued in 1955 but declined in 1956. Further declines occurred from 1957 to 1961, followed by increases in the Hagan Arm and Wright Bay areas along Babine Lake in 1962 and 1963 (Figure 6). There was another marked decline in 1964 and levels remained low until 1970. Between 1960 and 1963, up to 15 000 lodgepole pine were killed in the Kitwanga area.

Infestations increased to 1200 trees in **1970** at Weegett Creek along the Cranberry River and at Burdick Creek in the Skeena River Valley. About 3500 trees were killed in **1971** in patches north of Kispiox Village and from Kitwanga east to Hazelton. At Babine Lake, 110 trees in two small groups were killed.

There was a general increase in infested area to 1990 ha, and number of trees killed (5700) in all the established outbreaks in **1972**. Tree mortality occurred over about 2200 ha in mixed stands near Kitwanga, northeast along the Skeena River to Hazelton and north of Kispiox Village to Kline Lake along the Kispiox River. By **1973**, 7200 trees were killed on 2500 ha, although most of the outbreaks in the Kispiox and Hazelton area had been logged. Elsewhere, 1850 trees on 320 ha were killed in the Seeley and Kline Lakes area, 540 trees were killed on 200 ha on the Kitwancool Indian Reserve, and 20 to 110 trees were killed in 27 areas ranging from 2 ha to 220 ha between Kitwanga and the Kitsequecla River.

The Kitwanga, Skeena, Kispiox and Suskwa river infestations continued in **1974** with additional beetle-killed trees along the Skeena River to Ritchie and east of Burns Lake, totaling 17 100 trees over 1330 ha in 50 areas. Outbreaks continued in **1975** with a total of 17 700 trees over 2030 ha at 48 locations region-wide, mainly at Harold Price Creek and Radio Tower Hill, north of Kitwanga.

About 20 800 beetle-killed trees were mapped in **1976**, including at Harold Price Creek (4200), Burdick Creek (2200), Radio Tower Hill (2000), and near Ritchie (1000) and Seeley lakes (1000). Small localized infestations occurred near Babine, Taltapin and Burns lakes in the Houston area and in the Kispiox, Cranberry, Kitwanga and Skeena river valleys. Only 11 600 beetle-killed trees were mapped in **1977**, the first reduction since outbreaks developed near Date Creek in 1969. The Harold Price Creek infestation contained 2575 beetle-killed trees, but at Radio Tower Hill, outbreaks declined to 110 trees. Infestations along the Skeena River from Hazelton to Doreen, contained 5475 trees including 1500 at Ritchie and 975 in the Kitwanga and Cranberry river valleys. About 1150 trees were killed over 450 ha in Tweedsmuir Park near the junction of the Dean and Takia rivers. The majority of the 23 000 trees mapped in the region in **1978** were adjacent to previously recorded infestation areas. This included at Harold Price Creek (6500 trees), Seeley Lake (600 trees), and in the Kispiox River Valley (1600 trees).

In **1979,** outbreaks contained 29 700 recently killed pine over 4800 ha region-wide, including Harold Price Creek, the Suskwa River Valley (over 520) ha, and the Kispiox River Valley. Infestations in the Skeena River Valley covered 1340 ha. Localized infestations developed at the mouth of the Kinskuch River and on the Nass River, and expanded on the Newman Peninsula area of Babine Lake. Minor declines in the number of beetle-killed trees

occurred in the Ritchie area (1230) and at Woodcock (1000), where 87% of the trees in a cruise strip were killed.

Infestations expanded region-wide in **1980** to 13 200 ha containing 49 800 trees in 115 widely scattered areas along the Kispiox, Cranberry, Skeena, and Bulkley river valleys, and the Babine Lake area. The largest was at Harold Price Creek. Five small new infestations were recorded in the Houston area, the first since control programs were completed in 1974-75. The number of outbreaks in the region increased in **1981** to 179 800 trees in 332 separate areas totaling 5700 ha. Over 100 000 trees were killed at Harold Price Creek. Outbreaks persisted in the Kispiox, Suskwa, and Skeena river valleys where 132 areas contained 44 170 beetle-killed trees over 1930 ha. In the Nass and Cranberry river valleys, 12 390 trees were killed over 860 ha. In the Houston area, 15 infestations contained 5985 trees over 142 ha.

About 298 800 recently killed lodgepole pine were mapped over 5800 ha in the region in **1982**. Major infestations continued at Harold Price Creek, in the Skeena, Suskwa and Kispiox river valleys. In the Cranberry and Nass rivers area, 52 600 trees were killed over 765 ha. Major infestations continued over 270 ha at Morrison Lake and on 430 ha along the Dean River to the Sakumtha River junction.

The number of mature pine killed by the beetle in **1983** increased threefold to 961 000, this occurred over 13 300 ha, double the area infested the previous year. Infestations expanded in the Babine, Fulton and Morrison lake areas, where beetle populations had increased annually since 1979. Modest increases occurred in number and size of infestations in the Telkwa River drainage, and beetle-killed trees were mapped in the Cranberry and Nass river drainages over areas similar to 1982.

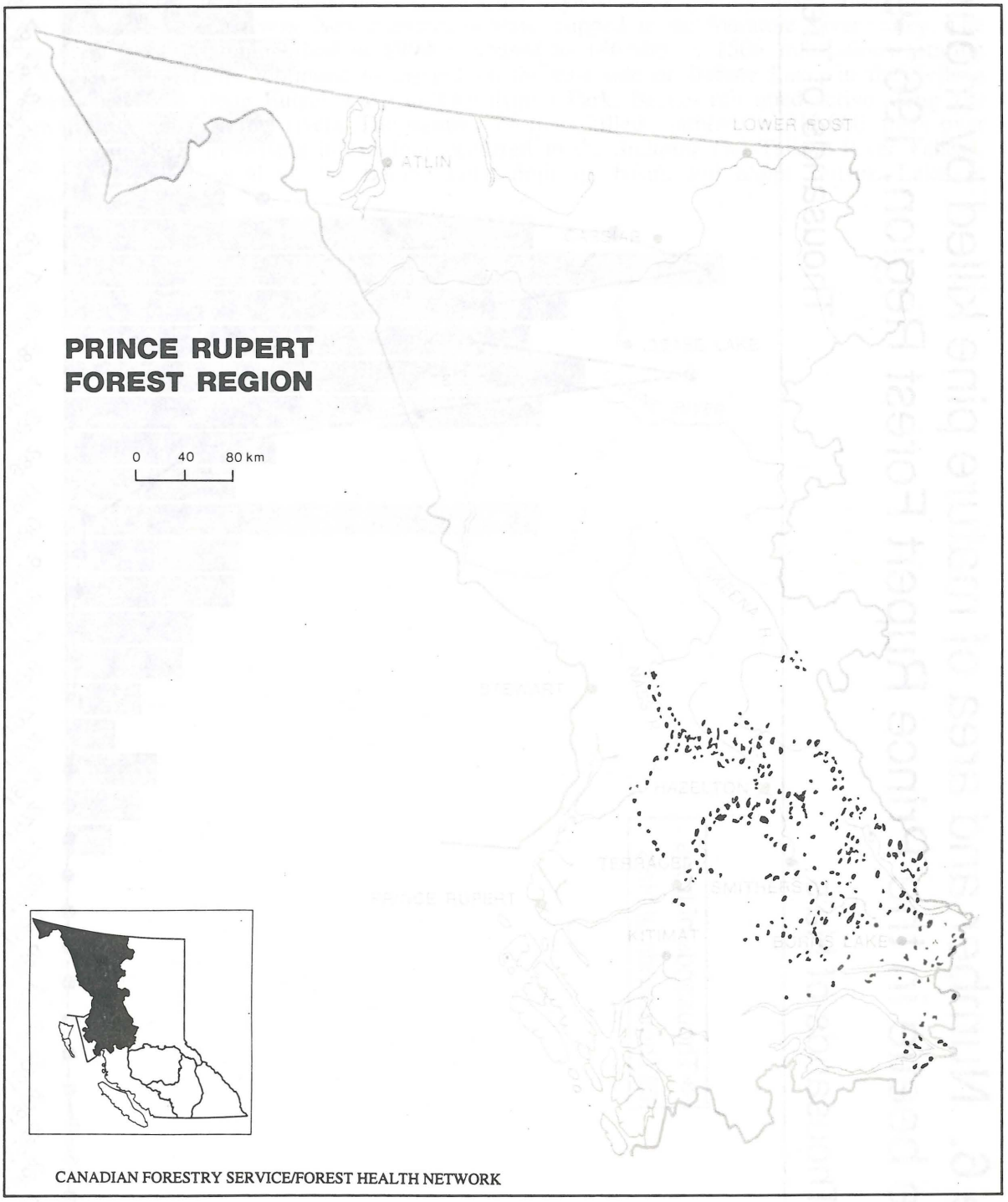
The number of newly killed pine increased 15% in **1984** to 1.1 million trees over 14 500 ha, a 10% increase in area. Most of the increases occurred in the Cranberry and Nass rivers area, and along the Skeena, Babine and Telkwa rivers. Infestations continued around Harold Price Creek, along Babine, Morrison, Fulton and Chapman lakes and Fleming Creek.

Infestations occurred over 13 000 ha killing 896 000 trees region-wide in **1985.** Tree mortality was recorded over 6000 ha in the Nass and Cranberry rivers area, with increased spread to the north and south. About 191 000 pine were killed over 1200 ha in mixed stands along the Kispiox and Skeena Rivers. Major infestations continued in the Babine River, Harold Price Creek and upper Fulton River drainages, in the Telkwa and Bulkley river valleys, and in the Babine and Morrison lake drainages.

Infestations covered 14 000 ha in **1986**, mainly in the western part of the region, and contained an estimated 946 000 recent beetle-killed trees. Infestations continued along the Nass, Skeena and Telkwa rivers. Numerous groups of 5 to 10 beetle-killed pine from Lakelse to Rosswood airport were significantly west of recently recorded beetle-infested stands. Infestations near Chapman Lake, Babine River and Nilkitkwa Lake continued to decline.

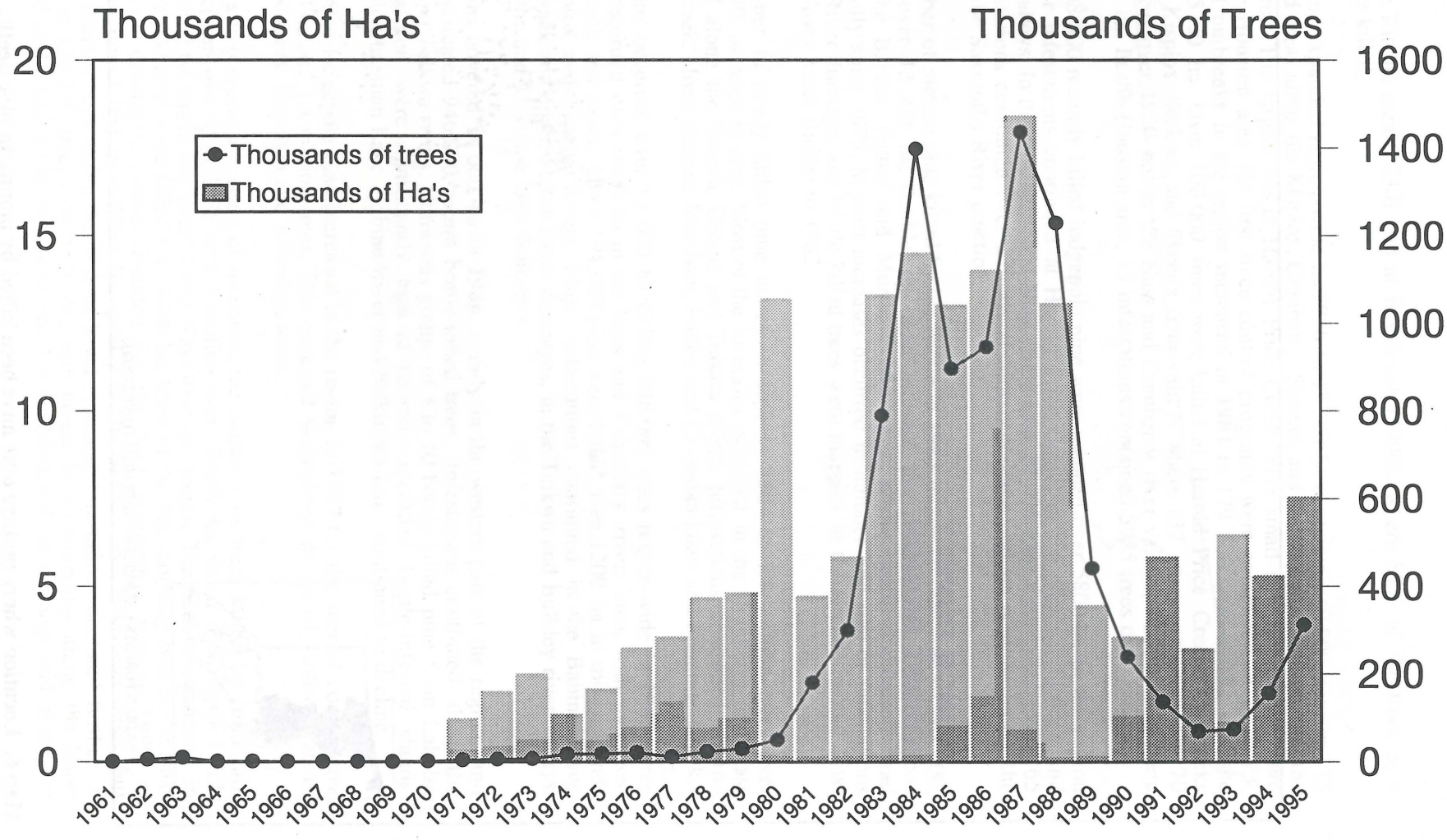
Beetle-killed lodgepole pine increased in the region in **1987** for the second consecutive year, to 18 400 ha and 1.4 million trees. This occurred throughout previously infested areas, mainly in the Kispiox, Hazelton and Kitwanga areas.

Following two successive years of increases, the numbers of trees killed by mountain pine beetle declined overall in **1988** to 1.2 million over 13 000 ha, down 30% from 1987. Most of the mortality was in the Skeena and Nass river drainages. The decline continued in **1989**, when 441 000 trees were killed over 4400 ha. Most of the tree mortality was in the Nass and Skeena river drainages. Losses declined for the third consecutive year in **1990**, to 238 400 mature pine killed over 3530 ha, mostly in the Skeena and Nass river areas, but increasing infestations occurred in the Telkwa River drainage. Infestations declined further in **1991** by 38% to 136 290 trees over 5840 ha, with infestations continuing along the lower Nass River, and beetle activity increasing ninefold in the Morice River drainage and along the



Map 6. Location where mature pine have been killed by mountain pine beetle, 1953-1995.

Figure 6. Number and area of mature pine killed by mountain pine beetle in the Prince Rupert Forest Region, 1961-95



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east side of Babine Lake. In **1992**, 69 000 trees were killed on 3200 ha. Infestations remained active in the Aiyansh and Nass river and Kitwanga areas.

Increasing beetle populations killed an estimated 73 800 mature pine in the region in **1993** on 1110 infestations totaling 7700 ha. The main infestations were on the east side of Babine Lake. Populations remained active in the Aiyansh area, but decreased along most of the Nass and Skeena rivers. New infestations were mapped in the Sicintine River valley. The number of mature pine killed in **1994** increased to 156 000 in 1506 infestations totaling 5300 ha. Infestations continued to expand on the east side of Babine Lake, in the Telkwa river valley, and along Eutsuk Lake in Tweedsmuir Park. Beetles remained active along the lower Nass and Sicintine rivers. The number of trees killed doubled to 312 000 trees over 7545 ha in **1995**. Increasing infestations occurred in the Sicintine and Telkwa River Valleys, in widespread areas along the Babine Lake drainage basin, and along Eutsuk Lake in Tweedsmuir Park.

History of Mountain Pine Beetle in British Columbia

VI. Vancouver Forest Region

Historically, losses to mountain pine beetle in the Vancouver Forest Region have been less than other regions due to the proportionally smaller area of susceptible pine in the region.

The earliest records of mountain pine beetle infestations in the Vancouver Region were in the 1940's continuing into the 1960's (Map 7). These occurred in western white pine stands in the Squamish River valley, side drainages of the Fraser River, Skagit River Valley, and on the 'north shore' mountains north of Vancouver. Major infestations were recorded through this period on Vancouver Island over 135 300 ha, with close to 4 million trees killed, especially in the Nimpkish River Valley, Buttle Lake, Forbidden Plateau, Port Renfrew, San Juan Valley, Carmanah and Englishman River areas.

The first records of beetle-killed lodgepole pine in the region were in the mid-1960's when small groups of trees were killed in the Skagit River Valley (Figure 7). The first major infestation in lodgepole pine developed in the early 1970's near Pemberton, and in the Klinaklini and Homathko river valleys in the mid-coast part of the region.

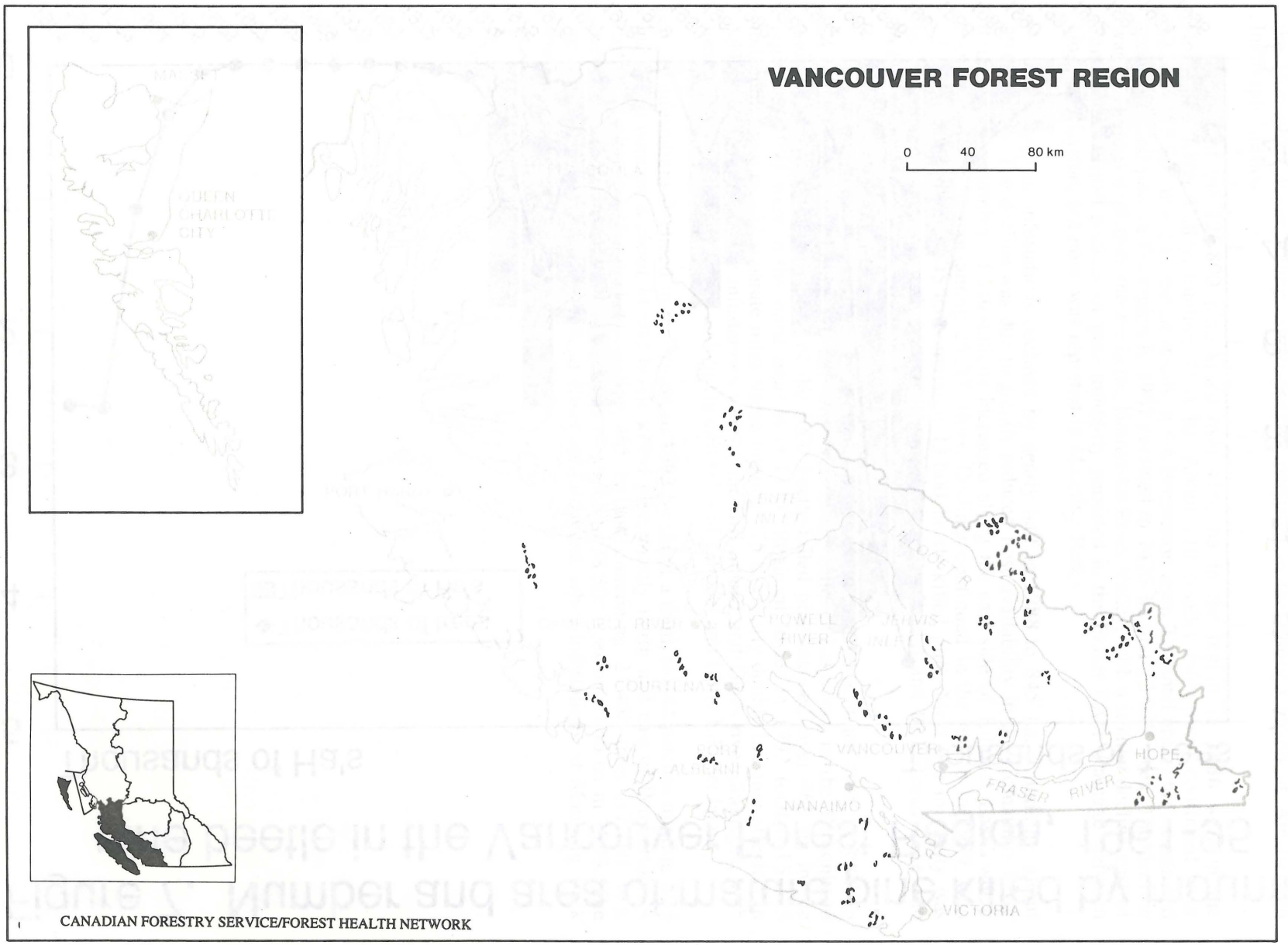
Infestations developed in the Pemberton area in **1971** when 250 mature trees were killed at Birkenhead Lake. In **1972**, 1300 trees were killed along Lillooet Lake and Anderson River. In **1973**, 2900 trees were killed, and new infestations were mapped in the Nahatlatch River drainage. In **1974,** large infestations in the Klinaklini River Valley brought the regional total to 12 600 trees over 1832 ha. Infestations continued in the Pemberton and Fraser river areas, especially in the Nahatlatch River drainage.

In **1975**, 43 800 trees were killed over 2600 ha, mainly in the Klinaklini River area. Small infestations along the Fraser River and in the Pemberton area continued to increase. There was a marked decline in the number of trees killed in all infestation areas to 19 000 trees in **1976**. Along with the Klinaklini River infestation, small infestations persisted in the Nahatlatch River drainage, Sumallo River, and at Birkenhead Lake. Infestations continued to decline in **1977**, with only 4400 additional trees killed. Most of the mortality remains in the Klinaklini River drainage, but activity continued in side drainages along the Fraser River and at Birkenhead and Anderson lakes. In **1978**, recent tree mortality dropped to 2500 trees on 360 ha. While infestations were declining in the Klinaklini River, increasing populations were recorded in the Anderson Lake area. The Klinaklini River infestation collapsed in **1979**, but increasing beetle activity in the Anderson Lake area accounted for most of the 1600 recently killed trees recorded in the region.

Populations increased in **1980**, with over 21 600 trees killed on 1800 ha. Renewed activity was recorded in the Klinaklini River area, large increases occurred along the Fraser Canyon and Pemberton areas, and new infestations developed at Manning Park. In **1981**, the number of trees killed declined to 5100 over 1600 ha. Increasing activity occurred in the Anderson Lake area, but no activity was recorded in the Klinaklini River area. Populations continued to decline in **1882,** with 3000 trees killed over 500 ha. New infestations were recorded in the Homathko River.

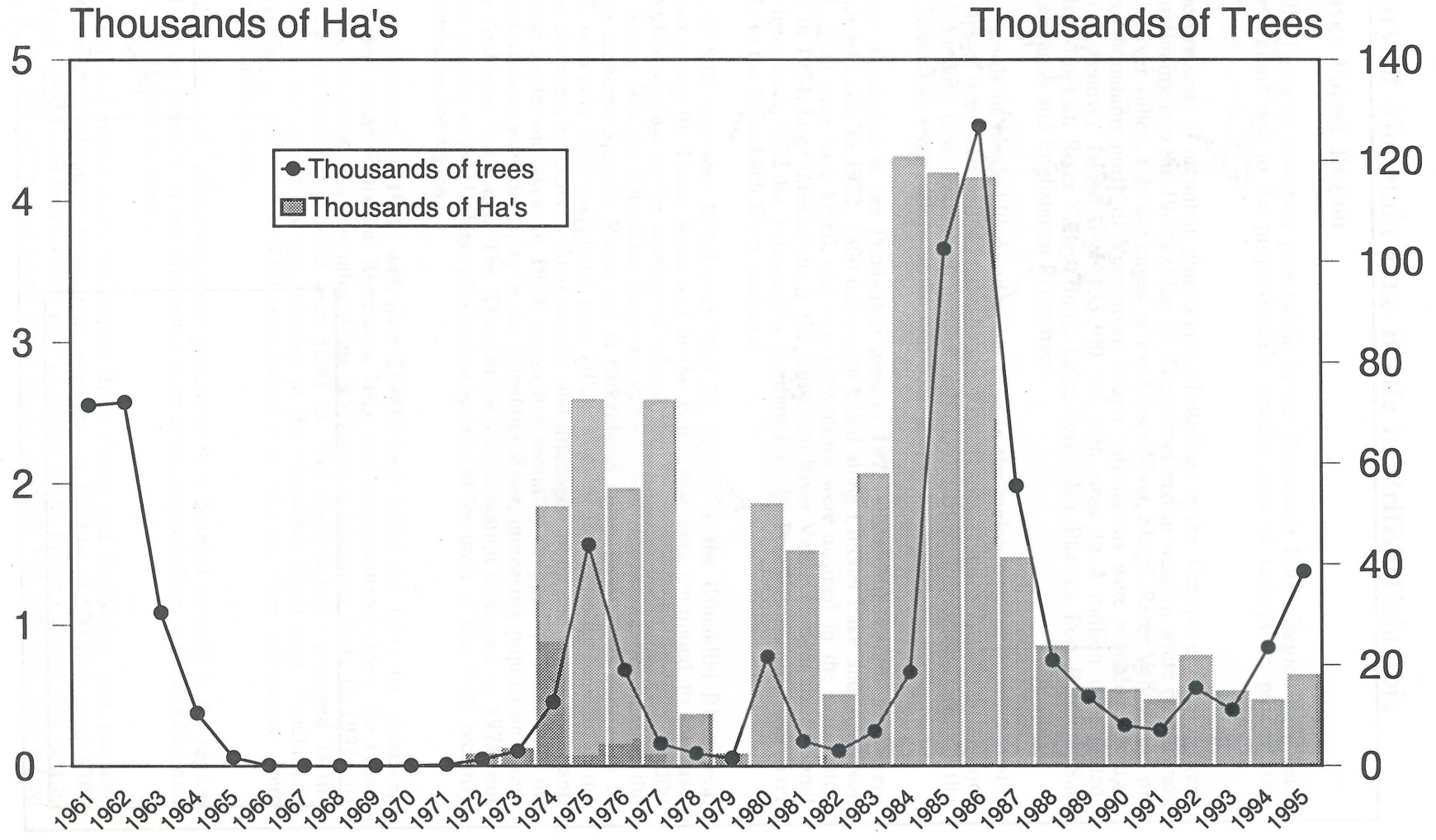
The number of recently killed lodgepole pine more than doubled to 6900 in the region in **1983,** mainly in the Pemberton and Homathko river areas, expandeding at Gates Lake and Specht, Spruce and Haylmore creeks.

Major infestations, mainly in the Homathko River Valley and Pemberton area, but also including the Gates and Birkenhead lakes areas, expanded in **1984** to 18 500 trees over 4300 ha. Scattered groups of 5 to 20 beetle-killed pine occurred in the Fraser Canyon area east to Manning Park. Major infestations continued in the region in **1985;** 102 500 trees were killed



Map 7. Location where mature pine have been killed by mountain pine beetle, 1947-1995.

Figure 7. Number and area of mature pine killed by mountain pine beetle in the Vancouver Forest Region, 1961-95



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over 4200 ha in the Gates River, Birkenhead Lake and Devine areas near Pemberton and in the Homathko River Valley. Small pockets persisted in the Fraser Canyon at Ainslie and Inkitsaph Creeks.

Most of the 126 800 pine killed over 4160 ha in the region in **1986** were in the Homathko River Valley, totaling 2770 ha. About 110 smaller infestations continued over 1200 ha (58 800 trees) in mixed stands in the Pemberton area. The total area which contained recently killed pine in the region in **1987** declined to 1470 ha and 55 000 trees. The decline was due to host depletion, mostly in the Homathko River Valley, with a smaller decline east of Pemberton. Small pockets of pine mortality persisted in the Fraser River drainage between Hope and Lytton, but none was reported in Manning Park.

The area of infestations declined by nearly half in **1988** to 845 ha, containing about 20 000 trees. The decline was due to greatly reduced host availability in the Homathko River drainage. The number of infestations increased along the east side of Lillooet Lake, where they totaled 665 ha, containing 25 200 trees. Declines continued in the region in **1989**, with 53 infestations totaling 545 ha containing 13 600 beetle-killed pine. Most tree mortality was in the Lillooet Lake area, with declining numbers near Pemberton and Birkenhead Lake due to host depletion.

The number of pine killed by the beetle in the region in **1990** declined 40%, to 8000 in 64 separate patches totaling 540 ha. Most were along Lillooet Lake and in the Birkenhead and Gates river drainages. Most of the 7000 beetle-killed pine mapped over 465 ha in the region in **1991** were in the same areas as in 1990. Regional losses in **1992** totaled 15 375 lodgepole pine in 152 separate infestations totaling 775 ha; nearly double the area affected in 1991. The majority of the infestations were in the Birkenhead and Gates river drainages, with increases at Blackwater Creek and on the east sides of Lillooet and Little Lillooet lakes.

Infestations declined in the region in **1993** by about a third, to 144 patches totaling 525 ha, which contained about 11 000 beetle-killed pine, mostly north and east of Pemberton. A further decline to 156 pockets totaling 465 ha and containing 23 400 trees (17 160 m^3), occurred in the area in **1994**. Infestations increased to 38 500 trees over 640 ha in **1995**. The main infestations in the Birkenhead River area doubled, while infestations at Manning Park and Dean River remained stable.

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Appendix

Summary of Annual Losses to Mountain Pine Beetle

For the purposes of this table, TSA includes all lands geographically associate with it, including provincial and national parks, and TFLs.

Cariboo Forest Region

TSA	Year	# trees	# ha	Major infestation areas
100 Mile House				
	'95	6 600	90	Clinton to northwest of 100 Mile
	'94	9 200	125	Clinton to northwest of 100 Mile
	'93	9 500	220	Fraser R.
	'92	3 000	40	Fraser R.
	'91	360	60	Fraser R.
	'90	--	--	
	'89	--	--	
	'88	--	--	
	'87	--	--	
	'86	86 967	3 760	Fraser R. ***Ips**
	'85	229 867	7 820	Fraser R.
	'84	397 583	5 960	Fraser R.
	'83	4 728 667	22 560	Fraser R.
	'82	547 333	4 270	Fraser R.
	'81	364 350	5 205	Fraser R.
	'80	269 800	6 745	Fraser R.
	'79	4 680	2 700	Fraser R.
	'78	8 800	3 584	Fraser R.
	'77	5 250	2 560	Fraser R.
	'76	10 315	3 392	Fraser R.
	'75	8 300	1 100	Fraser R.
	'74	120	16	Dog Cr.-Jesmond
	'71-73	--	--	
	'70	100	--	
	'69	300	--	
	'68	310	--	
	'67	400	--	
	'66	450	--	
	'65	2 200	--	
	'64	1 500	--	
	'63	150	--	
	'62	50	--	
	'61	30	--	
	'60	--	--	
	'59	26	--	
	'58	25	--	
Quesnel				
	'95	82 700	1 020	Narcosli R., Fraser R.
	'94	42 000	570	Narcosli R., Fraser R.
	'93	6 800	140	Narcosli R.
	'92	1 000	15	Narcosli R.
	'91	150	25	Fraser R.
	'87-90	--	--	
	'86	982 750	20 670	Bowron, Nazko, Blackwater ***Ips**

TSA	Year	# trees	# ha	Major infestation areas
Quesnel (Cont'd)				
	'85	718 133	14 410	Bowron, Nazko, Blackwater
	'84	638 783	9 080	Bowron, Nazko
	'83	2 313 150	12 730	Bowron, Nazko
	'82	60 700	450	Bowron, Nazko
	'81	37 500	300	Bowron
	'80	27 500	275	Bowron
	'79	350	50	
	'78	40	20	
	'77	75	32	
	'76	600	128	
	'75	225	30	
	'74	300	35	
	'71-73	--	--	
	'70	30	--	
	'69	850	--	Cuisson L.
	'68	1 150	--	Cuisson L.
	'67	2 180	--	Cuisson L.
	'66	3 120	--	Cuisson L.
	'65	1 000	--	Cuisson L.
	'64	1 000	--	Cuisson L.
	'63	715	--	
	'62	85	--	
	'61	40	--	
	'60	--	--	
Williams Lake				
	'95	195 200	2740	Big Lake, Riske Cr., DND
	'94	71 000	965	Chilcotin, Horsefly, Narcosli, DND
	'93	18 700	435	Chilko Lk., Horsefly, Narcosli, DND
	'92	16 000	210	Chilko Lk., Horsefly
	'91	13 250	265	Chilko Lk.
	'90	15 700	315	Chilko Lk.
	'89	36 000	720	Chilko Lk.
	'88	65 000	1 290	Chilko Lk.
	'87	25 000	500	Chilko Lk.
	'86	3 184 897	83 045	N. of Chilcotin, Gaspard, ***Ips**
	'85	9 305 197	167 234	Chilko R., Gaspard
	'84	24 110 550	367 281	Chilko R., Taseko, Gaspard
	'83	64 687 206	346 580	Chilcotin & Homathko Rs., Tatla L.
	'82	44 700 873	217 115	Homathko R., Tatla & Charlotte Ls.
	'81	8 742 110	67 247	Tatla & Charlotte Ls.
	'80	1 986 775	56 765	Klinaklini, Tatla, Charlotte, Riske
	'79	131 500	14 850	Klinaklini, Tatla, Charlotte, Riske
	'78	855 960	28 090	Klinaklini, Tatla, Riske Cr.
	'77	38 375	13 352	Klinaklini R., Riske Cr.
	'76	73 870	12 352	Klinaklini R., Riske Cr.
	'75	109 075	13 900	Klinaklini R., Riske Cr., Williams L
	'74	9 280	1 500	Cariboo Lk., Riske Cr., Williams L
	'73	--	--	
	'72	720	100	Cariboo Lk.
	'71	160	40	Cariboo Lk.
	'70	30	20	Cariboo Lk.
	'69	12 600	--	Williams L., Cariboo L.

TSA	Year	# trees	# ha	Major infestation areas
Williams Lake (Cont'd)				
	'68	39 150	--	Williams L., Cariboo L.
	'67	12 100	--	Williams L., Cariboo L.
	'66	13 350	--	Williams L., Cariboo L.
	'65	7 500	--	Williams L., Cariboo L.
	'64	13 625	--	Williams and Tyhee L.
	'63	300	--	
	'62	20	--	
	'61	--	--	
	'60	--	--	
	'51-56	10 000	--	Atnarko R.
	pre'50	250 000 000	--	Chilcotin Plateau

Kamloops Forest Region

TSA	Year	# trees	# ha	Major infestation areas
Kamloops				
	'95	41 000	934	N. Thompson, Adams Lk., Paxton V.
	'94	17 200	329	N. Thompson, Adams Lk.
	'93	22 240	555	N. Thompson, Adams Lk.
	'92	31 400	1 700	N. Thompson, Adams Lk.
	'91	51 500	1 800	N. Thompson, Adams Lk.
	'90	9 600	580	N. Thompson, Adams Lk.
	'89	10 400	800	N. Thompson, Adams Lk.
	'88	4 800	170	Barriere Lk.
	'87	16 000	150	N. Thompson
	'86	20 400	340	Kamloops & Adams L.
	'85	12 000	240	
	'84	5 800	295	
	'83	194 700	1 650	
	'82	1 900	550	
	'81	2 300	215	Blue R., Adams L.
	'80	4 800	595	Blue R., Adams L.
	'79	2 100	260	Blue R., Adams L.
	'78	6 800	850	Blue R., Adams L.
	'77	10 856	1 357	Blue R., Adams L.
	'76	17 776	2 222	Blue R., Adams L.
	'75	11 200	1 400	Blue R., Adams L.
	'74	8 200	1 025	
	'73	4 500	562	
	'72	3 600	400	
	'71	5 400	380	
	'70	800	--	
	'69	1 000	--	N. Thompson
	'68	5 770	--	Cache C., N. Thompson
	'67	6 501	--	Cache C., N. Thompson
	'66	9 735	--	Cache C., N. Thompson
	'65	4 868	--	Cache C., N. Thompson, Momich L.
	'64	5 503	--	Cache C., N. Thompson, Momich L.
	'63	2 070	--	N. Thompson, Adams L.
	'62	2 610	--	N. Thompson, Adams L.
	'61	761	--	N. Thompson
	'60	162	--	N. Thompson
	'59	315	--	N. Thompson, Adams L.
	'58	110	--	N. Thompson
	'51-56	500	--	N. Thompson
	pre-'50	42 000	--	
Okanagan				
	'95	722 900	4 925	E. & W. Okanagan L., Chase
	'94	1 006 200	6 520	E. of Okanagan L., Trout Cr.
	'93	3 001 000	16 550	E. of Okanagan L., Trout Cr.
	'92	3 296 050	18 500	E. of Okanagan L., Trout Cr.
	'91	3 360 300	16 453	E. of Okanagan L., Trout Cr.
	'90	751 000	5 110	E. of Okanagan L., Trout Cr.
	'89	1 079 000	9 600	E. of Okanagan L., Trout Cr.
	'88	2 940 400	13 550	E. of Okanagan L., Trout Cr.
	'87	1 053 700	11 300	E. of Okanagan L., Trout Cr.

TSA	Year	# trees	# ha	Major infestation areas
Okanagan (Cont'd)				
	'85	690 000	6 900	E. of Okanagan L., Trout Cr.
	'84	395 525	7 710	Okanagan L. Trout Cr., Ashnola R.
	'83	807 700	3 940	Mission & Trout Crs., Ashnola R.
	'82	72 900	7 400	Mission, Lambly, Trout, Ashnola
	'81	47 075	2 145	Mission, W Okanagan L., Ashnola
	'80	321 940	19 810	Mission, W Okanagan L., Ashnola
	'79	243 180	12 341	Mission, W Okanagan L., Ashnola
	'78	200 340	10 020	Mission, W Okanagan L., Ashnola
	'77	151 880	8 390	Mission, W Okanagan L., Ashnola
	'76	181 240	9 060	Mission, W Okanagan L.
	'75	91 060	4 550	Mission, W Okanagan L.
	'74	24 615	1 980	Mission, W Okanagan L.
	'73	9 800	960	Mission, W Okanagan L.
	'72	9 500	895	Mission, Lambly, Whitman crs.
	'71	6 900	660	Mission, Lambly, Whitman crs.
	'70	2 400	--	Mission, Lambly crs.
	'69	6 300	--	Mission, Lambly crs.
	'68	5 700	--	Mabel L., Lambly C.
	'67	4 050	--	Mabel L., Lambly C.
	'66	3 020	--	Mabel L., Lambly C.
	'65	7 500	--	Mabel L., Lambly C.
	'64	10 740	--	Mabel L., Lambly C.
	'63	17 860	--	Mabel L., Lambly C.
	'62	2 710	--	Mabel L., Lambly C.
	'61	899	--	Mabel L.
	'60	738	--	Mabel L.
	'59	546	--	Mabel L.
	'58	50	--	Mabel L.
	'51-56	10 000	1 500	Shuswap L., Penticton
	pre'50	50 000	--	
Merritt				
	'95	242 000	1 830	Similkameen R.
	'94	359 000	1 977	Similkameen R.
	'93	487 100	2 814	Hayes Cr., Similkameen R.
	'92	171 600	800	Hayes Cr., Similkameen R.
	'91	107 550	712	Hayes Cr., Similkameen R.
	'90	74 400	310	Hayes Cr., Similkameen R.
	'89	141 000	1 500	Hayes Cr., Similkameen R.
	'88	575 100	2 650	Hayes Cr., Similkameen R.
	'87	238 600	2 250	Hayes Cr., Similkameen R.
	'86	431 650	4 010	Hayes Cr., Similkameen R.
	'85	131 000	2 620	Hayes Cr., Similkameen R.
	'84	62 390	3 165	Hayes Cr., Similkameen R.
	'83	279 600	2 370	Hayes Cr., Similkameen R.
	'82	14 500	2 000	Hayes Cr.
	'81	8 660	415	Hayes Cr.
	'80	17 488	2 186	Hayes Cr.
	'79	23 264	2 908	Hayes Cr.
	'78	8 963	532	Hayes Cr.
	'77	11 547	1 283	Hayes Cr.
	'76	800	89	
	'75	1 200	158	

TSA	Year	# trees	# ha	Major infestation areas
Merritt (Cont'd)				
	'74	800	80	
	'73	2 500	143	
	'72	2 000	122	
	'71	1 100	75	
	'70	1 000	--	
	'69	1 600	--	Similkameen R., Nicola R.
	'68	4 020	--	Similkameen R., Nicola R.
	'67	14 312	--	Nicola R.
	'66	5 700	--	Nicola R., Hayes Cr.
	'65	8 648	--	Nicola R., Hayes Cr.
	'64	6 915	--	Nicola R., Hayes Cr.
	'63	5 730	--	Nicola R., Hayes Cr.
	'62	3 960	--	Chapperon L., Similkameen R.
	'61	1 632	--	Chapperon L., Similkameen R.
	'60	1 762	--	Chapperon L., Similkameen R.
	'59	2 009	--	Chapperon L.
	'58	500	--	Chapperon L.
	'51-56	1 617	--	Alleyne L., Aspen Grove
	pre '50	70 000	--	
Lillooet				
	'95	33 700	193	Spences Bridge, Cayoosh Cr.
	'94	8 600	39	Fraser R., Duffy L.-Cayoosh Cr.
	'93	160	2	Duffy L.-Cayoosh Cr.
	'92	100	2	Duffy L.-Cayoosh Cr.
	'91	300	2	
	'90	--	--	
	'89	3 100	100	
	'88	47 200	1 260	Downton L., Yalakom R., Stein R.
	'87	541 600	5 300	Downton L., Stein R., Fraser R.
	'86	3 140 450	30 630	Downton L., Stein R., Fraser R.
	'85	3 700 000	37 000	Downton L., Stein R., Fraser R.
	'84	4 542 510	46 830	Downton L., Stein R., Fraser R.
	'83	4 428 000	36 000	Downton L., Stein R., Fraser R.
	'82	830 700	12 050	Carpenter L., Stein R.
	'81	2 647 000	16 725	Carpenter L., Stein R.
	'80	2 294 066	14 495	Carpenter L., Stein R.
	'79	514 680	4 289	Carpenter L., Stein R.
	'78	446 000	6 373	Carpenter L., Stein R.
	'77	250 000	4 454	Carpenter L.
	'76	232 500	4 650	Carpenter L.
	'75	12 500	1 255	Carpenter L.
	'74	4 375	700	Carpenter L.
	'73	3020	376	Cayoosh Cr.
	'72	3 000	350	Cayoosh Cr.
	'71	1 600	190	Cayoosh Cr.
	'70	2 500	--	Cayoosh Cr., Bridge R.
	'69	9 800	--	Cayoosh Cr., Bridge R.
	'68	5 785	--	Cayoosh Cr., Bridge R.
	'67	4 450	--	Cayoosh Cr., Bridge R.
	'66	1 000	--	Bridge R.
	'65	1 100	--	Bridge R.

TSA	Year	# trees	# ha	Major infestation areas
Lillooet (Cont'd)				
	'64	1 400	--	Bridge R.
	'63	150	--	Bridge R.
	'62	100	--	
	'51-'61	--	--	
	pre '50	19 000	--	

Nelson Forest Region

TSA	Year	# trees	# ha	Major infestation areas
Cranbrook				
	'95	39 000	361	Moyie L., S. Cranbrook
	'94	29 000	157	Moyie L., S. Cranbrook
	'93	71 000	436	Moyie L.
	'92	188 200	2 190	Moyie L., Gold Cr.
	'91	480 000	8 530	Elk, Bull Rs., Moyie L., Jaffray
	'90	466 500	6 600	Elk, Bull Rs., Moyie L., Gold Mtn.
	'89	524 100	7 965	Elk, Bull Rs., Moyie L., Gold Mtn.
	'88	204 000	5 250	Gold Mtn., Chipka Cr., Galtons
	'87	237 000	3 450	Gold Mtn., Galtons, Bloom Cr.
	'86	191 000	3 800	Gold Mtn., Galtons, Bloom-Gilnockie
	'85	372 800	3 850	Gilnockie-Bloom Crs.
	'84	394 000	3 600	Gilnockie-Bloom Crs.
	'83	117 700	810	Gilnockie-Bloom Crs.
	'82	1 253 000	8 620	Gilnockie-Bloom Crs., Flathead R.
	'81	6 045 000	22 760	Gilnockie-Bloom Crs., Flathead R.
	'80	7 001 000	15 570	Gilnockie Cr., Flathead R.
	'79	2 002 500	8 125	Flathead R.
	'78	100 000	4 000	Flathead R.
	'77	4 545	493	Flathead R.
	'76	1 030	115	
	'75	--	--	
	'74	--	--	
	'73	120	5	
	'72	--	--	
	'71	230	10	
	pre '70	--	--	Sporadic small pockets only
Invermere				
	'95	112 200	1161	Columbia Valley, Forster Cr.
	'94	68 000	484	Columbia Valley, Forster Cr.
	'93	137 000	1 376	Columbia Valley, Frances Cr.
	'92	88 300	1 460	Columbia Valley, Frances Cr.
	'91	50 300	1 320	Columbia Valley, Frances-Toby Crs.
	'90	69 100	1 845	Columbia Valley, Frances-Toby Crs.
	'89	76 100	2 425	Columbia Valley, Frances-Toby Crs.
	'88	200 000	3 400	Columbia Valley, Steamboat-Toby Cr
	'87	283 000	6 800	Steamboat Mtn., Kootenay-White Rs.
	'86	663 400	13 600	Steamboat Mtn., Kootenay-White Rs.
	'85	521 400	8 300	Steamboat Mtn., Kootenay-White Rs.
	'84	1 389 000	14 350	Steamboat Mtn., Kootenay-White Rs.
	'83	1 707 500	16 240	Steamboat Mtn., Kootenay-White Rs.
	'82	2 113 000	20 100	Steamboat Mtn., Kootenay-White Rs.
	'81	3 680 000	23 750	Steamboat Mtn., Kootenay-White Rs.
	'80	2 699 000	13 050	Steamboat Mtn., Kootenay-White Rs.
	'79	2 192 750	10 379	Toby Cr., Kootenay-White Rs.
	'78	286 805	11 332	Toby Cr., Kootenay-White Rs.
	'77	122 630	10 099	Toby Cr., Kootenay-White Rs.
	'76	43 315	5 506	Toby Cr., White R.
	'75	60 410	1 085	White R.
	'74	24 489	540	White R.
	'73	6 440	180	White R.

TSA	Year	# trees	# ha	Major infestation areas
Invermere (Cont'd)				
	'72	3 285	110	White R.
	'71	6 375	180	White R.
	'70	600	--	White R.
	'69	3 700	--	White R.
	'68	5 300	--	White R.
	'67	2 899	--	White R.
	'66	2 640	--	White R.
	65	6 895	--	White R.
	'64	3 025	--	White R.
	'63	1 785	--	White R.
	'62	750	--	White R.
	'61	300	--	White R.
	'60	4 600	--	White R.
	'59	3 000	--	White R.
	'58	350	--	White R.
	'57	300	--	White R.
	'51-56	2 980	--	White R., Windermere L.
	'30's	50 000	--	Kootenay R.
Golden				
	'95	13 700	162	Columbia Valley, Kootenay R.
	'94	9 400	57	Columbia Valley, Kootenay R.
	'93	7 000	95	Columbia Valley, Waitabit
	'92	2 600	35	Columbia Valley, Waitabit
	'91	800	40	Columbia Reach,
	'90	150	6	
	'89	200	8	
	'88	1 300	10	
	'87	6 000	260	
	'86	11 000	440	
	'85	19 400	325	
	'84	24 300	520	Blaeberry R.
	'83	163 500	1 500	Blaeberry R, Columbia Rch, Bush Ar
	'82	610 000	5 560	Blaeberry R, Columbia Rch, Bush Ar
	'81	510 000	6 300	Golden, Columbia Reach, Bush Arm
	'80	300 000	1 000	Golden, Columbia Reach, Bush Arm
	'79	237 950	3 650	Columbia Reach, Bush Arm
	'78	31 000	2 100	Columbia Reach, Bush Arm
	'77	14 575	1 844	Columbia Reach, Bush Arm
	'76	41 225	4 306	Columbia Reach, Bush Arm
	'75	9 875	1 034	Columbia Reach, Bush Arm
	'74	4 425	880	Columbia Reach
	'73	3 925	780	Columbia Reach
	'72	1 650	160	
	'71	1 530	150	
	'70	300	--	Columbia Reach
	'69	2 500	--	Columbia Reach
	'68	2 600	--	Columbia Reach
	'67	3 702	--	Columbia Reach
	'66	3 260	--	Columbia Reach
	'65	5 740	--	Columbia Reach, Bush R.
	'64	5 600	--	Columbia Reach, Bush R.

TSA	Year	# trees	# ha	Major infestation areas
Golden (Cont'd)				
	'63	2 875	--	Columbia Reach, Bush R.
	'62	1 265	--	Columbia Reach, Bush R.
	'61	350	--	Columbia Reach
	'60	800	--	
	'59	75	--	
	'58	50	--	
	'57	--	--	
Revelstoke				
	'95	--	--	
	'94	50	1	
	'93	30	2	
	'92	300	10	upper Arrow L.
	'91	90	5	Scattered
	'90	120	4	
	'89	200	5	
	'88	270	4	
	'87	600	20	
	'86	3 900	1 530	
	'85	150	5	
	'84	225	40	
	'83	400	60	
	'82	330	50	
	'81	2 360	1 600	
	'80	3 000	375	
	'79	3 120	219	
	'78	385	36	
	'77	--	--	
	'76	--	--	
	'75	250	18	
	'74	300	30	
	'73	860	35	
	'72	1 465	68	
	'71	480	18	
	'70	--	--	
	'69	--	--	
	'68	655	--	
	'67	--	--	
	'66	140	--	
	'65	1 650	--	
	'64	2 565	--	
	'63	2 580	--	
	'62	3 347	--	
	'61	386	--	
	'60	800	--	
	'59	75	--	
	'58	50	--	
	'48-'55	8 000	--	
Boundary				
	'95	29 800	351	Kettle R., Boundary Cr.
	'94	53 600	386	Kettle R., Boundary Cr.
	'93	81 800	960	Kettle R., Boundary Cr.

TSA	Year	# trees	# ha	Major infestation areas
Boundary (Cont'd)				
	'92	238 000	3 100	Kettle R., Boundary Cr.
	'91	136 000	2 960	Kettle R., Boundary Cr.
	'90	521 760	12 500	Kettle R., Boundary Cr.
	'89	990 800	19 555	Kettle R., Boundary Cr.
	'88	820 060	15 460	Kettle R, Boundary Cr, Christina L
	'87	628 500	10 700	Kettle R, Boundary Cr, Christina L
	'86	327 500	5 150	Kettle R, Boundary Cr, Christina L
	'85	105 600	1 200	Kettle R, Boundary Cr, Christina L
	'84	47 000	1 025	W Kettle R., Grand Forks
	'83	98 000	820	W Kettle R., Grand Forks
	'82	167 000	1 400	W Kettle R., Grand Forks
	'81	178 000	2 000	W Kettle R., Grand Forks
	'80	13 500	2 400	W Kettle R., Christina L.
	'79	7 608	1 147	W Kettle R.
	'78	5 432	1 189	W Kettle R.
	'77	3 477	922	W Kettle R.
	'76	5 550	890	W Kettle R.
	'75	5 075	534	W Kettle R.
	'74	1 000	125	W Kettle R.
	'73	--	--	
	'72	2 050	260	W Kettle
	'71	2 675	325	W Kettle
	'70	860	--	
	'69	1 600	--	W Kettle
	'68	1 725	--	W Kettle
	'67	1 260	--	W Kettle
	'66	150	--	
	'65	300	--	
	'64	2 000	--	Kettle R.
	'63	2 700	--	Kettle R.
	'62	4 000	--	Kettle R.
	'61	850	--	
	'60	300	--	
	'59	600	--	
	'58	550	--	
	'57	350	--	
	'56	--	--	
	'20's	11 500	--	Kettle R.
Arrow				
	'95	144 500	2 188	Arrow lakes
	'94	70 800	637	Arrow lakes
	'93	252 500	3 800	Nancy Greene L., u. Arrow L.
	'92	87 000	1 390	Nancy Greene L., u. Arrow L.
	'91	37 000	875	Nancy Greene L.
	'90	38 300	1 110	Nancy Greene L.
	'89	33 200	905	Nancy Greene L.
	'88	56 700	1 298	Nancy Greene L.
	'87	61 100	950	Nancy Greene L.
	'86	14 700	750	Nancy Greene L., Slocan L.
	'85	23 000	250	Slocan V.
	'84	23 000	500	Slocan V.
	'83	18 900	160	Slocan V.

TSA	Year	# trees	# ha	Major infestation areas
Arrow (Cont'd)				
	'82	134 500	1 120	Slocan V.
	'81	80 000	1 030	Slocan V.
	'80	5 355	720	
	'79	1 220	294	
	'78	415	158	
	'77	945	36	
	'76	130	6	
	'75	3 625	515	
	'74	2 475	284	
	'73	3 625	450	Trout L.
	'72	15 700	981	Trout L., N Kootenay L., U Arrow L
	'71	20 885	1160	Trout L., Upper Arrow L.
	'70	1 810	--	
	'69	540	--	
	'68	2 940	--	Trout L.
	'67	2 005	--	Trout L.
	'66	710	--	Arrow L.
	'65	2 970	--	Arrow L.
	'64	10 425	--	Arrow L.
	'63	6 865	--	Arrow L.
	'62	6 685	--	Arrow L.
	'61	1 498	--	Arrow L.
	'60	2 007	--	Arrow L.
	'59	2 720	--	Arrow L.
	'58	2 070	--	
	'57	1 200	--	
	'51-56	142 600	--	Arrow L.
Kootenay				
	'95	4 500	56	scattered
	'94	11 640	91	West Arm
	'93	25 000	290	Hawkins, Freeman Crs., Goat R.
	'92	2 900	90	Hawkins, Freeman Crs., Goat R.
	'91	1 400	40	Hawkins, Freeman Crs.
	'90	12 850	360	Hawkins, Freeman Crs.
	'89	15 000	205	Hawkins, Freeman Crs.
	'88	4 330	147	Hawkins, Freeman Crs.
	'87	1 200	130	Hawkins, Freeman Crs.
	'86	3 500	400	Hawkins, Freeman Crs.
	'85	2 000	35	scattered white pine
	'84	11 600	570	
	'83	2 600	140	
	'82	14 000	750	
	'81	500	420	
	'80	1 645	225	
	'79	1 445	186	
	'78	1 040	122	
	'77	--	--	
	'76	--	--	
	'75	100	30	
	'74	200	25	
	'73	475	59	
	'72	4 370	291	

TSA	Year	# trees	# ha	Major infestation areas
Kootenay (Cont'd)				
	'71	3 875	258	
	'70	--	--	
	'69	--	--	
	'68	170	--	
	'67	12	--	
	'66	140	--	
	'65	320	--	Duncan R.
	'64	1 510	--	Duncan and Lardeau Rs.
	'63	755	--	Duncan and Lardeau Rs.
	'62	1 665	--	Duncan and Lardeau Rs.
	'61	437	--	Lardeau R.
	'60	50	--	
	'59	10	--	
	'58	10	--	
	'57	--	--	
Kootenay National Park				
	'95	210 000	2 403	
	'94	86 600	897	
	'93	77 900	715	
	'92	72 900	600	
	'91	56 000	860	
	'90	17 300	566	
	'89	19 700	615	
	'88	42 000	600	
	'87	4 000	1 000	
	'86	5 500	1 600	
	'85	4 000	600	
	'84	3 800	600	
	'83	3 100	410	
	'82	3 400	450	
	'81	2 350	360	
	'30's	200 000	--	
Glacier				
	'95	3 700	65	
	'94	1 375	25	
	'93	1 140	30	
	'92	1 400	36	
	'91	900	35	
	'90	390	41	
	'89	300	87	
	'88	35	2	
	'87	100	10	
	'86	440	75	
	'85	350	65	
	'84	50	5	
	'83	100	50	
	'82	400	200	
	'81	1 070	240	
	'70's	???	--	included in Golden TSA

TSA	Year	# trees	# ha	Major infestation areas
Mt. Revelstoke National Park				
	'95	--	--	
	'94	15	1	
	'93	0	0	
	'92	20	1	
	'91	90	5	
	'90	120	4	
	'89	20	1	
	'88	90	3	
	'87	100	10	
	'86	1 700	835	
Yoho National Park				
	'95	1 100	45	
	'94	520	15	
	'93	600	20	
	'92	280	8	
	'91	200	10	
	'90	75	2	
	'30s	5 000	-	

Prince George Forest Region

TSA	Year	# trees	# ha	Major infestation areas
Pr. George				
	'95	???????	??????	
	'94	791 300	16 815	Sustut R., Takla L., Blackwater R.
	'93	648 375	12 210	Takla L.
	'92	351 600	8 280	Takla L.
	'91	332 656	9 090	Takla, Trembleur Ls.
	'90	257 550	7 875	Takla, Trembleur Ls., Sustut R.
	'89	102 387	2 485	Takla, Trembleur Ls., Sustut R.
	'88	86 300	3 720	Takla, Trembleur Ls., Sustut R.
	'87	165 150	4 055	Takla, Trembleur Ls., Sustut R.
	'86	7 700	880	Takla L., Tachie R.
	'85	9 700	480	Tachie R., Blackwater R.
	'84	7 250	225	Tachie R., Blackwater R.
	'83	2 620	200	Tachie R.
	'82	3 310	744	Tachie R.
	'81	1 200	260	Tachie R.
	'80	1 300	310	Tachie R.
	'79	355	221	
	'78	185	15	
	'77	395	20	
	'76	360	35	
	'75	300	30	
	'69-74	--	--	
	'68	100	--	Takla L.
	'67	600	--	Takla L.
	'66	6 690	--	Takla L.
	'65	31 490	--	Takla L.
	'64	24 035	--	Takla L.
	'63	19 235	--	Takla L.
	'62	8 365	--	Takla L.
	'61	3 037	--	Takla L.
	'60	35 000	--	Takla L.
	'59	55 000	--	Takla L.
	'58	70 000	--	Takla L.
	'57	90 000	--	Takla L.
	'50-56	650 000	--	Takla L.
	pre '50	15 000	--	Takla L.
McBride				
	'95	??????	???	
	'94	30 000	150	Canoe Reach
	'93	34 125	400	Canoe Reach
	'92	14 650	150	Canoe Reach
	'91	12 500	220	Canoe Reach
	'90	--	--	
	'89	20 000	320	Canoe Reach
	'88	3 825	245	Canoe Reach
	'87	520	235	Canoe Reach
	'86	900	300	Canoe Reach
	'85	5 000	150	Canoe Reach
	'84	114 125	2 575	Canoe Reach
	'83	15 400	520	Canoe Reach, Swift Cr.

TSA	Year	# trees	# ha	Major infestation areas
McBride (Cont'd)				
	'82	12 550	840	Canoe Reach, Swift Cr.
	'81	5 100	725	Canoe Reach, Swift Cr.
	'80	9 100	5 200	Canoe Reach, Swift Cr.
	'79	4 308	2 057	Canoe Reach, Swift Cr.
	'78	1 770	4 480	Canoe Reach, Swift Cr.
	'77	3 705	9 120	Canoe Reach, Swift Cr.
	76	420	1 200	Canoe Reach, Swift Cr.
	'70-75	--	--	
	'71	150	--	
	'70	150	--	
	'69	80	--	
	'68	130	--	
	'67	75	--	
	'66	--	--	

Prince Rupert Forest Region

TSA	Year	# trees	# ha	Major infestation areas
Kalum				
	'95	26 500	445	Nass R.
	'94	29 130	615	Nass R.
	'93	21 250	730	Nass R.
	'92	22 520	825	Nass R.
	'91	57 140	1 245	Nass R.
	'90	99 400	1 240	Nass R., Skeena R.
	'89	221 100	1 950	Nass R., Skeena R.
	'88	193 000	1 840	Nass R., Skeena R.
	'87	360 000	3 600	Nass R., Skeena R.
	'86	273 700	3 300	Nass R., Skeena R.
	'85	239 500	3 500	Nass R., Skeena R.
	'84	374 100	3 200	Nass R.
	'83	28 800	420	Nass R.
	'82	11 340	165	Nass R.
	'81	1 440	100	Nass R.
	'80	1 520	560	Nass R.
	'79	200	16	Nass R.
	'78	125	5	Nass R.
	pre '77	--	--	no significant records
Kispiox				
	'95	30 600	325	Sicintine, Skeena Rs.
	'94	8 450	250	Skeena, Cranberry Rs.
	'93	10 850	380	Skeena, Cranberry Rs.
	'92	24 060	770	Skeena, Cranberry Rs.
	'91	23 000	475	Skeena, Cranberry Rs.
	'90	88 200	1 100	Skeena, Cranberry Rs.
	'89	196 200	1 730	Skeena, Cranberry Rs.
	'88	996 000	9 490	Skeena, Cranberry, Kispiox Rs.
	'87	820 000	11 100	Skeena, Cranberry, Kispiox Rs.
	'86	460 300	7 100	Skeena, Cranberry, Kispiox Rs.
	'85	389 500	4 100	Skeena, Cranberry, Kispiox, Suskwa
	'84	479 500	4 350	Skeena, Cranberry, Kispiox, Suskwa
	'83	276 900	3 880	Skeena, Cranberry, Kispiox, Suskwa
	'82	167 100	2 800	Skeena, Cranberry, Kispiox, Suskwa
	'81	68 960	2 690	Skeena, Cranberry, Kispiox, Suskwa
	'80	22 800	7 700	Skeena, Cranberry, Kispiox, Suskwa
	'79	15 600	2 800	Skeena, Cranberry, Kispiox, Suskwa
	'78	15 495	3 050	Skeena, Cranberry, Kispiox, Suskwa
	'77	8 570	2 400	Skeena, Cranberry, Kispiox, Suskwa
	'76	15 395	2 175	Skeena, Cranberry, Kispiox, Suskwa
	'75	15 125	1 796	Skeena, Cranberry, Kispiox, Suskwa
	'74	11 550	909	Skeena, Cranberry, Kispiox, Suskwa
	'73	5 500	2 178	Skeena, Cranberry, Kispiox, Suskwa
	'72	5 466	1 980	Skeena, Cranberry, Kispiox, Suskwa
	'71	3 550	1 200	Skeena, Cranberry Rs.
	'70	1 200	400	Skeena, Cranberry Rs.
	'69	100	--	
	pre '68	--	--	no records of major infestations

TSA	Year	# trees	# ha	Major infestation areas
Bulkley				
	'95	75 400	1 540	Telkwa, Bulkley Rs., Nilkitkwa L.
	'94	43 400	1 450	Telkwa R., Nilkitkwa L.
	'93	19 650	1 310	Telkwa R., Nilkitkwa L.
	'92	13 190	340	Telkwa R., Nilkitkwa L.
	'91	42 400	2 320	Telkwa, Bulkley Rs., Nilkitkwa L
	'90	48 000	1 080	Telkwa, Bulkley Rs., Nilkitkwa L
	'89	21 000	625	Telkwa, Bulkley Rs., Nilkitkwa L
	'89	21 000	625	Telkwa, Bulkley Rs., Nilkitkwa L
	'88	31 200	1 020	Telkwa, Bulkley Rs., Nilkitkwa L
	'87	225 000	3 300	Telkwa, Bulkley Rs., Harold Price
	'86	178 000	3 100	Telkwa, Bulkley Rs., Harold Price
	'85	185 000	3 300	Telkwa, Bulkley Rs., Harold Price
	'84	306 900	3 500	Telkwa, Bulkley Rs., Harold Price
	'83	273 600	3 300	Telkwa, Bulkley Rs., Harold Price
	'82	98 610	2 300	Telkwa, Bulkley Rs., Harold Price
	'81	103 000	1 730	Telkwa, Bulkley Rs., Harold Price
	'80	21 155	2 965	Telkwa, Bulkley Rs., Harold Price
	'79	12 915	1 795	Bulkley R., Harold Price Cr.
	'78	7 180	1 600	Bulkley R., Harold Price Cr.
	'77	2 960	1 120	Bulkley R., Harold Price Cr.
	'76	4 500	1 000	Harold Price Cr.
	'75	2 075	209	
	'74	2 880	186	
	'73	1 160	223	
	'72	240	16	
	'66-'71	--	--	
	'65	30	--	Babine L.
	'64	90	--	Babine L.
	'63	1 100	--	Babine L.
	'62	250	--	Babine L.
	pre '61	--	--	small infestations Babine
Morice				
	'95	138 000	3 725	Babine, Morrison Ls.
	'94	48 450	1 950	Morrison, Babine Ls.
	'93	19 250	4 000	Morrison, Babine Ls., Morice R.
	'92	8 490	1 230	Morrison, Babine Ls., Morice R.
	'91	11 850	1 570	Morrison, Babine Ls., Morice R.
	'90	1 330	50	Morrison, Babine Ls., Morice R.
	'89	2 270	60	Morrison, Babine Ls., Morice R.
	'88	5 300	510	Morrison, Babine Ls., Morice R.
	'87	25 000	300	Morrison, Babine Ls.
	'86	31 500	450	Morrison, Babine Ls.
	'85	76 000	2 000	Morrison, Babine Ls.
	'84	212 000	2 600	Morrison, Babine Ls.
	'83	143 000	3 900	Morrison, Babine Ls.
	'82	15 385	450	Morrison, Babine Ls.
	'81	6 000	142	Morrison, Babine Ls.
	'80	2 560	1 260	Morrison, Babine Ls.
	'79	535	144	Babine L.
	'78	90	10	
	'77	70	15	
	'76	550	40	

TSA	Year	# trees	# ha	Major infestation areas
Morice (Cont'd)				
	'75	243	35	
	'74	1 660	136	Houston
	'73	475	85	Houston
	'72	--	--	
	'71	100	5	
	'70	50	5	
	'69	--	--	
	'68	50	--	
	'67	20	--	
	'66	25	--	
	'65	50	--	
	'64	600	--	Babine L.
	'63	8 400	--	Babine L.
	'62	4 215	--	Babine L.
	'60-61	--	--	
	'59	5 000	--	Babine L.
	'58	20 000	--	Babine L.
	'57	50 000	--	Babine L.
	'50-56	300 000	13 600	Babine L.
Lakes				
	'95	62 000	2 220	Babine, Francois Ls., Tweedsmuir
	'94	26 800	1 025	Babine, Francois Ls., Tweedsmuir
	'93	1 900	230	scattered throughout TSA
	'92	1 040	30	Babine, Francois Ls.
	'91	1 900	230	Babine L.
	'90	1 500	60	Babine L.
	'89	550	75	Babine L.
	'88	2 800	200	Babine, Francois Ls.
	'87	6 000	100	Babine, Francois Ls.
	'86	2 500	50	Babine L.
	'85	6 000	100	Babine L.
	'84	24 800	850	Babine L.
	'83	66 400	1 800	Babine L.
	'82	4 360	110	Babine L.
	'81	400	35	Babine L.
	'80	1 720	630	Babine L.
	'79	425	52	Babine L.
	'78	40	5	
	'77	--	--	
	'76	325	5	
	'75	259	13	
	'74	1 010	102	
	'73	50	4	
	'66-72	--	--	no significant infestations
	'65	20	--	
	'64	50	--	
	'63	250	--	Babine L.
	'62	600	--	Babine L.
	pre '61	--	--	Babine infestation, see Morice TSA

Vancouver Forest Region

TSA	Year	# trees	# ha	Major infestation areas
Fraser				
	'95	4 500	50	Manning Park
	'94	4 500	95	Manning Park
	'93	1 875	50	Manning Park
	'92	600	40	Manning Park
	'91	1 200	80	Manning Park
	'90	--	--	
	'89	600	25	Hope - Boston Bar
	'88	2 300	95	Hope - Boston Bar
	'87	2 100	85	Hope - Boston Bar
	'86	4 850	190	Hope - Boston Bar
	'85	6 250	245	Hope - Boston Bar
	'84	50	15	Hope - Boston Bar
	'83	645	270	Hope - Boston Bar
	'82	830	140	Hope - Boston Bar
	'81	720	390	Hope - Boston Bar
	'80	9 846	452	Hope - Boston Bar
	'79	100	5	
	'78	350	21	
	'77	100	6	
	'76	856	51	
	'75	2 275	130	
	'74	1 545	92	
	'73	430	25	
	'72	470	28	
	'66-'71	--	--	scattered small groups
	'65	--	--	
	'64	400	--	
	'63	555	--	
	'62	2 010	--	Skagit, Fraser Rs., Silverhope C.
	'56-61	170 000	--	Skagit, Fraser Rs.
	'50-55	10 000	--	
Soo				
	'95	30 450	550	Birkenhead, Lillooet L.
	'94	15 300	330	Birkenhead, Gates
	'93	8 925	470	Birkenhead, Gates
	'92	14 775	735	Birkenhead, Gates
	'91	5 800	385	Lillooet L.
	'90	8 000	535	Lillooet L.
	'89	13 000	520	Lillooet L.
	'88	16 600	665	Lillooet L.
	'87	25 200	565	Lillooet L.
	'86	58 800	1 200	Lillooet L.
	'85	38 750	1 430	Lillooet L.
	'84	8 500	1 990	Lillooet L.
	'83	4 030	1 395	Lillooet L.
	'82	920	160	Lillooet L.
	'81	4 160	1 130	Lillooet L.
	'80	9 440	200	Lillooet L.
	'79	1 500	80	
	'78	680	40	

TSA	Year	# trees	# ha	Major infestation areas
Soo (Cont'd)				
	'77	330	20	
	'76	135	8	
	'75	1 570	60	
	'74	760	40	
	'73	2 500	95	
	'72	855	50	
	'71	250	10	
	pre '70	--	--	only occasional small pockets
Mid- coast				
	'95	3 600	40	Dean R.
	'94	3 600	40	Dean R.
	'93	225	5	Dean R.
	'92	0	0	
	'91	--	--	sporadic, Dean River drainage
Sunshine Coast				
	'95	--	--	
	'94	--	--	
	'93	--	--	
	'92	--	--	
	'91	--	--	
	'90	--	--	
	'89	--	--	
	'88	2 000	85	Homathko R.
	'87	28 200	820	Homathko R.
	'86	63 200	2 770	Homathko R.
	'85	57 500	2 520	Homathko R.
	'84	10 000	2 305	Homathko R.
	'83	2 200	400	Homathko R.
	'82	1 250	200	Homathko R.
	'81	--	--	
	'80	--	--	
Kingcome				
	'81-'95	--	--	
	'80	2 350	1 195	Klinaklini R.
	'79	25	5	
	'78	1 500	300	Klinaklini R.
	'77	4 000	2 560	Klinaklini R.
	'76	18 000	1 900	Klinaklini R.
	'75	40 000	2 400	Klinaklini R.
	'74	10 300	1 700	Klinaklini R.
	'72	--	--	
Strathcona/ Arrowsmith				
	70-80's	--	--	only occasional small pockets
	'65	10 000	--	widely scattered from Jordan R. to
	'64	30 000	--	Nimpkish L.
	'63	70 000	--	
	'62	70 000	--	
	'56-61	1 000 000	--	
	'51-55	1 300 000	--	
	pre'50	1 500 000	--	