Not for Publication*

ANNUAL DISTRICT REPORTS

FOREST INSECT AND DISEASE SURVEY

BRITISH COLUMBIA

1965

FOREST RESEARCH LABORATORY

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FOREST INSECT AND DISEASE SURVEY

BRITISH COLUMBIA

1965

R.L. Fiddick

FOREWORD

There was a marked decline in the Spruce bark beetle infestation in the Prince George and Prince Rupert Forest Districts in 1965. The attack on green standing trees was light. Recent windfall apparently absorbed a high percentage of the adult population .

Mountain pine beetle and Douglas-fir beetle infestations declined or remained static in most areas.

Black-headed budworm caused moderate defoliation of hemlock in patches of several hundred acres to several square miles in the eastern portion of the East Kamloops District and in the Central and West Nelson districts.

There was a remarkable increase in the population of the larch sawfly in the Nelson Forest District and in a number of areas in the Kamloops District. More than 350,000 acres of larch were affected.

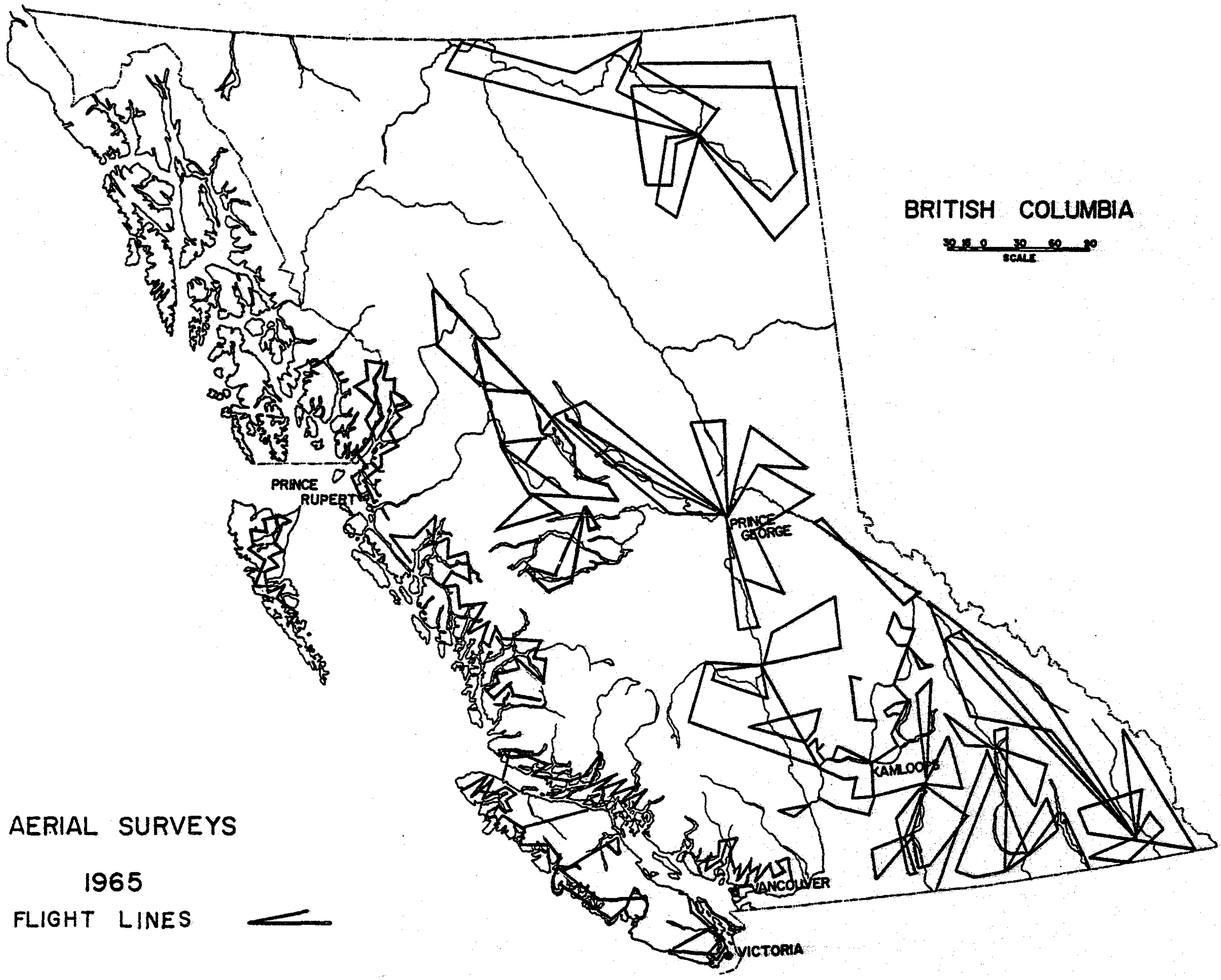
An outbreak of a needle miner, Epinotia sp., caused light to moderate defoliation of hemlock on some 80,000 acres on North Vancouver Island. Larvae had completed their feeding and were pupating in early June.

An intensive survey to determine the extent and intensity of balsam woolly aphid on the coast was carried out by members of the British Columbia Forest Service under the guidance of Insect and Disease Survey personnel.

Balsam mortality due to the insect-disease complex, Dryocoetes-ceratocystis, declined in 1965.

Increased use of aircraft to survey remote areas and to map infestations allowed more flexibility in the survey in 1965 and field personnel were able to devote more time to special problems and appraisal of insect damage.

The map on the following page shows areas covered by aerial surveys.



AERIAL SURVEYS

1965

FLIGHT LINES

FOREST INSECT AND DISEASE SURVEY

BRITISH COLUMBIA

1965

VANCOUVER FOREST DISTRICT

VANCOUVER ISLAND SECTION

FOREST INSECT AND DISEASE SURVEY

VANCOUVER FOREST DISTRICT

VANCOUVER ISLAND SECTION

1965

D.G. Collis

INTRODUCTION

Ranger assignments continued unchanged on Vancouver Island in 1965 with N.E. Alexander in the North Vancouver Island District for the fifth consecutive year and D. Collis in the South Vancouver Island District for the sixth.

Intensive surveys disclosed that balsam woolly aphid infestations extended from Sooke to Nanaimo.

Considerable defoliation of hemlock resulted from an outbreak of a needle miner, *Epinotia sp.*, near Holberg.

There was light frass drop from pine butterfly larvae in the Nanaimo and Chemainus River valleys. Egg counts indicated only moderate numbers of larvae for 1966.

No further spread of the European pine shoot moth was detected.

FOREST INSECT AND DISEASE SURVEY

SOUTH VANCOUVER ISLAND DISTRICT

1965

FOREST INSECT AND DISEASE SURVEY

SOUTH VANCOUVER ISLAND DISTRICT

1965

D.G. Collis

INTRODUCTION

The 1965 field season extended from March to October. Early surveys were made for balsam woolly aphid and European pine shoot moth. The annual forest insect and disease detection survey started on June 8 and continued until August 20. The remainder of the season was occupied with balsam woolly aphid plot examinations on the mainland and hemlock needle miner counts in the laboratory.

Table 1 shows the collections by host made by the writer and by co-operators. Map 1 shows the approximate locations of the sample points.

Numbers of larval defoliators found in field collections increased slightly this year. Excluding hand-picked samples, 62% of collections contained larvae in 1965, 41% in 1964, 51% in 1963 and 46% in 1962 .

Table 1

Collections by Hosts

South Vancouver Island District, 1965

Coniferous hosts	Forest insects	Forest diseases	Broad-leaved hosts	Forest insects	Forest diseases
Cedar, Port Orford	1		Aspen, trembling	1	
Cedar, western red	48	1	Alder, red	4	
Douglas-fir	148	4	Cottonwood, black	1	
Fir, amabilis	28		Maple, broadleaf	2	
Fir, grand	25	1	Oak, Garry	5	
Fir, spp.		3	Willow	2	
Hemlock, western	150	3	Chestnut		1
Larch, European	1	1	Totals	15	1
Pine, Austrian	9		Miscellaneous collections (all hosts):		
Pine, bishop	2		Victoria Insectary	221	
Pine, cluster	1		B.C. Forest Service	14	
Pine, lodgepole	47	2	Industry	2	
Pine, Monterey	1		Private co-operators	55	
Pine, Mugho	15				
Pine, ponderosa	6				
Pine, Scots	3				
Pine, western white	6				
Pine, spp.	10	17			
Spruce, Sitka	11				
Totals	512	32	GRAND TOTALS	819	33

FOREST INSECT CONDITIONS

Important Insects

Balsam Woolly Aphid <u>Adelges piceae</u>. (Ratz.)

To determine the extent of the balsam woolly aphid infestation on Vancouver Island, one research officer, the Victoria ranger staff, four Vernon rangers, two men from the forest industry and one temporary employee were engaged in a survey during February and March 1965. A branch sampling survey for the dormant stage was conducted. Where the insect was not obvious, two branch tips were taken from the upper third and two from the lower third of the crowns of each of three overstory grand fir trees at each locality. A mobile "Skyworker", capable of lifting a person to 50 feet, was used to sample the upper crowns. Two branches from each of three understory trees were also collected at each locality. All branches were examined in the laboratory for aphid.

Samples were taken at 172 localities from Qualicum Beach south to Victoria and Sooke. The aphid was found at 28 points south of Nanaimo. Most of the infested trees were in the Saanich Peninsula - Sooke areas. Infestations were also located at Gabriola Island, near Duncan, Mill Bay and on Saltspring Island.

In April, the Protection Division of the B.C. Forest Service assigned a crew of up to 12 members to expand and intensify the survey. The infestation boundaries were delineated and a program of felling spot infestations along the boundary of the main infestation was initiated with the hope of slowing the spread of the insect. This program is now under review because of the large number of attacked stems located by the intensive survey. The known extent of infested balsam to December 1965 is shown on Map 2.

Infested balsam were found at several Victoria nurseries; one nursery was taking cuttings from gouted trees. Although most infested stock has been sprayed, some nurseries are surrounded by infested grand fir and control measures can only be considered temporary.

Three study plots were established in 1965 in stands containing infested grand fir near Victoria. The following table summarizes tree conditions.

	Number of Trees				
Plot location	Not visibly infested	Gouted	Stem attacked	Dead	Total
Burnside Road	97	17	57	12	173
Thetis Lake No. 1	14	5	19	6	42
Thetis Lake No. 2	35	14	17	1	61

Little balsam mortality was recorded during aerial observations from Nanaimo south to Victoria and west to Sooke and Port Renfrew on November 2. Grand fir may live for several years after being heavily stem attacked. Present surveys indicate that the infestation is largely confined to grand fir trees at low elevation. However, at Deerholme, near Duncan, one aphid was taken in December from amabilis fir.

In a continuing program of biological control, 6025 predacious insects were released at Thetis Lake in 1965 .

European Pine Shoot Moth, Rhyacionia buoliana Schiff.

No spread of the pine shoot moth infestation was detected in 1965. Infested shoots came from trees in nurseries or those planted out as ornamentals in the Greater Victoria area. The results of the survey for the past three years are summarized in Table 2. The discrepancy between the large number of trees shown as infested and the relatively small number of larvae found is due to mined shoots being collected and submitted to the insectary without first determining the presence of an insect. Dissections of shoots for larvae were done in the laboratory. Not all infested shoots found were collected.

Table 2

Summary of Pine Shoot Moth Survey Showing Host Trees Examined, Number of Trees Infested and Number of Insect Species Found. South Vancouver Island District

Species of pine examined	No. trees examined			No. trees infested			No. collections containing larva or pupa					
							Rhyacionia buoliana			Epinotia hopkinsana		
	1963	1964	1965	1963	1964	1965	1963	1964	1965	1963	1964	1965
Austrian	126	430	1031	6	14	81	3	1	6			1
bishop	350	292	322	3	0	0						
cluster	119	100	370	1	0	0						
Japanese black	543	595	330	13	39	60	1	3	1			
lodgepole	329	1286	531	44	76	69		1	8	6	1	6
Monterey	350	442	174	13	2	0						
Mugho	457	883	1005	12	23	41	3	6	9	4		2
ponderosa	143	326	102	11	15	8				2		
red	100	62	50									
Scots	63	239	436		19	10		4	2			
strobus			472									
pine spp.	778	1284	442	20	9	10	1	1		5		
Total	3358	5939	5265	123	197	279	8	16	26	17	1	9
Total larvae or pupae							29	76	100	50	1	9

Pine Butterfly, Neophasia menapia (F. & F.)

Unusually large flights of pine butterfly adults occurred in the Chemainus and Nanaimo River valleys in 1964. During the summer of 1965 these areas were checked three times for indications of a heavy feeding population. Frass trays were set up in each valley on July 5. At this time no frass was seen but by July 16 it was present in trays and on beating sheets after sampling understory trees. The amount of frass which fell was light at all sample points compared to the Cathedral Grove infestation of 1959-61. Beating samples from understory hemlock on July 23 produced 16 Neophasia larvae and one pupa. Normally these insects are not found on the understory, so these probably dropped from the crowns of mature Douglas-fir to pupate.

Eighteen-inch branch tips from both valleys were gathered on December 2, 1965 and examined for eggs. Previously, whole branches had been examined but it was found to be difficult to locate intact branches after trees were felled. As in previous egg surveys, three branches were selected from the upper crown and one from the mid and lower crowns of each of three trees at each location. The results are listed in Table 3 along with the 1964 figures. It is probable there were more eggs per square foot of foliage on the 18-inch branch tips than on the previously used whole branch sample. Defoliation at all sample points was light and egg counts do not indicate a high population in 1966.

Table 3

Number of Pine Butterfly Eggs

South Vancouver Island District

Location	Area	Eggs per sq. ft. of foliage 1964	1965
Chemainus River			
	M		2.6
	S-3		7.0
	C-35	1.4	7.2
Nanaimo River	R-5		3.1
	D-16		0
Total		1.4	4.0

Green-striped Forest Looper, Melanolophia imitata Wlk.

For the second season, there was a considerable increase in the percentage of collections containing this insect. The average number of larvae per sample remained low as indicated in the following table.

Number of samples taken during larval period			% samples containing larvae			Average number of larvae per sample		
1963	1964	1965	1963	1964	1965	1963	1964	1965
293	324	380	1.3	4.6	16.8	1.0	1.0	1.6

After heavy feeding by this looper in 1960, two mortality plots were established near Ahousat. Total defoliation averaged 31.8% in one and 40.2% in the other plot at that time. The plot trees were re-examined in 1965. Only one suppressed hemlock had died. In 1961, 11 of 100 plot trees showed some top kill. In 1965, top kill was evident on 5 trees. The dead portions had either broken off or were obscured by new growth.

A Spruce Tip Moth Zeiraphera spp.

Sitka spruce growing along West Coast beaches were damaged by tip moth larvae for the third consecutive year. At Port Renfrew, where damage was less than in 1964, 60% of the shoots examined were mined but few were killed. Some small trees lost up to 90% of their current foliage but overall defoliation did not exceed 15%. Little feeding occurred in the top third of larger trees. In the Nitinat area, beach fringe spruce lost an average of 50% and up to 90% of their new foliage. At Long Beach, 76% of the new shoots suffered some feeding but overall defoliation was light.

Fall Webworm, Hyphantria cunea (Drury)

Webs have been common along roadsides for many years but they were extremely scarce in 1965. Counts of webs made over a mile of road near Ladysmith have shown a steady decline over the last five years, as follows: 167, 127, 63, 34 and 1.

A Tortricid on Oak, Pandemis ribeana Hubner

Garry oak in the Saanich area of Greater Victoria were lightly to moderately defoliated in the spring of 1965 by a complex of several insects. The majority of the feeding was done by a tortricid, Pandemis ribeana Hubner. This is apparently the first record of the insect in Canada; trees in this area have been sampled for oak looper larvae, Lambdina somniaria (Hulst) for many years. The insect was observed feeding on other vegetation and so it is possible that the population built up on ground cover before attacking oak. Adults were flying in June but there was no evidence of a second generation during the summer.

A Pine Aphid Pineus sylvestris Annand

Stem and branch infestations of this aphid appear to have increased on exotic pines. Affected hosts included Pinus strobus, P. mugho and P. sylvestris with the heaviest attacks occurring on the latter. The insects' distribution appears to be restricted to western North America where its natural host is probably *Pinus radiata*.

Silver-spotted Tiger Moth, *Halisidota argentata* Pack.

There was an increase in the number of webs recorded in roadside counts in the spring of 1965. A summary of records covering the last four years appears in Table 4.

Table 4

Roadside Web Counts of Silver-spotted Tiger Moth Colonies,

South Vancouver Island District

Area surveyed	Total no. webs recorded				Average no. webs per mile			
	1962	1963	1964	1965	1962	1963	1964	1965
Victoria to Duncan	1592	200	75	51	49.0	5.7	2.2	1.5
Duncan to Nanaimo	743	9	16	130	23.4	0.2	0.5	3.9
Nanaimo to Parksville	940	39	24	125	40.3	1.7	1.3	5.6
Parksville to Cameron L.	416	53	12	44	28.5	3.6	0.8	3.0
Duncan to Lake Cowichan	181	23	33	5	10.4	1.2	1.8	0.3
Lake Cowichan to Youbou	170	14	6	1	17.7	1.3	0.7	.09
Total	4042	338	166	356	31.3	2.4	1.3	2.7

Coniferous Sawflies, *Neodiprion* spp.

Neodiprion larvae were found more frequently than any other in the District. The 57 positive samples averaged 9.6 larvae each. A maximum of 183 larvae were collected near Ucluelet, 75 near Ahousat and 65 at Jump Creek. Colonies were also found feeding on Monterey pine near Ladysmith.

Other Noteworthy Insects

Insect	Host	No. of Collections	Remarks
Acleris variana (Fern.)	F, H, Bg	12	Black-headed budworm increased slightly for the second consecutive year. Collections averaged 1.4 larvae each.
Choristoneura fumiferana (Clem.)	F, H, Bg, Pl	11	Only one collection of spruce budworm in 1964. Samples averaged 1.7 larvae in 1965.

Other Noteworthy Insects

Insect	Host	No. of Collections	Remarks
Contarinia spp.	F	0	Light needle miner attacks on mature Douglas-fir, wide spread.
Ectropis crepuscularia (Schiff.)	F,H,C	8	One saddleback looper per collection found in 1965; only two larvae found in 1964.
Lambdina fiscellaria lugubrosa (Hulst)	H	1	Western hemlock looper is continually scarce.
Lecanium coryli Linn.	D,M,W	0	Scale insect a continuing problem on deciduous hosts.
Malacosoma spp.	numerous	0	Tent caterpillar much reduced from 1964. Only a problem in orchards and road side thickets.
Mindarus abietinus Koch	B, Bg	0	Continuous attacks of balsam twig aphid on grand and amabilis firs, causing needle and twig deformities.
Nyctobia limitaria (Wlk.)	F. H, Bg, C	27	Thirty-eight larvae of the green balsam looper found, mostly from Douglas-fir.
Pissodes sitchensis Hopk.	S	0	Continuous attack by Sitka-spruce weevil in the San Juan, Nitinat, Sarita and Kennedy Lake areas.
Stilpnotia salicis (L.)	*populus* spp.	0	Spot infestations of satin moth in Saanich and Langford.

FOREST DISEASE CONDITIONS

Heavier than normal snow fall caused considerable damage to regeneration and second growth stands throughout the District in 1965. Hardest hit were alder and exotic pines. Low temperatures also damaged the cambial layers of many exotics, but the extent of this injury will not be known until the 1966 examinations.

Important Diseases

Red Band Disease, Dothistroma pini Hulbary

Damage to exotic pines planted on the west coast of Vancouver Island continued in 1965. As in the past, infection was most severe on Monterey Pine; two plots of 50 trees each suffered complete mortality in three years (Table 5.) Bishop pine, though heavily damaged in some plots, was making remarkable growth in others and some trees may, with this increase in height and improved light, survive the disease. D. pini has also been identified on cluster pine foliage, a new host record, and needle loss in some plantations has now reached 50%. The perfect stage of this organism was discovered on lodgepole pine foliage and was described by Drs. Funk and Parker of the Victoria Laboratory.

Table 5

Per Cent Defoliation and Tree Mortality Caused by

Red Band Disease, South Vancouver Island District

Host	Plantation number	Average % foliage loss			No. of living trees		
		1963	1964	1965	1963	1964	1965
Monterey pine	175	3.3	8.7	45.2	50	50	50
	177	8.6	16.6	55.1	50	47	39
	178	9.8	8.6	37.3	50	50	45
	189	63.2	86.7	91.5	47	29	4
	190	49.0	68.0	86.6	50	50	13
	112	61.2	99.0	100.0	50	14	0
	151	44.0	78.0	84.0	46	43	6
	158	72.0	92.1	100.0	50	36	0
Bishop pine	175	0	3.0	6.0	50	50	50
	177	2.0	10.5	25.1	50	50	49
	178	0	4.8	14.1	50	50	49
	112	28.9	59.3	70.0	50	46	35
	151	1.3	9.6	11.6	50	50	49
	158	0	18.9	47.3	47	46	46

Exotic Plantations

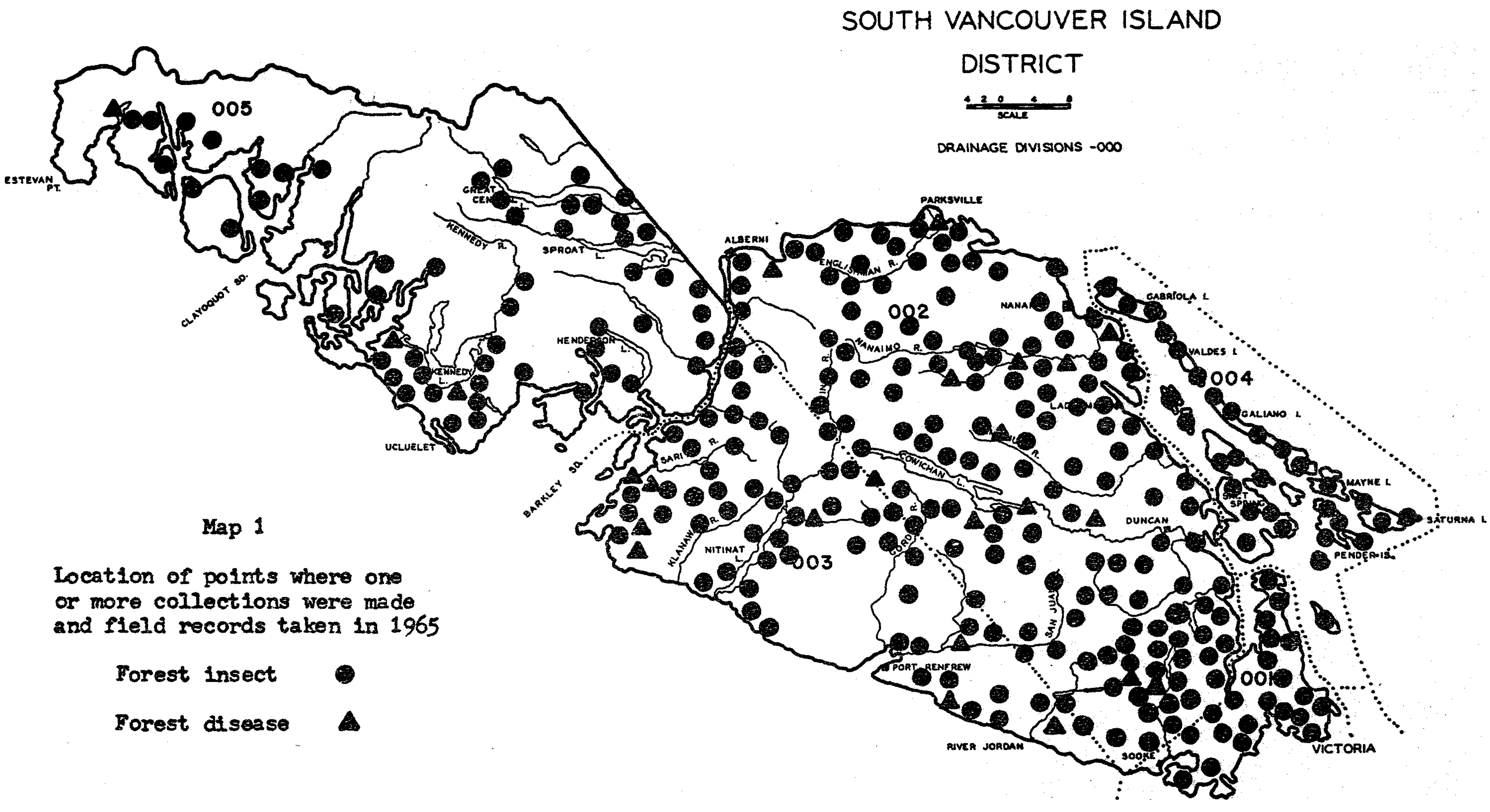
Considerable effort and time were again expended in the examination of exotic plantations in this District. This survey was conducted to check for the occurrence of both native and introduced diseases or insects. Plots examined in 1965 were as follows:

XP Number	Location	Exotic species	Remarks
28 B	Robertson River	Larix Europeae	No problems, max. ht. 25' .
28 C	Robertson River	Larix Europeae	Good growth, dbh up to 9" .
29	Robertson River	Picea glauca	Very slow growth .
30	Sutton Creek	Pinus sylvestris	Planted 1953, maximum height 11', average 8', light snow breakage.
32	Sutton Creek	Pinus resinosa	Planted 1953, maximum ht. 12', 24 of 50 trees snow bent or broken.
53	San Juan River	Chamaecyparis lawsoniana	Planted 1955, maximum ht. 14', under strong competition from native species, which are out growing same.
75	Harmac	Mixture	Pitch moth on ponderosa pine.
90	Lake Cowichan	Nothofagus sp.	All trees apparently suffering heavy winter damage when examined on June 2.
112	Kennedy Lake	Pinus radiata	See Table 5; all trees dead.
112	Kennedy Lake	Pinus muricata	See Table 5; some trees still making up to 4 feet of growth per year.
112	Kennedy Lake	Pinus pinaster	Thirty per cent of trees snow bent, average of 21% defoliation from Dothistroma pini.
151	Kennedy Lake	Pinus radiata	See Table 5.
151	Kennedy Lake	Pinus muricata	See Table 5.
151	Kennedy Lake	Pinus pinaster	Twenty per cent of trees snow broken, maximum ht. 20'.
153	Wilson Creek	Pinus muricata	Forty-three trees located, all snow bent and broken.
154	Wilson Creek	Pinus radiata	Eleven trees located, all snow bent and broken.
155	Wilson Creek	Pinus pinaster	Five trees located, all snow bent and broken.
158	Kennedy Lake	Pinus radiata	See Table 5, all plot trees dead.
158	Kennedy Lake	Pinus muricata	See Table 5.
158	Kennedy Lake	Pinus pinaster	Twenty-five % of trees dead. Defoliation caused by D. Pini averages 50%.
175	Sarita River	Pinus radiata	See Table 5. Maximum height up to 16 feet. Planted 1958.
175	Sarita River	Pinus muricata	See Table 5. Spring planted in 1958. Some trees now 25 feet high.
175	Sarita River	Pinus pinaster	Slow growing, poor looking trees.
176	Sarita River	Pinus muricata	Very good growth. D.Pini infection light. Some snow damage.
176	Sarita River	Pinus pinaster	Forty-two trees located of which 14 were dead. Trees are snow damaged and chlorotic.
177	Pachena River	Pinus radiata	See Table 5. Trees in other parts of plantation mainly dead.
177	Pachena River	Pinus muricata	See Table 5. Some trees still making good growth. Maximum height 20 feet, planted in 1958.

XP Number	Location	Exotic species	Remarks
177	Pachena River	*Pinus pinaster*	*D. pini* causing only light defoliation. Trees 98% bent.
178	Coleman Creek	Pinus *radiata*	See Table 5. Trees not thrifty, may be winter damage.
178	Coleman Creek	*Pinus muricata*	See Table 5. Many of these trees appear to be dying, possible winter damage.
178	Coleman Creek	*Pinus pinaster*	Majority of trees snow bent, chlorotic and slow growing.
179	Bamfield	*Pinus nigra*	Trees healthy and sturdy but will be overtaken by native species.
189	Bamfield	*Pinus radiata*	See Table 5. All trees in plantation will be dead in 1966.
189	Bamfield	*Pinus pinaster*	Heavy needle loss caused by *D.pini*. Plot averages 50% defoliation with individual loss up to 75% .
190	Bamfield	Pinus *radiata*	See Table 5. Complete mortality can be expected in 1966.
194	Nanaimo	*Pinus pinaster*	Slow growth, 92% of trees snow bent.
195	Chemainus River	*Pinus pinaster*	All trees deformed by snow press.
197	Haslam Creek	*Pinus radiata*	All trees dead.
198	Ladysmith	Mixed conifer	All trees seriously damaged by deer. Majority of trees dead.

Other Noteworthy Diseases

Host	Organism	Locality	Remarks
Cluster and bishop pines	*Sclerophoma* sp.	Nanaimo Bamfield	New host record on cluster pine
Amabilis fir	*Hypoderma robustum* Tub. and *Lophodermium consociatum* Darker	Coleman Creek	H. robustum found in immature stage, with *L. consociatum* in all stages of maturity preventing fruiting of the former. Both new records.

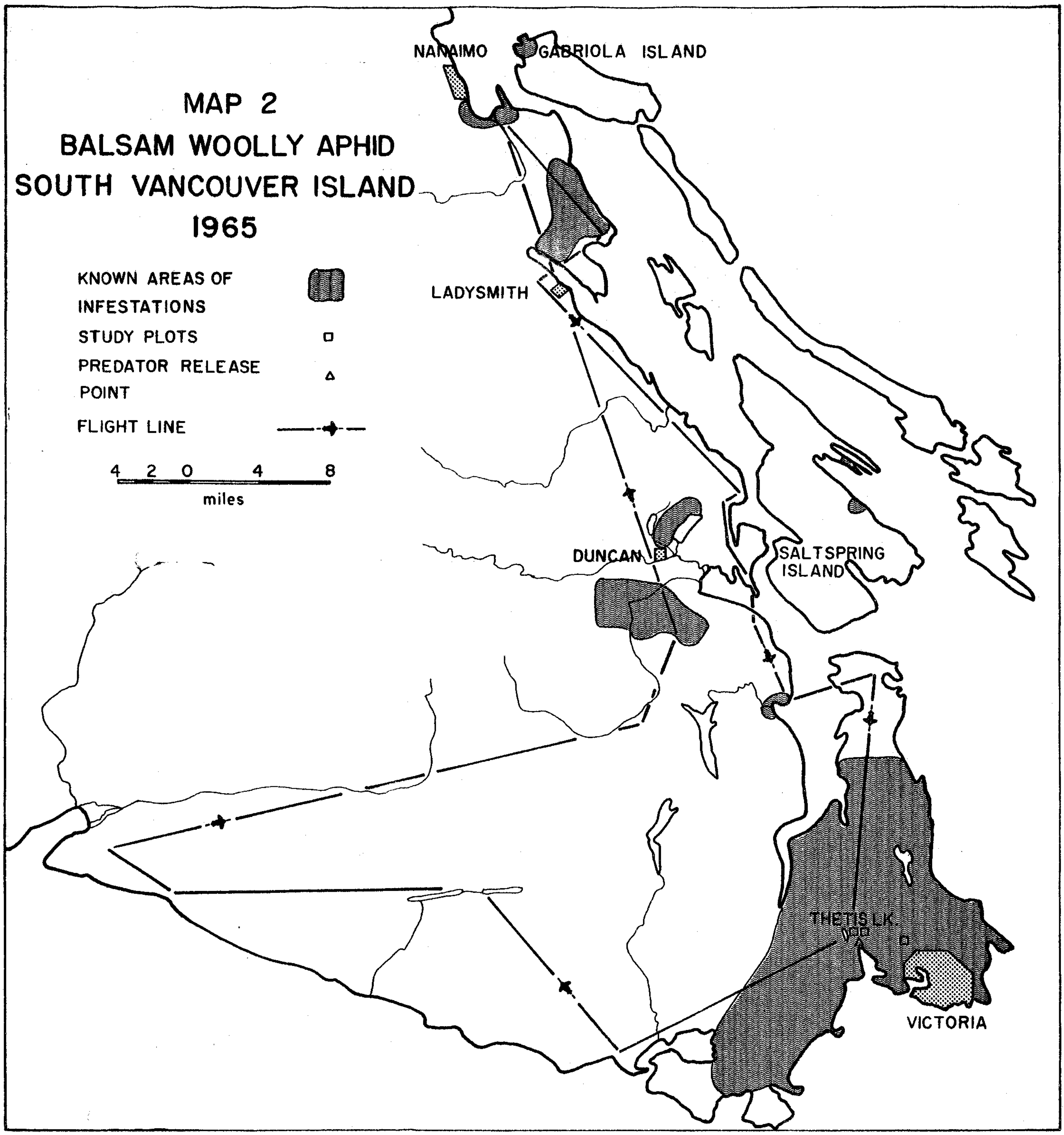


Map 1

Location of points where one or more collections were made and field records taken in 1965

Forest insect ●

Forest disease ▲


MAP 2
BALSAM WOOLLY APHID
SOUTH VANCOUVER ISLAND
1965
KNOWN AREAS OF INFESTATIONS
STUDY PLOTS
PREDATOR RELEASE POINT
FLIGHT LINE
4 2 0 4 8
miles
NANAIMO
GABRIOLA ISLAND
LADYSMITH
DUNCAN
SALTSPRING ISLAND
THETIS LK.
VICTORIA

FOREST INSECT AND DISEASE SURVEY

NORTH VANCOUVER ISLAND DISTRICT

1965

FOREST INSECT AND DISEASE SURVEY
NORTH VANCOUVER ISLAND DISTRICT

1965

N.E. Alexander

INTRODUCTION

The Forest Insect and Disease Survey in the District commenced in mid May and ended in August. Insect populations were at a slightly higher level than in 1964.

The principal insect problem was an outbreak of a hemlock needle miner, *Epinotia* sp., at Holberg and Buck Creek at the northern end of Vancouver Island (D.D. 025). Considerable time and effort was spent investigating this infestation.

The pine butterfly, *Neophasia menapia* (F. & F.), was present in higher than usual numbers in the Nimpkish Valley (D.D. 024), as evidenced by the flight of adult butterflies in August.

A "Found" aircraft was used for the routine survey of the west coast and the operation was very successful, largely owing to good weather.

A total of 348 forest insect and 18 forest disease collections was made during the field season. Collections are listed by hosts in Table 1 and Map 1 shows the location of points where collections were made and the boundaries of the Drainage Divisions referred to in the text of the report.

The author would like to take this opportunity to express thanks to personnel of Rayonier (Canada) Ltd. and Canadian Forest Products whose initiative in reporting unusual insect conditions and subsequent cooperation did so much to expedite the season's work.

Table 1

Collections by Hosts
North Vancouver Island District, 1965

Coniferous hosts	Forest insects	Forest diseases	Broad-leaved hosts	Forest insects	Forest diseases
Cedar	1	-	Alder, red	2	1
Cedar, western red	18	-	Aspen, trembling	1	-
			Maple	1	-
Douglas-fir	69	2	Oak, Garry	1	-
Fir	6	-	Poplar	1	-
Fir, amabilis	37	-	Willow	4	1
Fir, grand	12	1	Yew	-	1
Hemlock	3	-			
Hemlock, mountain	2	-			
Hemlock, western	166	3			
Pine	3	-			
Pine, cluster	-	1			
Pine, lodgepole	3	4			
Pine, red	-	1			
Pine, Scots	1	-			
Pine, shore	5	-			
Pine, western white	4	-			
Spruce, Norway	-	1			
Spruce, Sitka	8	2			
Totals	338	15	Totals	10	3
			GRAND TOTALS	348	18

FOREST INSECT CONDITIONS

Important Insects

A Hemlock Needle Miner, *Epinotia* sp.

In mid May 1965, discoloration of hemlock was reported by Rayonier personnel at Holberg. A sample of foliage submitted to Forest Research Laboratory, Victoria was defoliated by needle- and twig-mining insects similar to the condition recorded at Ida Lake in D.D. 024 in 1963. An investigation at Holberg revealed the infestation to be extensive and potentially serious. The damage could not be associated with any insect previously encountered by the Survey. Subsequent investigations by S. Condrashoff, revealed that two species of insect were involved: *Argyresthia* sp., a member of a family of insects that are largely leaf and shoot miners, and *Epinotia* sp., a needle mining insect previously unrecorded by the Survey in British Columbia and not described in the literature. The latter insect was identified to genus by Dr. T.N. Freeman, Entomological Research Institute, Canada Department of Agriculture, Ottawa.

Damage

The affected trees were damaged by having their twigs mined by *Argyresthia* and their needles both mined and partially excavated by *Epinotia* larvae. *Epinotia* was determined to be the principal cause of damage. Both mining and excavation caused the needles to brown and drop, a condition which became most apparent in the first weeks of May, coinciding with the last stadia of the larvae, and reached a height of colour at about the time of pupation near the middle of May. As the needles dropped from the trees the damage became less and less apparent under casual observation and when the trees finally flushed their 1965 foliage in August the defoliation was hard to detect.

The infested area at Holberg exceeded 83,000 acres with approximately 17,400 acres of moderate and 18,240 acres of heavy defoliation. Light defoliation was found in all areas, both in reproduction and in mature timber, but moderate to heavy defoliation was confined to mature and overmature stands. Because of the varied logging pattern in the area, however, a precise delineation of affected stands could not be made and the areas mapped represent general outlines (Map 2).

In addition to the Holberg infestation, defoliation was observed on approximately 17,680 acres in the Buck Creek-LeMare Lake area. This area lies to the south of Quatsino Sound and to the north of Klaskino Inlet. Ground examinations were not made in this area. Except for about 1,000 acres south and west of LeMare Lake and south of Culeet Creek, the Buck Creek infestation appeared to be lighter than that at Holberg.

At Holberg, ocular estimates of defoliation on sample trees in heavily defoliated areas showed up to 80% loss of one-year old and older foliage. Heaviest defoliation occurred in the lower crown of dominant trees, in the lower and middle crown of co-dominant trees, and in the upper or entire crown of intermediate or suppressed trees. Cedar was not attacked and amabilis fir had only the occasional needle damaged. Distribution of defoliation by % classes is shown in Table 2.

Biological studies indicated that initial defoliation likely started in the fall of 1964 with the greatest damage being done in March and April of 1965 coincident with the last stadia of the feeding larvae. Typical needle damage is shown in Figure 1. Mining of the entire needles occurred in te-production stands where loss of foliage was light.

Table 2

Distribution of Defoliation by % Classes,

North Vancouver Island, 1965

Total defoliation in %	Number of trees			% of trees in defoliation class.
	S.E. area	S.W. area	North area	
90+	0	0	0	0
80-89	1	2	5	4.4
70-79	12	3	7	12.1
60-69	14	5	6	13.7
50-59	7	11	19	20.3
40-49	4	13	19	19.8
30-39	8	8	15	17.0
20-29	3	8	7	9.9
10-19	2	0	3	2.7
0-9	0	0	0	0
Total trees (182)	51	50	81	

Defoliation was not confined to valley bottoms or ridges but was general over all aspects at about the 1000' level.

Defoliation caused by this insect in any one year is the result of feeding in the fall and following spring. It did not appear that the 1964-1965 defoliation would result in appreciable tree mortality.

Sampling methods

Three mature hemlock stands were selected: two heavily defoliated (Pegattem Creek and Port Hardy Access Road) and one unattacked or lightly infested (Br.N50). Five dominant or co-dominant trees were felled at each location and 5 18-inch branch tips taken from each upper crown level. In addition, 5 18-inch branch tips were taken from each of 5 reproduction trees near these sampling areas. Samples were taken at 2 month intervals by Rayonier company personnel and shipped to the Forest Research Laboratory where observations were made of the pupae, adults, eggs, and larvae to learn about their life history, larval feeding behaviour at various times of the year, factors leading to severe defoliation, and natural control factors. This project will continue in the 1966 season.

In addition to the ground sampling as described several flights were made in both fixed-wing aircraft and helicopters to delineate areas and intensities of infestation. Ground checks verified the extent of the infestation.

Experimental control

An experimental spray project was carried out by Rayonier (Canada) Ltd. on August 18 in cooperation with the Department of Forestry of Canada and the Department of Fisheries of Canada. This project was undertaken to find an insecticide which would be effective against Epinotia sp. which feeds within the needle during its early instars. Two systemic insecticides, phosphamidon and dimethoate formulated at the rate of one-half pound of active ingredient per U.S. gallon of water were applied by helicopter at one U.S. gallon per acre. A surfactant, Invadine JFC, and dyes were added to the mix to facilitate leaf penetration and spray assessment.

One plot of 60 acres was sprayed with phosphamidon, another of 40 acres with dimethoate, and the third was used as a check. In addition, one-half mile of stream was sprayed with dimethoate as a check on fish mortality. It was found to be reasonably safe with caged salmon fry.

Both materials were active against the insect and were capable of some control. A greater degree of control may have been affected if all eggs had hatched before the date of spray rather than the estimated 70%. Mortality of the insects in the plots was 23% in the check, 72% in the phosphamidon-treated area, and 83% in the dimethoate-treated area. Whether this degree of control will be effective in preventing damage will not be known until spring of 1966 when final assessments and comparisons can be made.

Discussion

Little was known about this insect, Epinotia sp., which caused severe defoliation of forest stands very early in the season. Pupation occurred in the early spring and adults emerged from early June through July (when peak emergence took place), and into August. Eggs were laid from June 23 on, with more than half being laid before July 16. More than 70% of the eggs had hatched by August 16; the larvae then entered the needles to feed.

Larvae reared in the laboratory mined more than four needles each since emergence and will remain in the needles until spring, when they may adopt external feeding habit.

Larval counts made on the foliage samples indicated a population of some 30 to 60 larvae per 18-inch tip. Larvae were still actively mining in November when between 10 and 25% of the foliage had been mined. Comparing the number of larvae present in the samples in November with the number of pupae found in the spring of 1965 and allowing a generous percentage for overwintering larval mortality, it would appear that the population in the spring of 1966 will be similar to that which existed in the spring of 1965. The infestation at Ida Lake in 1963 disappeared without a trace after causing heavy defoliation in the spring. That population, however, collapsed in either the late larval instars or the pupal stage. There is no evidence of such heavy disease or parasitism in this current population to indicate that a similar collapse will occur. It may be possible that winter or spring weather will play a decisive role in the survival of the population.

Summary

The hemlock stands in the vicinity of Holberg and Buck Creek in D.D. 025 suffered heavy defoliation by a species of needle mining insect during the spring of 1965. Defoliation was not sufficient to kill trees in one season. The insect population survived the summer and fall and is overwintering in the larval stage. If sufficient larvae come through the winter, and if they follow the same feeding habits as in the spring of 1965, there is the danger of extensive tree mortality in the areas of heavy 1965 defoliation.

Pine Butterfly, Neophasia menapia, (F. & F.)

Populations of pine butterfly have fluctuated in the Nimpkish Valley in D.D. 024 for a number of years but the only serious defoliation recorded was in 1963 when some of the mature Douglas-fir lost up to 55% of their total foliage complement. This was the heaviest defoliation recorded for this insect in the coastal forests. Egg counts in the fall of 1963 ranged from 0.8 eggs per sq. ft. of foliage to 4.9 and averaged 2.0 . These samples were taken from entire branches of foliage. At the time of examination, 54% of the eggs had suffered predation or were otherwise unviable. In 1964, there was no sign of larval activity and the adult flight was delayed by bad weather well into the fall. There was no noticeable larval activity in the summer of 1965 (as indicated by frass fall) but a heavy butterfly flight was reported in August. Some feeding occurred during the summer, and when egg counts were made in the fall a fair number of eggs were found, with a very high count in one location.

Branch samples were taken by the forestry staff of Canadian Forest Products Englewood Division at seven locations during November and submitted to the Forest Research Laboratory for examination. At each location three trees were sampled and three 18-inch branch tips were taken from each upper crown, one from each mid crown, and one from each lower crown, making a total of 15 branch tips at each sample location. The number of eggs per tip and per square foot are shown in Table 3. These counts are not directly comparable with those made in previous years from entire branches as we are now using the more practical 18" branch tip for field sampling.

Table 3
Pine Butterfly Egg Counts, North Vancouver Island, D.D. 024, 1965

Location	Sq. ft. foliage sampled	Eggs per sq. ft.			Range of eggs per 18-inch tip
		Viable	Unviable	Total	
Mile 15	10.0	1.0	0.0	1.0	0.0 - 10.0
Upper Woss Rd.	18.2	0.0	0.0	0.0	0.0 - 0.0
Duncan Rd.	9.6	11.8	0.2	12.0	0.0 - 30.8
Maquilla Rd.	20.8	0.7	0.0	0.7	0.0 - 14.0
Vernon Lake	11.0	0.7	0.0	0.7	0.0 - 8.0
Vernon Rd.	19.9	0.8	0.0	0.8	0.0 - 11.0
Alston Rd.	8.9	1.5	0.0	1.5	0.0 - 13.0

Egg counts varied markedly at the various locations in the Nimpkish Valley. This is to be expected with this insect as it has repeatedly shown a tendency to reach high population levels in very restricted areas, not only within major geographic areas such as Vancouver Island, but also within smaller divisions such as the Englishman and Nanaimo River drainages, the areas round McMillan Park, and within the Nimpkish Valley. Since the egg samples made were separated by as much as 8 miles and were located in relatively small forests created by logging patterns, the count at each locality could be considered only as representative of that specific area.

Considering our knowledge of egg counts and subsequent population levels, and considering each location as a separate entity, it would appear then that the overwintering egg populations at Maquilla Road, Vernon Lake, and Vernon Road will be enough to maintain the present population levels into 1966. The population at Mile 15 and Alston Rd. may increase and the population at Duncan Road is likely to show an increase. There is no reason to believe that tree mortality could occur from population levels which might occur in 1966 unless there is an unusual gain in both larval numbers and larval feeding.

Green-striped Forest Looper, Melanolophia imitata Wlk.

The green-striped forest looper population showed a slight rise in 1965, although it was still at a very low level. The fluctuations over the last three years were as follows:

Number of samples taken during larval period			% samples containing larvae			Average number of larvae per sample		
1963	1964	1965	1963	1964	1965	1963	1964	1965
248	309	301	2.4	1.6	15.6	1.8	2.0	2.9

Black-headed Budworm, Acleris variana (Fern.)

The black-headed budworm population remained at a very low level in 1965 with 4.7% of 253 collections averaging 2.0 larvae each.

During examination of Douglas-fir foliage from the Nimpkish Valley (D.D. 024), budworm eggs were noticed occasionally.

Pacific Willow Leaf Beetle, Galerucella carbo (Lec.)

This leaf beetle has been at infestation levels in D.D. 021 and D.D. 022 for at least the last 5 years. In 1961, defoliation of willow was most evident in the areas around Menzies Bay and south to Campbell River. The infestation now appears to have spread both north and south from that centre and is most evident in the Tsolum and Salmon River valleys.

The intensity of the infestation varied with the incidence of the preferred host, Salix spp., and the areas described as being infested had a high beetle population and abundant willow.

Sporadic heavy feeding occurred throughout drainages 022 and 021 from Kelsey Bay south to Parksville and west to the Ash River valley. Many trees had 100% of their leaves at least partly skeletonized. As is common with most deciduous trees, defoliation appeared to do little damage. In economic terms there may be some beneficial value to defoliation in areas where considerable effort is spent trying to inhibit deciduous growth so that conifers may better survive and grow.

Silver-spotted Tiger Moth, _Halisidota argentata_ Pack.

The population of silver-spotted tiger moths increased in the area between Parksville and Campbell River in 1965. A summary of web counts since 1960 is as follows:

Table 4
Silver-spotted Tiger Moth Webs, North Vancouver Island District

Year	Total number of webs recorded	Average number of webs per mile
1960	97	1.2
1961	441	5.6
1962	3,466	37.4
1963	87	1.0
1964	32	0.4
1965	211	3.8

Other Noteworthy Insects

Insect	Host	Number of collections	Remarks
Adelges piceae (Ratz.)	B, Ba, Bg	0	No balsam woolly aphid were found in examinations made throughout the district.
Choristoneura fumiferana (Clem.)	F, B	2	1% of 88 collections averaged 1.0 spruce budworm larvae.
Hyphantria _cunea_	Deciduous	-	Very low, 17 fall webworm tents in 1 mile strip.
Lambdina fiscellaria lugubrosa (Hulst)	H, S	4	1.5% of 263 collections averaged one hemlock looper larva.
Neodiprion spp.	Conifers	44	One isolated Pl shade tree at Alberni 80% defoliated. Otherwise of common occurrence in low numbers. Av. 7.3 sawfly larvae per collection.
Stilpnotia salicis (L.)		1	Population of satin moth at Courtenay has disappeared leaving signs of _Apanteles_ parasitism.

FOREST DISEASE CONDITIONS

Important Diseases

A Needle cast on Lodgepole pine.

A needle cast was severe on lodgepole pine in several parts of the District during 1965. In one location at Qualicum Beach, more than 80% of the trees were infected. At Campbell Lake some trees had lost up to 80% of their foliage and 75% of the trees were infected. This needle cast is caused by a fungus in the family Hypodermataceae and is presently under study in the laboratory.

A Canker disease on Red alder.

An unusual condition was noted on red alder in the Tsable River area where in one small area approximately 60% of the small alder stems had a yellowish blistering and canker formation. Samples were submitted to the laboratory and specimens are presently in Ottawa being identified.

Douglas-fir Needle Blight, Rhabdocline pseudotsugae Syd.

The Douglas-fir needle blight was much more in evidence during 1965 than in the last few years. Many trees in the Bowser area had lost up to 75% of their pre-1965 foliage. This disease was also noted throughout most of D.D. 021.

Exotic Plantations

There was only one instance of serious mortality in exotic plantations on northern Vancouver Island. This was on Pinus radiata near Alberni. Two plantations, one of Lawson cyprus and the other of Larix decidua, were heavily snow pressed. A summary of conditions found in exotic plantations is shown in Table 5.

Table 5

Summary of Disease Conditions on Exotic Plantations

XP Number	Location	Exotic species	Remarks
13	Tsolum	Pinus sylvestris	100% of stems lightly infested by an adelgid, ? Pineus sp.
17	Tsolum	Chamaecyparis lawsoniana	22% of stems broken by snow.
18	Tsolum	Picea abies	58% of stems with more than 50% of their buds infected by an unidentified bud necrosis. Only 8% of stems infested by Adelges.
26	Campbell Lake	Pinus sylvestris	This plantation has been unsuccessful.

Table 5- Cont'd.

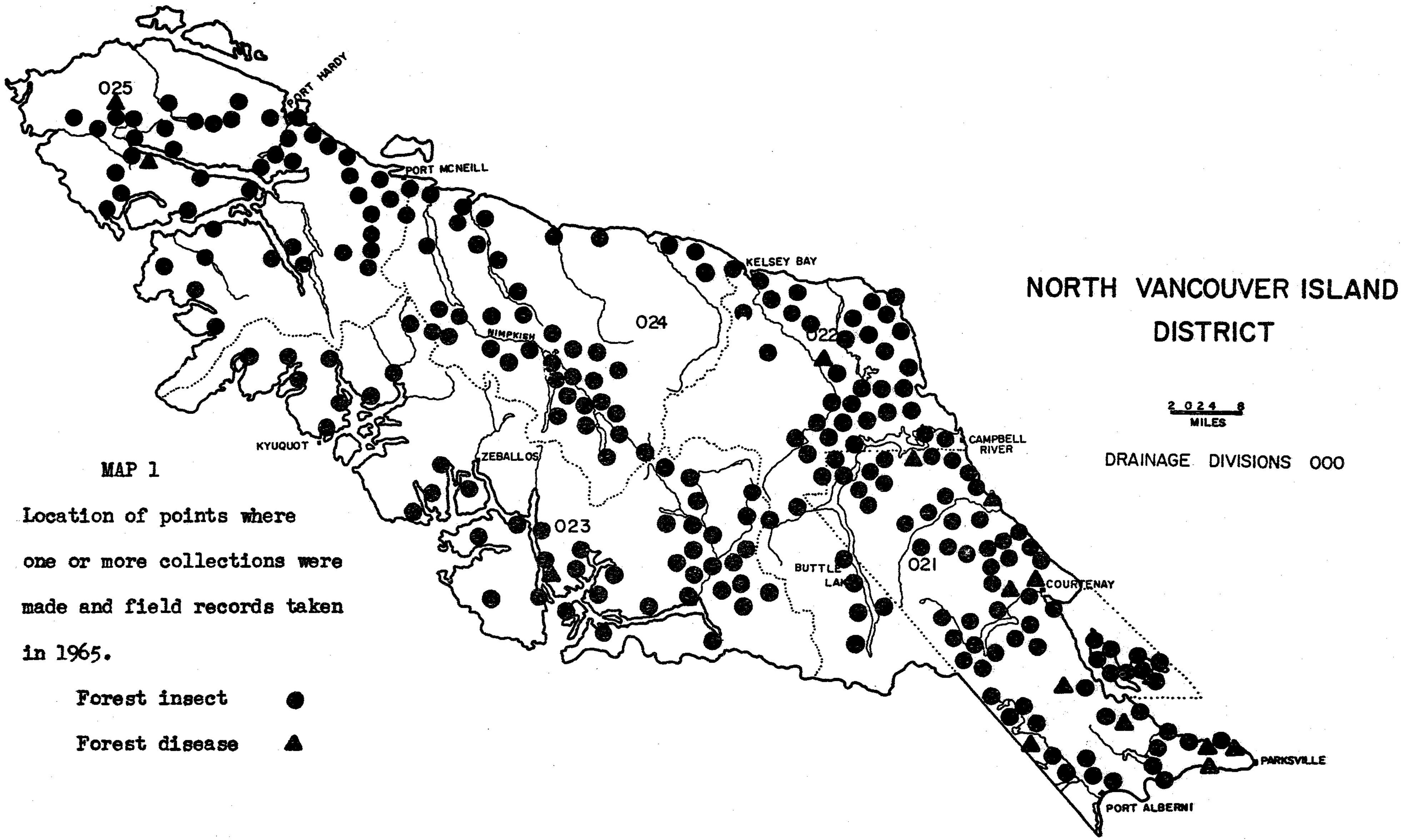
XP Number	Location	Exotic species	Remarks
38	Campbell River	Pinus resinosa	Only 5 of 10 trees remain. Unlikely to succeed as native fir overtopping.
42	Bowser	Pinus resinosa	19 of 25 trees survive. Native pines and fir overtopping. Light infection by a Hypodermataceous needle cast.
56	Sayward	Pinus resinosa	10% of stems mined by an Oleu-threutid. Otherwise very healthy.
57	Sayward	Larix decidua	Appear very thrifty.
68	Upana River	Larix decidua	Some snow press, otherwise normal.
74	Alberni	Pinus radiata	Plantation in poor condit-ion. Of 50 trees, 7 had died since '64, 8 died in '64, 2 visibly infected by Cronartium comptoniae Arth., 20 more dying, and 14 more living but in poor health. Cause of mortality undetermined.
188	Coombs	Pinus jeffreyi Pinus pinaster Pinus nigra var. calabrica Pinus echinata X taeda	The perfect state of the Ascomycete, Dothistroma pini Hulbary was recorded for the first time on these hosts and is being described by Drs. A. Parker and A. Funk.

Other Noteworthy Diseases

Host	Organism	Locality	Remarks
Fir, grand	Peridermium pseudo-balsameum (Diet. and Holw.) Arth. & Kern	Courtenay	A needle rust which can cause severe loss of foliage.
Hemlock, western	Ascoconidium tsugae Funk	Sayward	Known as a secondary pathogen in this area but suspected as a primary dieback fungus in the interior of the province.
Hemlock, western	Coccomyces sp.	Sayward	Associated with dieback of hemlock. Under study.
Pine, lodgepole	Hendersonia pinicola Wehm.	Comox Qualicum	Associated with a highly destructive needle cast caused by Hypodermella concolor (Dearn.) Darker.

Other Noteworthy Diseases-Cont'd.

Host	Organism	Locality	Remarks
Pine, Scots	*Atropellis piniphila* (Weir) Lohman & Cash	Alberni	A damaging canker causing disease of pine.
Spruce, Sitka	*Chrysomyxa weirii* Jacks.	Qualicum	The only needle rust found on old or previous years' foliage. Not known to be serious.

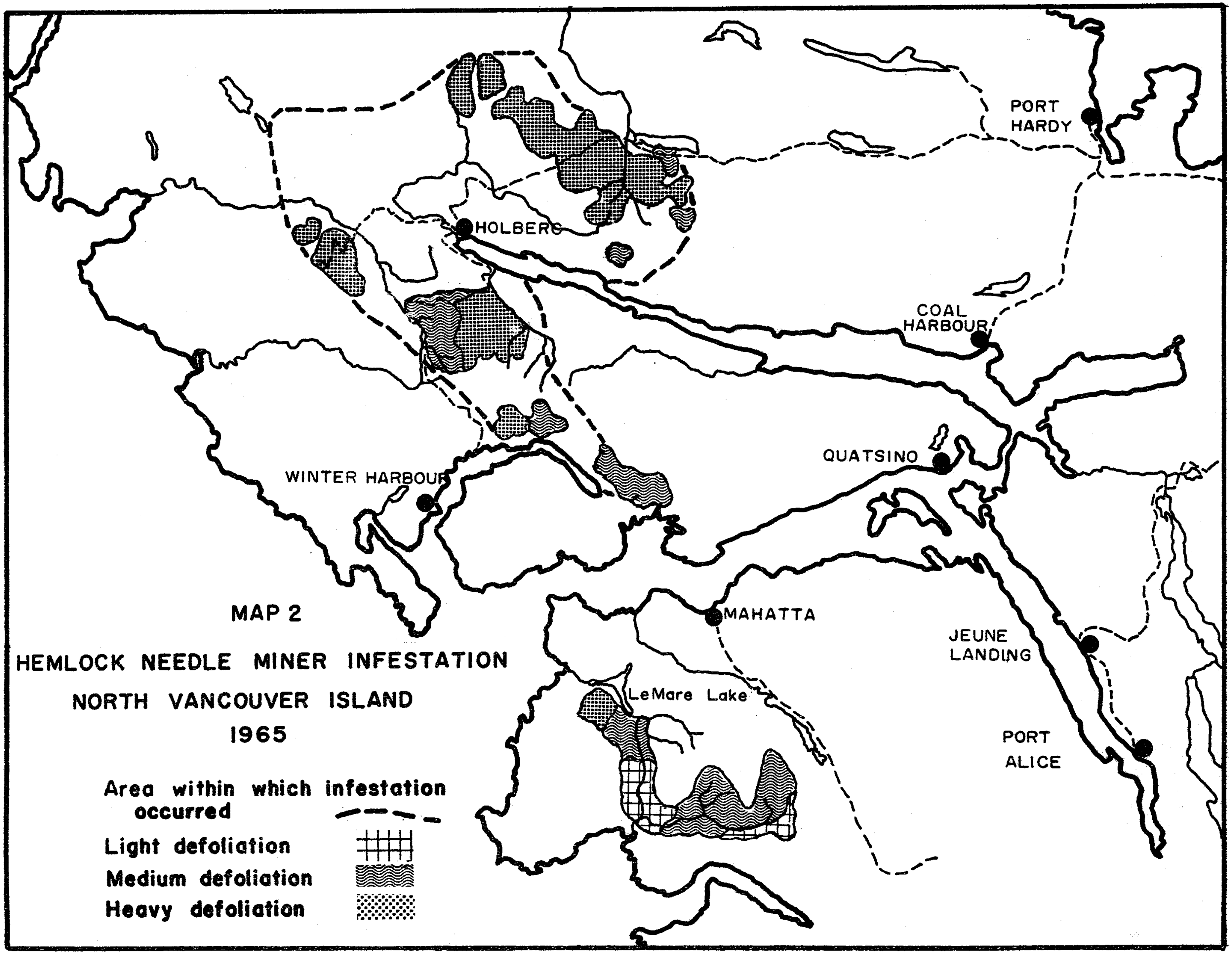


MAP 1

Location of points where one or more collections were made and field records taken in 1965.

Forest insect ●

Forest disease ▲


PORT HARDY
HOLBERG
COAL HARBOUR
QUATSINO
WINTER HARBOUR
MAHATTA
JEUNE LANDING
PORT ALICE
LeMare Lake
MAP 2
HEMLOCK NEEDLE MINER INFESTATION
NORTH VANCOUVER ISLAND
1965
Area within which infestation occurred
Light defoliation
Medium defoliation
Heavy defoliation

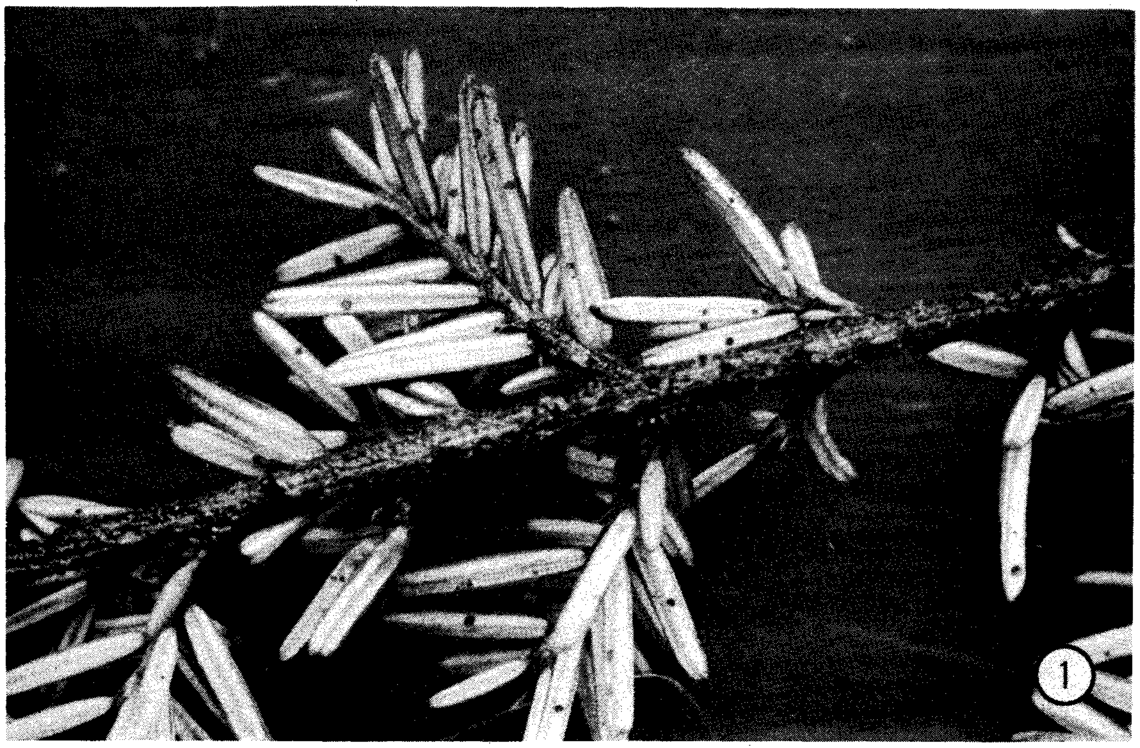


Figure 1. Needle damage caused by hemlock needle miner, <u>Epinotia</u> sp., North Vancouver Island District, June 1965. N. E. Alexander.

FOREST INSECT AND DISEASE SURVEY

BRITISH COLUMBIA

1965

VANCOUVER FOREST DISTRICT

MAINLAND SECTION

FOREST INSECT AND DISEASE SURVEY

VANCOUVER FOREST DISTRICT

MAINLAND SECTION

1965

E. G. Harvey

INTRODUCTION

The writer, E. G. Harvey, was assigned to the South Vancouver District in 1965. S. J. Allen remained in the North Vancouver District.

The balsam woolly aphid infestation increased in extent and intensity since the 1964 survey. A separate report for the Vancouver Forest District, Mainland Section, follows this introduction.

European pine shoot moth surveys were carried out in the Fraser Valley and Vancouver areas.

Mountain pine beetle activity has caused considerable tree mortality, especially in the Scuzzy Creek area.

The phantom hemlock looper remains a threat in Central and Hope Parks.

Black-headed budworm populations showed a marked increase in Queen's Park.

Green-striped forest looper larvae were more widespread and increased in numbers over 1964 .

Balsam Woolly Aphid, <u>Adelges piceae</u> (Ratz.) - - S.J. Allen and E.G. Harvey

During 1965, deterioration of amabilis fir infested with *Adelges piceae* increased in the southwestern portion of the Vancouver Mainland Forest District. Aerial and ground surveys showed both increased incidence of attack and intensified damage to amabilis fir in the infested area involving 672,000 acres (see area in Map 1). There were no signs of the aphid outside of this area.

Ground checks were made within the known aphid-infested area and beyond as far as Toba Inlet, Texada Island, Hope and Boston Bar. A total of 59 examinations throughout the South and North Vancouver districts involving about 500 *Abies* trees resulted in no extension of the infestation boundaries over the previous year.

An aerial survey of 14 hours by helicopter was made from the east side of Sechelt Inlet to Pitt Lake including Ashlu Creek and Howe Sound valleys and the Capilano, Seymour, Indian, Coquitlam and Pitt rivers (Map 2). Red-topped amabilis fir were counted. The heaviest areas of attack were Cypress Creek, Port Mellon-Rainy River, Seymour River, Capilano River, Indian River and Grand Creek.

A summary of balsam woolly aphid attack and tree mortality found on 11 permanent sample plots is shown in Table 2. The number of stem and gout attacks both more than doubled the numbers recorded during 1964. This was most noticeable at Seymour Dam, Port Mellon Road and Rainy River. Stem attacks were found for the first time at Rainy River. During 1965 21 plot trees died, bringing the total dead to 83,23 due to balsam woolly aphid. In the new 600 tree plot on Mt. Seymour, 226 trees showed gout symptoms and 114 were stem attacked.

The balsam woolly aphid infestation appears to be confined to the area outlined in Map 1, possibly due to physical barriers such as the mountainous terrain which runs from 4000 to 8000 feet elevation and to lowland areas of several miles which lack *Abies* species. Stands of amabilis fir growing above 3000 feet elevation close to infested lower-level amabilis firs, have not been observed affected by the aphid. Further spread of the aphid from infested to adjacent non-infested stands may be expected.

Table 1

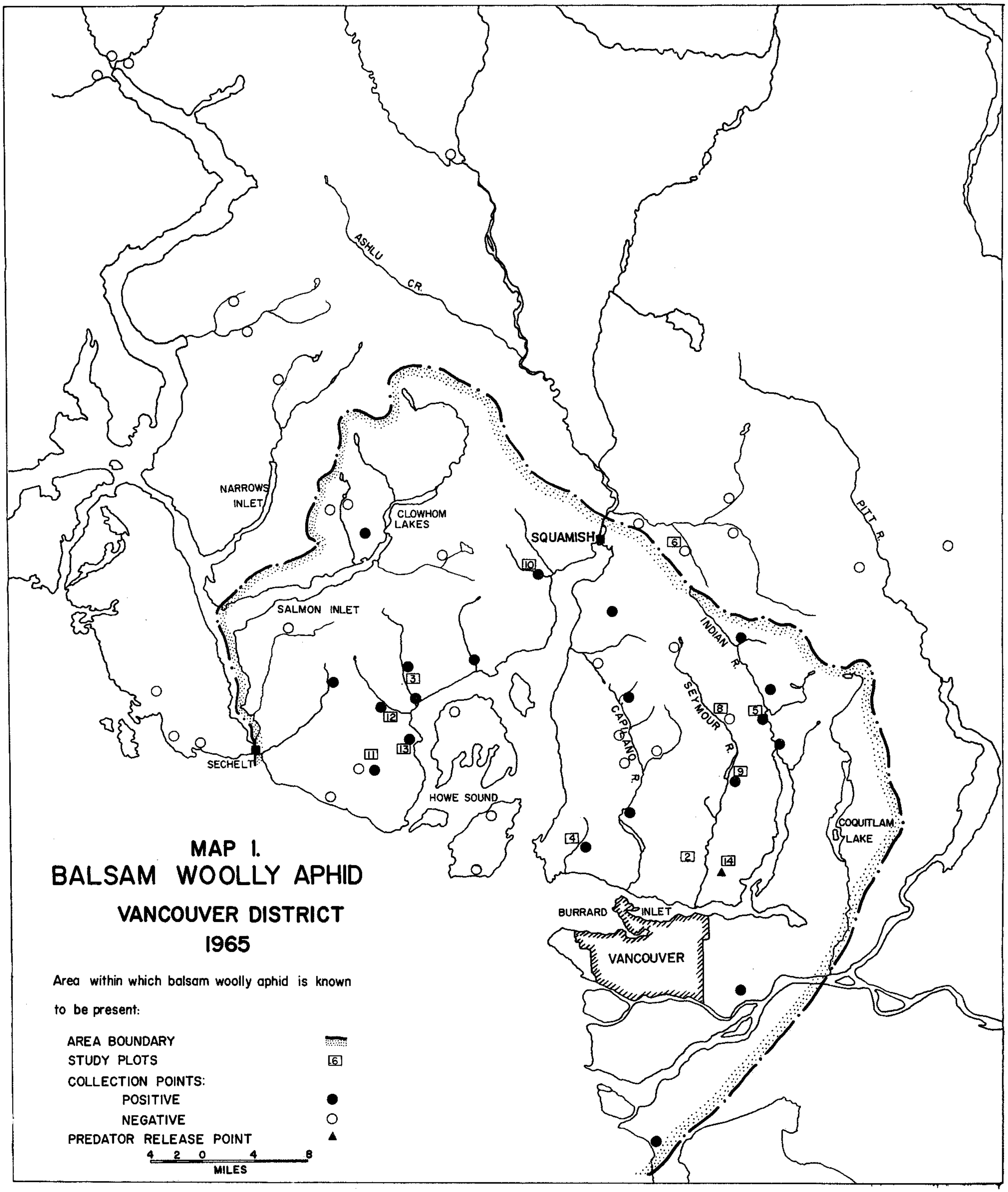
Defective Amabilis Fir within or adjacent to Balsam Woolly Aphid Areas as Determined by Aerial Surveys in the Vancouver Mainland Forest District.

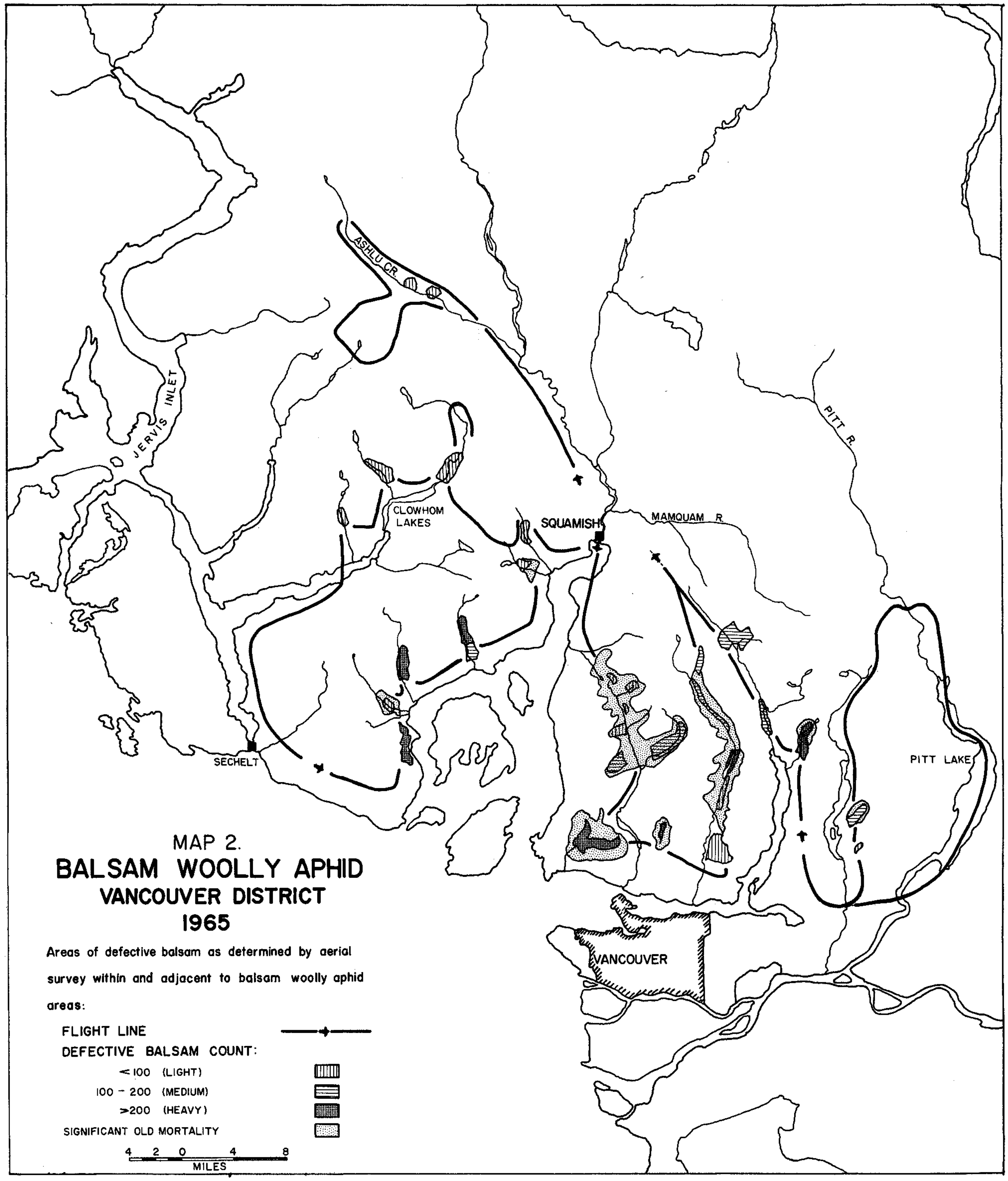
Area	Number of Defective Amabilis Fir 1963	1964	1965
Chapman Creek	12	11	n.s.
Gray Cr	0	6	n.s.
Thornhill Cr	n.s	20	n.s.
Clowhom R.	56	27	120
Bear Cr.	4	3	17
Tzoonie R.	5	12	n.s.
Jervis Inlet, N. end	0	26	n.s.
Ashlu Cr	203	52	169
Mill Cr.	17	11	26
Woodfibre Cr.	5	3	50
Sechelt Cr.	40	5	3
McNab Cr	9	22	315
Rainy R.	19	1	335
McNair Cr.	12	14	125
Cypress Cr.	86	30	425
Phillis Cr.	n.s.	n.s.	41
Hesketh Cr.	n.s.	15	149
Andrews Cr.	n.s.	10	18
Capilano R., upper	0	0	8
Enchantment Cr.	0	13	75
Eastcap Cr.	51	13	187
Seymour Mtn.	80	n.s.	25
Seymour R., below Dam	141	n.s.	82
Seymour Lake	66	n.s.	256
Seymour R. above Lake	170	n.s.	134
Indian River, upper	90	n.s.	49
Mes lillooet Cr.	36	n.s.	10
Indian River, lower	17	n.s.	50
Grand Creek	10	n.s.	200+
Coquitlam, R. lower	n.s.	n.s.	13
Coquitlam Lake E. side	71	n.s.	159
Coquitlam R upper	4	n.s.	31
Boise Cr.	n.s.	n.s.	15
Corbold Cr.	n.s.	n.s.	0
Vickers Cr.	n.s.	n.s.	8

n.s. = no survey

Table 2
Summary of Balsam Woolly Aphid Attacks and Mortality on Amabilis fir on Study Plots for 1963 to 1965, Vancouver Mainland Forest District

Plot number and Location		Healthy			Gout attack			Stem attack			Dead (BWA)			Dead (Misc.)			Total trees +
		1963	1964	1965	1963	1964	1965	1963	1964	1965	1963	1964	1965	1963	1964	1965	
2	Grouse Mtn.	28	23	12	7	11	10	3	1	0	5	5	5	5	8	21	48
3	Rainy River	44	35	11	14	13	28	0	0	3	1	2	2	2	10	12	61
4	Cypress Cr.	33	33	29	12	12	15	0	0	0	1	1	2	3	3	3	49
5	Indian R.	29	24	19	7	13	22	15	15	20	0	0	1	2	3	2	50
6	Raffuse Cr.	48	-	47	0	-	0	0	-	0	0	-	0	2	-	3	50
8	Seymour R.	42	41	38	4	4	7	0	0	3	1	1	1	3	4	4	50
9	Seymour Dam	34	36	10	6	7	34	9	6	13	2	2	3	1	1	1	50
10	Woodfibre Cr.	47	45	46	1	2	1	0	0	0	1	1	1	1	2	2	50
11	Dakota Cr.	45	45	46	1	1	0	0	0	0	1	1	1	2	2	2	49
12	McNair Cr.	9	9	7	10	9	11	0	0	0	5	5	5	2	3	3	26
13	Port Mellon Rd.	45	41	17	6	7	22	5	5	24	0	1	2	4	7	7	60
	TOTALS	404	332	282	68	79	150	32	27	63	17	19	23	27	43	60	543
14	Seymour Mtn.	-	-	235	-	-	226	-	-	114	-	-	-	-	-	51	610


MAP 1.
BALSAM WOOLLY APHID
VANCOUVER DISTRICT
1965
Area within which balsam woolly aphid is known to be present:
AREA BOUNDARY
STUDY PLOTS
COLLECTION POINTS:
POSITIVE
NEGATIVE
PREDATOR RELEASE POINT
4 2 0 4 8
MILES
ASHLU CR.
NARROWS INLET
CLOWHOM LAKES
SQUAMISH
SALMON INLET
PITT R.
INDIAN R.
SEYMOUR R.
CAPILANO R.
SECHELT
HOWE SOUND
COQUITLAM LAKE
BURRARD INLET
VANCOUVER


ASHLU CR.
JERVIS INLET
CLOWHOM LAKES
SQUAMISH
MAMQUAM R.
PITT R.
PITT LAKE
SECHELT
VANCOUVER
MAP 2.
BALSAM WOOLLY APHID
VANCOUVER DISTRICT
1965
Areas of defective balsam as determined by aerial survey within and adjacent to balsam woolly aphid areas:
FLIGHT LINE
DEFECTIVE BALSAM COUNT:
<100 (LIGHT)
100 - 200 (MEDIUM)
>200 (HEAVY)
SIGNIFICANT OLD MORTALITY
4 2 0 4 8
MILES

FOREST INSECT AND DISEASE SURVEY

SOUTH VANCOUVER DISTRICT

1965

FOREST INSECT AND DISEASE SURVEY

SOUTH VANCOUVER DISTRICT

1965

E. G. Harvey

INTRODUCTION

The regular forest insect and disease survey in the South Vancouver District commenced in mid-May and continued until late August. Special surveys for European pine shoot moth occupied several weeks at the beginning of the season. Balsam woolly aphid surveys and plot work extended the field season to mid-September. Aerial surveys were made by fixed-wing aircraft for bark beetles in the summer and by helicopter for balsam woolly aphid in the fall.

Totals of 538 insect and 32 tree disease collections were made during the season. Table 1 and Map 1 show collections by host and locality, respectively.

Table 1

Collections by Hosts

South Vancouver District, 1965

Coniferous hosts	Forest insects	Forest diseases	Broad-leaved hosts	Forest insects	Forest diseases
Cedar, W. red	53	2	Alder, red	9	1
Cedar, yellow	1		Arbutus	1	
Douglas-fir	111	2	Basswood	1	
Fir, alpine	5		Cherry	3	
Fir, amabilis	72	5	Cottonwood, black		1
Fir, grand	15	2	Elder		1
Hemlock, mountain	3		Holly	1	
Hemlock, western	103	2	Maple sp.	1	
Juniper	1		Maple, Douglas		1
Larch	1	1	Maple, vine		1
Pine, spp.	30		Poplar spp.		4
Pine, Austrian	1		Poplar, Lombardy	2	
Pine, lodgepole	52	2	Willow	8	1
Pine, mugho	15	1	Misc.	2	
Pine, ponderosa	8		No host	9	
Pine, red	1	2			
Pine, scots	12	1			
Pine, W. white	7				
Spruce, Sitka	8				
Spruce, white	1	1			
Yew, western	1	1			
Totals	501	22	Totals	37	10
			GRAND TOTALS	538	32

FOREST INSECT CONDITIONS

IMPORTANT INSECTS

Balsam Woolly Aphid, _Adelges piceae_ (Ratz.)

A report on the balsam woolly aphid infestation for the Vancouver Forest District, Mainland Section, follows the Introduction to the report for the District .

Douglas-fir Bark Beetle, Dendroctonus pseudotsugae Hopk.

A flight over all suspect areas indicated there were no active populations of this beetle in the District. No infested trees were found in ground surveys.

Mountain Pine Beetle, Dendroctonus ponderosae Hopk.

An aerial survey of stands of western white pine in the District was made on August 31. Several areas showed signs of current beetle attack, with patches of grey-dead trees, and surrounding red trees. The heaviest infestation was in the headwaters of Scuzzy Creek, just south of Scuzzy Mountain, where an estimated 1000 trees up to three feet d.b.h. were killed. There were an estimated 500 beetle-killed white pine trees in the Upper Anderson River area. These were widely scattered and in small groups. Many red trees occurred in the Skagit River Valley from the United States-Canada border north into the upper reaches of Silverhope Creek. The largest concentration of attacked trees was recorded just north of the flooded area near the border. Many of these were small-sized lodgepole pine. Based on the number of grey-dead trees in the area, the infestation apparently has been active for several years. Pine trees in Manning Park, along the upper Skagit River, have been infested with beetles for several years. An estimated 200 trees were red and many times that number were grey.

Fall Webworm, Hyphantrea cunea (Drury)

The fall webworm infestation in the Fraser Valley remained low throughout most of the area with only slight or no change in numbers of webs counted. Exceptions to this were along Camp Road, south of Chilliwack, where there was a marked increase, and Pierdonville Road west, where a decrease occurred (Table 2).

A road count was made in the Boundary Bay area for the first time because of the large number of webs observed in the area. Elsewhere in the District few webs were seen. Red alder and white birch were the most favored host trees.

Table 2

Counts of Fall Webworm in the Fraser Valley on Various Deciduous Hosts

as Determined by Roadside Counts, South Vancouver District

Location	Miles travelled	No. of webs			Average number of webs per mile		
		1963	1964	1965	1963	1964	1965
Pierdonville west	3.0	5	14	2	1.7	4.7	0.7
Pierdonville east	3.0	3	2	5	1.0	0.7	1.7
Rosedale north	2.8	6	1	1	2.2	0.4	0.4
Chilliwack (Camp Rd.)	7.4	20	2	26	2.7	0.3	3.5
Cultus L.(S.E. Side)	3.8	13	2	2	3.4	0.5	0.5
Yarrow east	3.6	5	1	0	1.4	0.3	0.0
Boundary Bay	1.8			106			58.9

Spruce Budworm, Choristoneura fumiferana (Clem.)

Spruce budworm populations showed a marked increase in distribution with a slight increase in numbers per collection in 1965 (Table 3). Larvae were found in all drainages except D.D. 43 (Harrison Lake). The greatest was in D.D.42 which takes in the Vancouver watershed from Howe Sound to Stave Lake. In 1964 no larvae were found here but in 1965 an average of 7.7 larvae was found in 13.6% of collections made during the larval period The largest collection, 17 larvae, was made in Queen's Park, New Westminster .

Table 3

Summary of Spruce Budworm Collections by Drainage Divisions,

South Vancouver District

Drainage division	Number of samples taken during larval period			% samples containing larvae			Average number of larvae per sample		
	1963	1964	1965	1963	1964	1965	1963	1964	1965
040	30	11	1	3.3	0.0	100.0	1.0	-	1.0
41	15	33	12	20.0	9.1	25.0	2.7	1.0	3.3
42	27	32	22	7.4	0.0	13.6	3.5	-	7.7
43	10	32	8	0.0	6.3	0.0	-	3.5	-
44	15	59	20	46.6	30.5	55.0	7.2	1.6	1.9
45	37	67	35	2.7	3.0	37.1	1.0	1.0	1.9
Total	134	234	98	10.4	10.7	31.6	4.8	1.7	2.6

Western Hemlock Looper, Lambdina fiscellaria lugubrosa (Hulst)

There was an increase of over 50% in the incidence of hemlock looper in collections, but the average number per collection decreased slightly (Table 4). The largest numbers, eight and nine larvae, were taken at Joffre Creek on Lillooet Lake and the upper Lillooet River, north of Pemberton Meadows, respectively.

Phantom Hemlock Looper, Nepytia phantasmaria (Stkr.)

There was an increase in populations of this looper, from a low of nine collections in 1964 to 42 in 1965, with an average of 6.7 larvae per collection. Light defoliation occurred in Central Park, where there were up to 62 larvae per collection. Other high populations were D'Arcy (21) and Hope Park (12).

Table 4

Summary of Western Hemlock Looper Collections by Drainage Divisions,

South Vancouver District

Drainage division	Number of samples taken during larval period			% samples containing larvae			Average number of larvae per sample		
	1963	1964	1965	1963	1964	1965	1963	1964	1965
040	35	10	13	11.4	0.0	0.0	2.2	-	-
41	35	39	26	8.6	0.0	0.0	1.8	-	-
42	70	75	84	32.9	14.7	17.9	3.2	2.6	1.1
43	41	37	27	17.1	10.8	22.2	2.4	5.8	2.0
44	42	60	30	26.2	25.0	30.0	3.0	3.1	1.7
45	34	78	59	11.8	15.4	37.3	3.4	2.3	4.0
Total	257	299	239	20.2	14.0	21.8	2.9	3.0	2.5

Black-headed Budworm, Acleris variana (Fern.)

Black-headed budworm populations have shown a steady increase in both incidence and numbers for the past four years (Table 5). The largest numbers were found in Queen's Park with 139 larvae in a collection and Central Park where 13 larvae were found in one collection.

Table 5

Summary of Black-headed Budworm Collections by Drainage Divisions,

South Vancouver District

Drainage division	Number of samples taken during larval period			% samples containing larvae			Average number of larvae per sample		
	1963	1964	1965	1963	1964	1965	1963	1964	1965
040	36	11	9	16.7	0.0	33.3	2.2	-	1.7
41	38	41	22	2.6	1.2	13.6	1.0	8.3	5.3
42	28	76	86	0.0	1.3	12.8	-	1.0	17.4
43	41	40	27	2.5	0.0	0.0	1.0	-	-
44	49	65	32	4.1	15.4	9.4	2.2	2.3	2.3
45	34	56	60	2.9	3.6	6.6	1.0	1.0	1.5
Total	226	289	236	4.9	6.2	10.2	1.9	3.7	9.4

Spruce Aphid, Neomyzaphis abietina Wlk.

The spruce aphid was still active on the spruce trees throughout the lower Fraser Valley and Vancouver areas. Many of the trees, retained as ornamentals or windbreaks, had very little green foliage left. There was some tree mortality but no counts were made as the trees are so few and scattered.

Green-striped Forest Looper, Melanolophia imitata Wlk.

This looper showed a consistent increase in numbers and incidence in 1965. The population was approximately double that of 1964, when a similar increase occurred (Table 6). Numbers ranged from one to 20 larvae per collection with an average of 5.8 larvae in 45.7% of the collections made on all host trees during the larval period.

Table 6

Summary of Green-striped Forest Looper Collections by Drainage Divisions

South Vancouver District

Drainage Division	Number of samples taken during larval period			% samples containing larvae			Average number of larvae per sample		
	1963	1964	1965	1963	1964	1965	1963	1964	1965
040	37	10	17	5.4	0.0	23.5	2.7	-	1.5
41	36	39	26	13.9	17.9	11.5	2.0	1.7	2.3
42	70	75	100	15.7	45.3	60.0	1.5	3.1	7.2
43	40	38	27	10.0	23.7	48.1	1.0	2.1	7.0
44	40	60	42	7.5	21.7	45.2	1.8	3.0	3.5
45	24	79	70	12.5	12.7	42.9	1.8	1.9	5.0
Total	247	301	282	11.3	24.3	45.7	1.6	2.7	5.8

European Pine Shoot Moth, Rhyacionia buoliana (Schiff.)

The special survey of pine shoot moth, started in 1963, was intensified and extended to all areas of the Fraser Valley from Boston Bar to the coast. Nurseries, plantations, and golf courses were examined by two officers from the Forest Research Laboratory, Victoria, and two from the Plant Protection Division, Canada Department of Agriculture, Vancouver. Their findings were included in a report prepared in September 1965 .1/

1/ Harris, J.W. E., D.S. Ruth, E. Fridell, and C.A. Gibson, 1965. European Pine Shoot Moth Survey South Coastal British Columbia, 1965. Can. Dep. For., For. Res. Lab., Victoria. 8 pp.

The present report deals with the examination of exotic and native pines planted as ornamentals around urban and country homes throughout the above mentioned area and in adjacent stands of native pines. A total of 1,599 trees were examined at 189 locations. Of these, 592 trees were infested; 64 collections containing 990 larvae and pupae of the pine shoot moth were made. These totals included four special mass collections containing 500 larvae which were sent to Vernon for experimental purposes.

Ten collections of apparently infested tips showed only damage; no larvae were found. These tips were probably attacked by some of the native species of tip moth which have a different life cycle from the pine shoot moth.

Table 7 shows the trees examined by species and percentage of attack. Map 2 shows the locations of the examinations and attacked trees.

Table 7

Number of Trees Examined for Pine Shoot Moth by

Host Species and Percentage of Trees Attacked,

South Vancouver District

Tree species	No. examined	No. infested	% infested
Lodgepole pine	1018	471	46.3
Mugho pine	264	34	12.9
Scots pine	174	57	32.8
Western white pine	26	1	3.8
Ponderosa pine	28	1	3.6
Red pine	14	1	7.1
Pine spp.	75	27	36.0
Total	1599	592	37.0

It is of interest to note that a native 5-needle, western white pine was infested. The shoot moth usually attacks only 2 and 3-needle pines.

Other Noteworthy Insects

Insect	Hosts	No. collections	Remarks
Adelges nusslini C. & B.	B	1	One small tree heavily infested at Deer Lake, Burnaby.
Aspidiosis britannicus Newst.	Holly	1	Heavy infestation of this scale insect on 18 trees at Chilliwack.
Caripeta divisata Wlk.	F,H,B,C	11	Increase from four collections in 1964 . Average 2.8 larvae per collection. Highest number, 12, at Cultus Lake.
Dichelonyx spp.	F,H,C, Bg. Pl, Py, Pu	37	Common and plentiful in early part of season. Largest number, 10, in park at Hope.
Ectropis crepascularia (Schiff.)	F,H,C, Bg	46	Average 2.2 larvae per collection. No large numbers taken.
Epirrita autumnata Gn.	F,H,C,B,Bg	23	Increase from six collections in 1964. Average 2.3 larvae per collection, with up to nine in one from Stanley Park.
Eupithecia unicolor Hulst.	C	9	Average 2.8 larvae per collection. Only found in early spring.
Feralia comstocki Grt.	F,H,C,B	28	Average 1.8 larvae per collection.
F. Jocosa (Guen.)	F,H,C	10	Average 2.3 larvae per collection.
Gabriola dyari Tayl.	F, H, Pl	14	Increase from six collections in 1964
Neodiprion spp.	F, H, Pl, S, Pw, Bg	85	Common and widespread. No defoliation observed. Average 8.6 larvae per collection.
Nyctobia limitaria (Wlk.)	F,H,C,B	33	Common, but no large numbers found.
Orgyia antiqua badia (Hy. Ed.)	H, C	5	Only 10 larvae found .
Pineus sylvestris Annand	Mugho pine	1	One ornamental tree at Jericho Beach heavily infested.
Stilpnotia salicis (L.)	Pop. Lombardy	2	Row of seven large trees opposite Hastings Park stadium 90% defoliated.

FOREST DISEASE CONDITIONS

Important Diseases

Winter Damage

The winter of 1964-65 was more severe than usual in the Vancouver District. Sharp frosts and heavy snowfalls caused mortality, partial killing, and breakage or bending of many species of trees and shrubs throughout the District. This was particularly evident among exotic tree species in the area. Damage to laurel hedges was most noticeable. At least 50% of them suffered frost damage, many being killed back to the root collar. In most cases, however, the roots were undamaged and new growth appeared in the summer. Many other exotics were killed.

Breakage and bending was common among native forest trees. Some of the exotic plantations suffered snow damage, as noted in Table 8.

Drought

Drought conditions resulting from the dry, hot summer weather caused a much heavier than normal needle drop, particularly among trees on dry or exposed sites. Many cedar trees were discolored and appeared, from a distance, as though they were dying. No dead trees were found, however, and apparently no serious damage was done.

Exotic Plantations

Thirteen exotic tree plantations were examined in 1965 (Table 8). Many exotic pine trees were also examined during the pine shoot moth survey.

Table 8

Exotic Plantations Examined, South Vancouver District, 1965

XP No.	Location	Tree sp.	Remarks
43	Green Timbers	Pine, Scots	Trees of poor form. One broken by snow, one nearly dead. Heavy needle cast caused by Hypodermataceae.
45	Green Timbers	Pine, Red	Healthy and vigorous
77	Green Timbers	Pine, Red	Trees very suppressed and crowded out by native species. Many dead leaders caused by Hypodermataceae.
93	Haney	Larch, Dunkold and European	Trees putting on excellent growth, but are top heavy and some bent by snow.
99	Haney	Pine, Scots	Poor form, but putting on good growth. Many bent and broken tops and limbs, caused by snow.
100	Haney	Spruce, Norway	All trees healthy and vigorous
103	Haney	Poplar, regenerata	Healthy and vigorous. Some trees have leaf spots caused by *Taphrina* sp.

Exotic Plantations Examined, South Vancouver District, 1965- continued

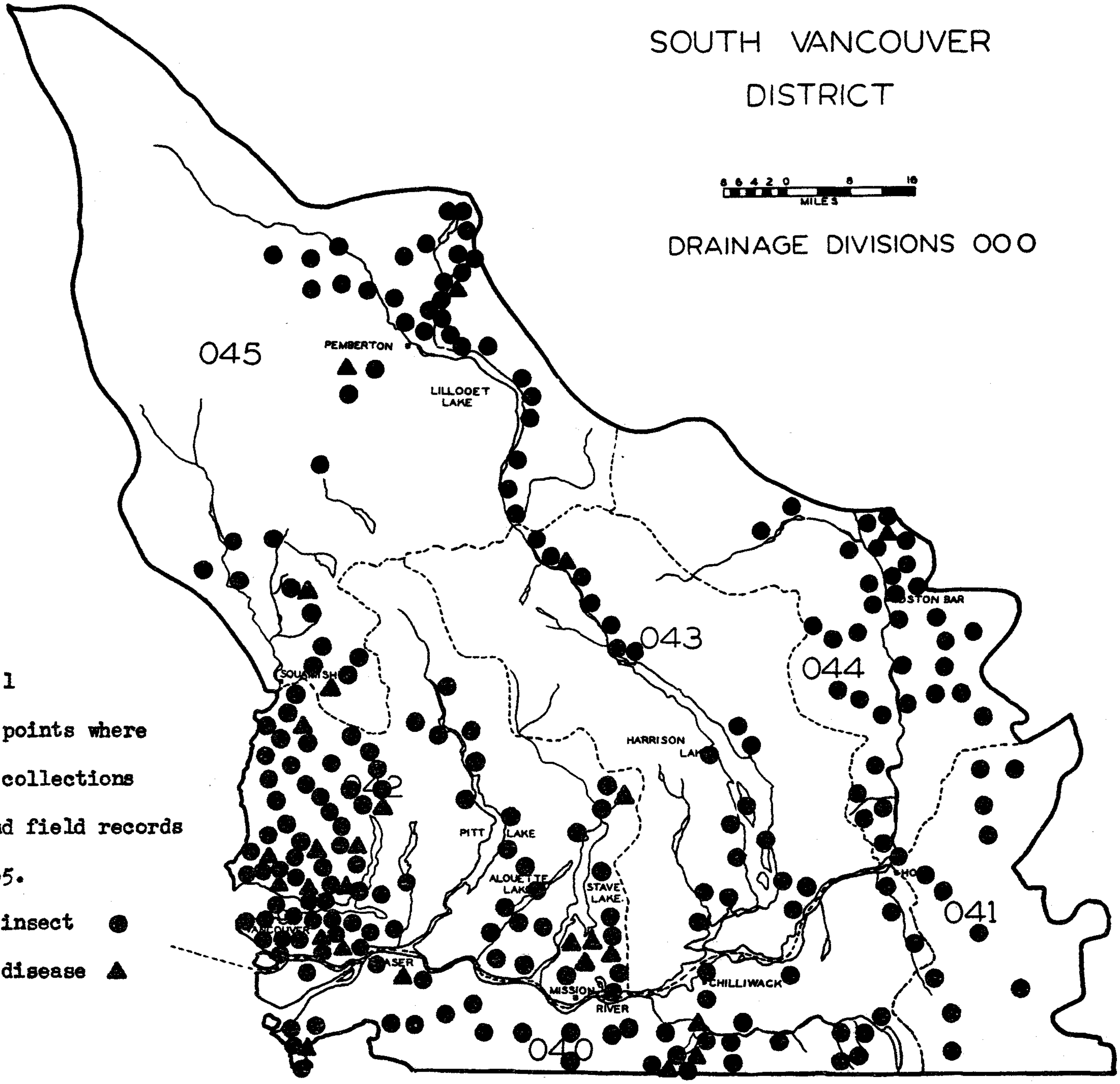
XP No.	Location	Tree sp.	Remarks
104	Haney	Poplar, Canadensis	Trees putting on good growth but heavily infected with *Taphrina populina* Fr.
105	Haney	Poplar, regenerata	Trees small and not very vigorous. Heavily infected with *Taphrina populina* Fr.
106	Haney	Pine , red	Heavy snow has damaged, bent or broken, many of these trees on a hillside. One dead tree was infected with *Armillaria mellea* (Fr.) Kummer.
107	Haney	Poplar, spp.	Healthy and vigorous
108	Haney	Poplar, grandis	Healthy and vigorous
109	Haney	Poplar, robustus	Most trees vigorous. Two trees with many dead tips caused by *Cytospora* sp. Some leaves with *Taphrina populina* Fr.

Other Noteworthy Diseases

Host	Organism	Locality	Remarks
Alder, red	*Caliciopsis* Sp.	Brittannia Beach	Thought to be a new species of canker.
Cedar, western red	*Didymascella thujina* (Durand) Maire.	Cultus L. Haney N. Vancouver	Cedar needle blight common throughout district. Heavy infection on trees in some areas.
Cottonwood, black	*Melampsora occidentalis* Jacks.	Tsawwassen	Light rust infection on some leaves.
Douglas-fir	*Rhabdocline pseudotsugae* Syd.	Port Douglas	Needle cast. Heavy infection on one tree only.
Fir, amabilis	*Nectria fuckeliana* Booth	N. Vancouver	On tree recently killed by balsam woolly aphid.
Fir, grand	*Dasyscyphus ciliatus* Hahn.	Boston Bar	Twig dieback, common in area. New host record.
Fir, grand	*Pucciniastrum epilobii* Otth.	Haney	Rust on needles of current years' growth.
Hemlock, western	*Melampsora epitea* Thum. f. sp. *Tsugae* Ziller	Haney	Needle rust on small regeneration trees.

Other Noteworth Diseases- continued

Host	Organism	Locality	Remarks
Maple, Douglas	Nectria sp.	Haney	Dieback affecting 10% of crown of 10 trees planted along Lougheed Hwy.
Pine, lodgepole	Coleosporium asterum (Diet.) Syd.	North Vancouver	Rust on needles. Light infection on one tree.
Pine, mugho	Peridermium harknessii J. P. Moore	North Vancouver	Rust gall on one small ornamental tree.
Pine, red	Armillaria mellea (F) Kummer	Haney	Root rot on one small dead tree in plantation.
Pine, red	Hypodermataceae	Green Timbers	Small, suppressed trees have many dead tips.
Pine, Scots	Hypodermataceae	Green Timbers	Heavy needle cast throughout plantation.
Poplar, spp.	Taphrina populina Fr.	Haney	Most of the exotic poplars in the plots have infected leaves.
Spruce, white	Chrysomyxa arctostaphyli Diet.	Vancouver	Rust broom on one ornamental tree.
Willow	Fomes igniarius (Lex. Fr.) Kickx	North Vancouver	Sporophore on living tree.
Yew, western	Sphaerulina taxicola (Pk.) Berl .	Tisdall	Needle cast, heavy on one tree.

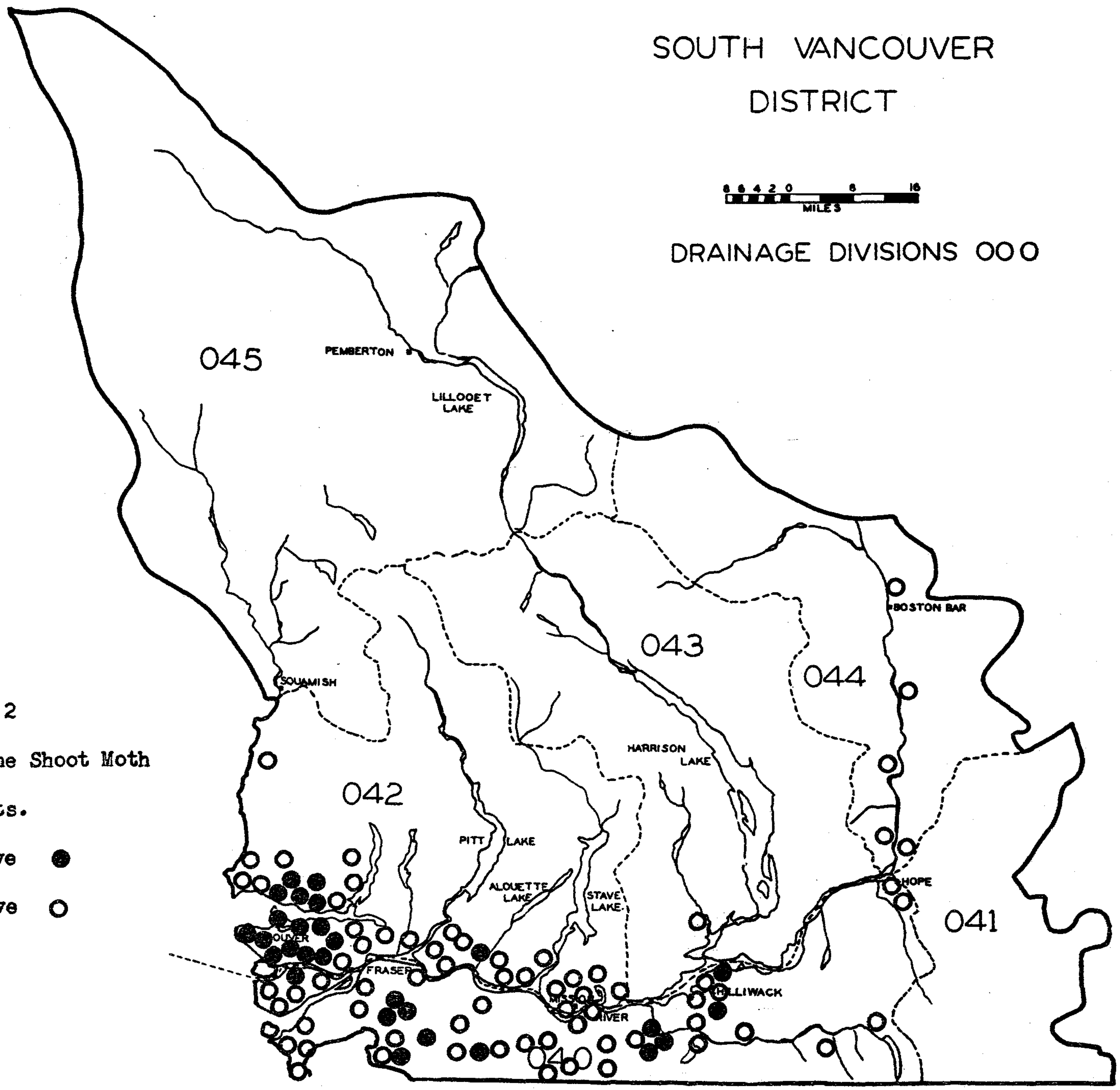


MAP 1

Location of points where one or more collections were made and field records taken in 1965.

Forest insect ●

Forest disease ▲



MAP 2

European Pine Shoot Moth

Sample Points.

Positive ●

Negative ○

FOREST INSECT AND DISEASE SURVEY

NORTH VANCOUVER DISTRICT

1965

FOREST INSECT AND DISEASE SURVEY

NORTH VANCOUVER DISTRICT

1965

S. J. Allen

INTRODUCTION

The 1965 survey of the North Vancouver District started May 25th and ended August 30th. Following that, work was done on several specific problems including balsam woolly aphid studies and aerial reconnaissance of infestations. While most insect populations remained at low levels, significant larval populations of some Geometridae were found during the survey.

A total of 24 disease samples, mostly tree rusts, were made in 1965. A total 556 insect collections were made, 534 by the North-Vancouver Ranger and 22 by co-operators (Table 1). The distribution of samples is shown on Map 1.

Table 1

Collections by Hosts

North Vancouver District, 1965

Coniferous hosts	Forest insects	Forest diseases	Broad leaved hosts	Forest insects	Forest diseases
Cedar, W. red	71		Alder	2	
Douglas fir	112	4	Alder, red	2	4
Fir, alpine	2		Cottonwood, black		1
Fir, amabilis	45	3	Willow	1	
Fir, balsam	3		Misc.	2	2
Fir, grand	18	2	No host	7	1
Hemlock	1				
Hemlock, mountain	2				
Hemlock, western	233	7			
Pine, lodgepole	22				
Pine, W. white	2				
Spruce, Sitka	31				
Totals	542	16	Totals	14	8
			Grand Totals	556	24

FOREST INSECT CONDITIONS

Important Insects

Green-striped Forest Looper, Melanolophia imitata Wlk.

Green-striped forest looper populations increased in 1965. Numbers found in collections were low from 1961 to 1963 but increased in 1964 and 1965. In the current year 497 larvae were collected. The highest numbers were found at Treat Creek, Jervis Inlet where 17 larvae were taken in a sample from Douglas-fir. Throughout the North Vancouver District 43.1% of the samples taken during the larval period contained larvae of this insect. In drainage divisions 061 and 063, 45% and 77 % of the collections contained larvae (Table 2).

Table 2

Summary of Green-striped Forest Looper Collections by Drainage Divisions,

North Vancouver District

Drainage division	Number of samples taken during larval period			% samples containing larvae			Average number of larvae per sample		
	1963	1964	1965	1963	1964	1965	1963	1964	1965
060	16	15	21	6.2	0	24.0	1.0	-	2.5
061	133	166	193	4.5	13.2	45.1	1.5	2.0	3.5
062	31	39	64	9.3	17.9	31.2	1.0	1.7	2.5
063	34	43	44	2.9	25.6	77.3	1.0	2.1	3.2
064	48	49	37	0	6.1	43.3	-	1.8	2.1
065	27	29	22	0	13.8	18.2	-	1.0	1.6
066	17	17	9	0	0	33.3	-	-	3.5
067	26	29	12	11.5	6.9	50.0	1.0	1.0	2.2
068	26	30	16	3.8	40.0	25.0	1.0	1.6	2.2
Total	358	417	418	4.2	14.6	43.1	1.2	1.8	3.1

Western Hemlock Looper, Lambdina fiscellaria lugubrosa (Hulst)

There was a slight increase in the number of hemlock looper larvae found in the District in 1965. The following is a summary of hemlock looper collections for the North Vancouver District.

Table 3

Number of samples taken during larval period			% samples containing larvae			Average number of larvae per sample		
1963	1964	1965	1963	1964	1965	1963	1964	1965
339	412	353	11.2	10.4	11.3	3.1	1.3	1.6

Yellow-lined Forest Looper, Nyctobia limitaria (Wlk.)

The population of this looper has increased since 1963. A total of 195 larvae were found in 93 positive samples compared to 64 larvae in 40 samples in 1964 (Table 4). This summary also indicated a more concentrated distribution in 1965.

Table 4

Summary of Yellow-lined Forest Looper Collections

North Vancouver District

Drainage division	Number of samples taken during larval period			% samples containing larvae			Average number of larvae per sample		
	1963	1964	1965	1963	1964	1965	1963	1964	1965
060	16	0	0	6.2	-	-	1.0	-	-
061	60	131	178	3.7	7.6	17.4	1.0	1.7	1.5
062	31	24	26	3.2	16.7	34.6	1.0	1.0	1.6
063	25	43	37	12.0	28.0	56.8	1.3	1.5	3.1
064	38	52	38	10.5	21.2	44.7	1.0	1.9	2.4
065	25	39	23	0	2.6	17.4	-	2.0	1.5
066	11	19	19	18.2	15.8	0	1.0	1.0	-
067	26	29	12	0	3.4	33.3	-	1.0	1.7
068	25	31	16	8.0	25.8	31.3	1.0	1.5	2.2
Total	257	368	349	5.8	13.6	27.5	1.1	1.6	2.1

Saddle-backed Looper, Ectropis crepuscularia (Schiff.)

The saddle-backed looper was found in 62 collections in 1965 compared with 27 collections in 1964. Collections averaged 1.3 and 1.1 larvae respectively.

European Pine Shoot Moth, Rhyacionia buoliana (Schiff.)

Only one suspect specimen of the European pine shoot moth was found in North Vancouver District in 1965, at Sliammon Lake, near Powell River. Nine examinations totalling 418 trees were made on Lodgepole pine stands throughout the District. Specimens of Olethreutidae, Cecidomiidae, Microlepidoptera and Neuroptera were found on these. The examinations were conducted during late May and June from Chapman Creek to Lund and included Texada Island.

Black-headed Budworm, Acleris variana (Fern.)

Black-headed budworm populations remained unchanged in 1965. The following is a summary of black-headed budworm collections for the North Vancouver District:

Table 5

Number of samples taken during larval period			% samples containing larvae			Average number of larvae per sample		
1963	1964	1965	1963	1964	1965	1963	1964	1965
314	386	341	3.2	2.3	1.7	2.1	1.0	1.0

Conifer Sawflies, Neodiprion spp.

The population of Neodiprion spp. rose in 1965 to an average of 4.4 larvae per sample compared to 3.6 in 1964 (Table 6). The samples containing the most larvae were found at Narrows Inlet, Misery Bay and Toba Inlet where 27, 37 and 50 larvae, respectively, were found.

Table 6

Summary of Conifer Sawflies Collections

North Vancouver District

Drainage division	Number of samples taken during larval period			% samples containing larvae			Average number of larvae per sample		
	1963	1964	1965	1963	1964	1965	1963	1964	1965
060	14	15	23	64.3	26.7	39.1	2.8	1.0	1.7
061	156	222	199	23.1	13.1	23.1	2.1	4.4	4.2
062	26	47	60	69.2	27.7	25.0	19.2	4.1	8.9
063	27	43	42	14.8	18.6	40.5	1.0	3.3	1.7
064	44	49	31	36.4	40.8	77.4	4.5	2.9	5.9
065	23	29	18	26.1	27.6	27.8	4.2	4.5	2.0
066	13	17	7	30.8	23.5	28.6	1.0	1.8	4.5
067	25	29	10	40.0	34.5	20.0	6.3	2.0	1.3
068	24	30	14	54.2	30.0	42.8	12.0	4.3	2.7
Total	352	481	404	33.0	23.9	31.2	6.6	3.6	4.4

Fall Webworm, Hyphantria cunea (Drury)

Fall webworm populations declined in 1965. Webs were late in appearing and only a few were noticeable this year. A comparison of roadside web counts made in three separate areas is shown in Table 7.

Table 7

Web Counts of Fall Webworm

North Vancouver District

Location	Miles travelled 1964	1965	Number of Webs 1964	1965	Webs per Mile 1964	1965
Earl Cove to Irvine Landing	10.0	10.0	466	49	46.6	4.9
Halfmoon Bay to Gibson Landing	13.6	13.6	12	2	0.9	.01
Langdale to Port Mellon	3.4	3.4	44	14	13.0	.3

Other Noteworthy Insects

Insect	Host(s)	Number of collections	Remarks
Caripeta divisata (Wlk.)	F, H, S, B, Pl	38	Average 4.4 larvae per collection. Distribution wide-spread, July 26-Aug 30.
Choristoneura fumiferana Clem.	-	0	None found in 1965.
Dendroctonus ponderosae Hopk.	Pw	0	Few attacks observed in 1965-Chapman Cr. area.
Epirrita autumnata Harr.	H, F, B	9	Bowen I. to Lund.
Eupithecia unicolor Hulst.	C, H	4	Powell River to Loughborough Inlet. Drop from 1964.
Neomyzaphis abietina Wlk.	S	-	Very light at Port Neville.
Pikonema alaskensis Roh.	S	10	Cracroft I. to Salmon In. Average 2.4 larvae per sample.
Semiothisa spp.	H, F, C, Pl, B	30	Quadra I. to Gibsons. Average 2.0 larvae per sample.

FOREST DISEASE CONDITIONS

Important Diseases

Douglas-fir Needle Cast, Rhabdocline pseudotsugae Syd.

There was an increase in the incidence of attack of this foliage disease on Douglas-fir in Sechelt, Powell River and Texada Island areas at Angus Creek, Southview, Duck Lake and Cook Bay. Most of this infection was on 1964 needles, affecting between 10 and 20% of the stems in immature and reproduction stands.

A Peridermium Rust on grand fir and amabilis fir, Peridermium pseudobalsameum (Diet. & Holw.) Arth. & Kern.

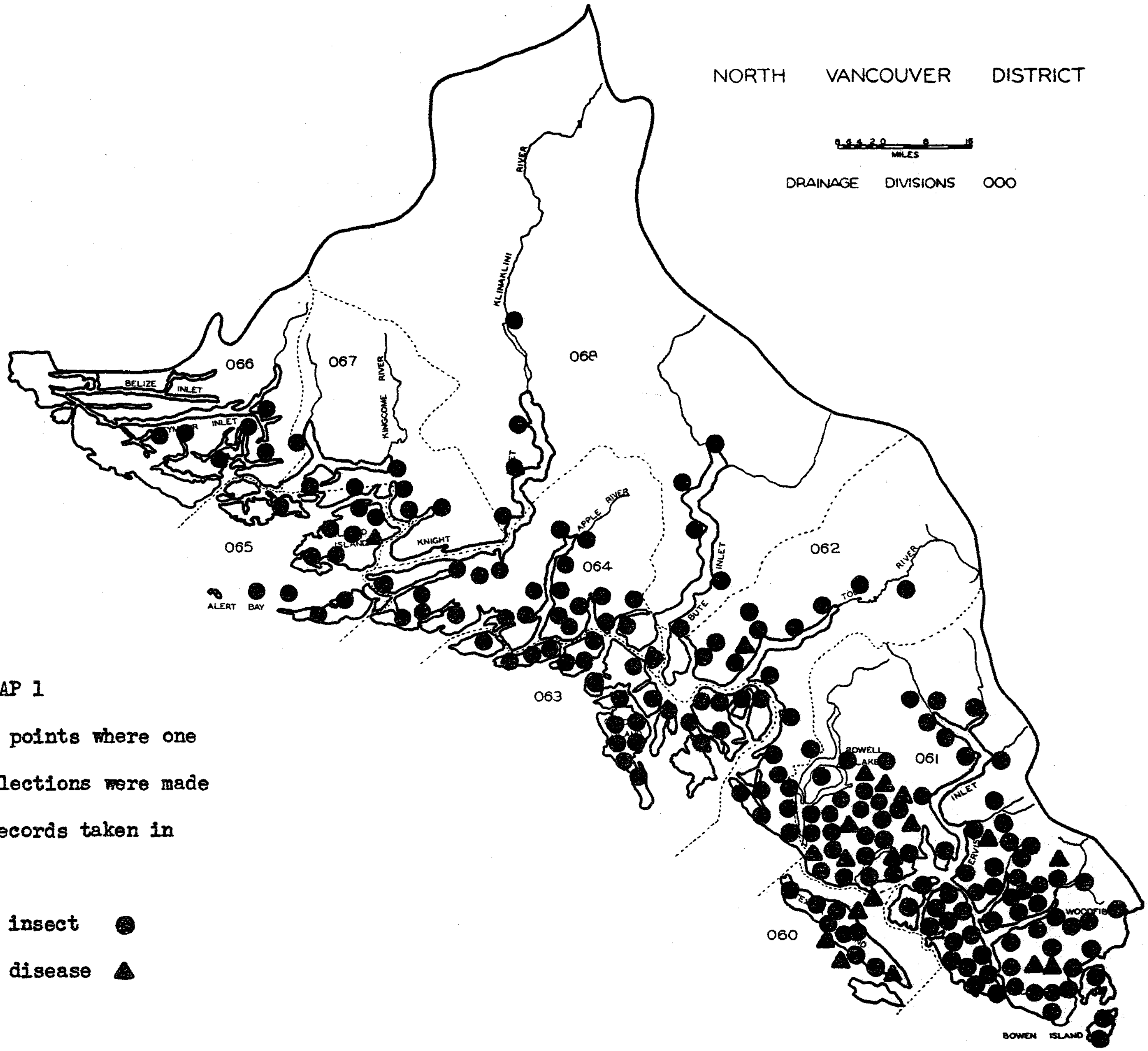
This rust recurred on grand fir exotic plantation, XP12, Powell River, where it affected nearly 30% of the foliage. Infections also occurred at Freda Lake, Gilford Island at Fraser Lake, and at Tin Hat Road near Lewis Lake. In these areas 75% of the 1964 foliage was affected. Most of the signs had all but disappeared and some of the foliage had died prematurely while the remainder was dry and discoloured.

Melampsora Rust of Black Cottonwood, Melampsora occidentalis Jacks.

This rust was collected at Vancouver Bay in 1965. It was observed at the head of Jervis Inlet, McNair Creek, Rainy River, Wilson Creek and Halfmoon Bay during August and September. Although higher than 1964, there was still a low incidence of infection.

Other Noteworthy Diseases

Host	Organism	Locality	Remarks
Alder, red	Taphrina sp.	Freda Cr. Texada I.	Associated with cankers and dieback.
Hemlock, western	Caliciopsis, pseudotsugae Fitzp.	Scots fir point Saltery Bay	Cankers and fruiting scarce.
Hemlock, western	Dimerosporium tsugae Dearn.	Toba Inlet, N. side	Sooty mould on old foliage, very sparse.
Hemlock, western	"Discocainia"-Type cankers	Fraser Lake, Scots fir point Clowhom Lake	Associated with branch dieback.
Tea, Labrador	Chrysomyxa ledicola Lagh.	Haslam and Duck Lakes	Rust, alternate host, Sitka spruce, over 1 mile distant from collection point.
Huckleberry, blue	Pucciniastrum goeppertianum (Kuhn) Kleb.	Texada I. L 373	Gall rust causing some Hypertrophic Symptoms.

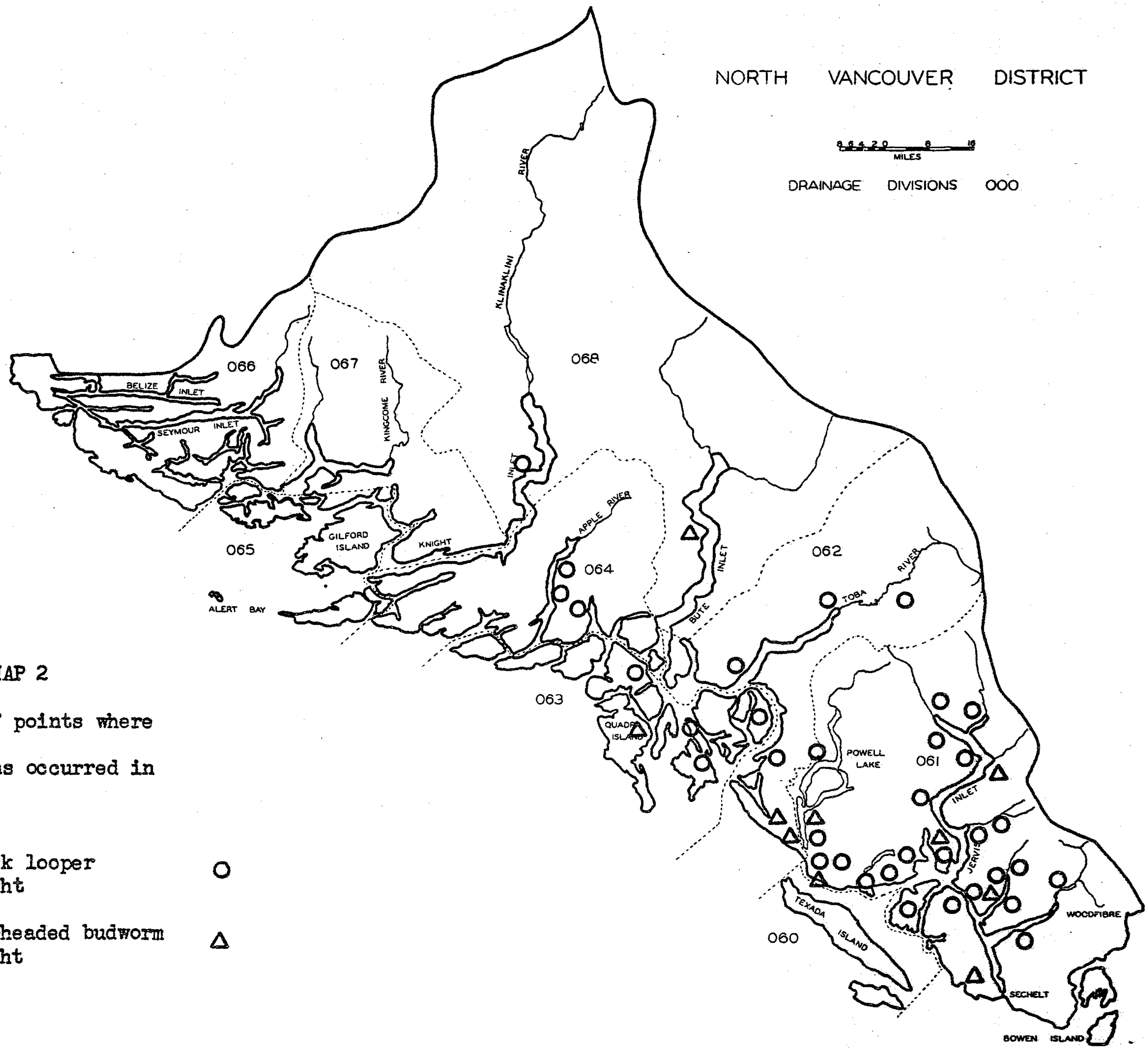


MAP 1

Location of points where one or more collections were made and field records taken in 1965.

Forest insect ●

Forest disease ▲



MAP 2

Location of points where infestations occurred in 1963.

Hemlock looper
Light ○

Black-headed budworm
Light △

FOREST INSECT AND DISEASE SURVEY

BRITISH COLUMBIA

1965

PRINCE RUPERT FOREST DISTRICT

FOREST INSECT AND DISEASE SURVEY

PRINCE RUPERT FOREST DISTRICT

1965

D. H. Ruppel

INTRODUCTION

Personnel involved in the survey of the Prince Rupert Forest District, including some changes from the previous year due to rotation and re-assignment, were as follows: D. H. Ruppel replaced E. G. Harvey in West Prince Rupert. A. K. Jardine remained in East Prince Rupert and a limited survey in South Prince Rupert was made by D. S. Ruth and J. S. Monts.

Aircraft were used more liberally in areas not accessible by road. Rangers collaborated on several projects and were assisted by other Departmental personnel and the B. C. Forest Service on spruce beetle and balsam mortality surveys. Several extensions in the known range of balsam mortality caused, at least in part, by a beetle-disease complex were found but the rate of mortality was generally lower. The status of this condition is reported jointly for Prince Rupert Forest District at the end of this introduction.

Spruce bark beetles declined but remain a hazard. This insect is also jointly discussed in the main introduction.

Mountain pine beetle damage decreased east of Babine Lake. Some current mortality occurred at Kitwanga.

Green-striped forest looper populations were very low but some tree mortality occurred in the outbreak area on the Queen Charlotte Islands.

Spruce tip moths were common in South and East Prince Rupert but damage was light. Sitka spruce regeneration on the Queen Charlotte Islands was found recovering from several years of injury by shoot feeders.

Severe damage to white spruce regeneration by Engelmann spruce weevils was noted along the Morice West Forest Development Road.

The Cooley spruce gall aphid was prevalent on Douglas-fir regeneration in the Saloomt River valley.

Spruce budworm, black-headed budworm and western hemlock looper were all at or near endemic levels.

Of several pests of deciduous hosts, forest tent caterpillar populations in East Prince Rupert collapsed, aspen leaf miner was active in eastern areas but progressively decreased to the west and willow leaf miners were epidemic in the Bella Coola Valley.

Unusually low winter temperatures accompanied by winds damaged western red cedar along Dean Channel.

Spruce Beetle, Dendroctonus obesus (Mann.)

D. H. Ruppel and A. K. Jardine

INTRODUCTION

Aerial surveys in August indicated reduced damage by spruce beetles in eastern areas of the Prince Rupert Forest District. Ground surveys of 10 selected areas by Canada Forestry personnel assisted by British Columbia Forest Service personnel in September confirmed the reduction of the infestation but revealed a continuing hazard in a few areas.

Balsam mortality encountered on the survey is dealt with under separate heading.

METHODS

Areas mapped from the air in late August 1965 coincided, approximately, with those of 1964. In addition, observations were made along the upper Nass and Bell-Irving rivers in the course of routine survey flights. The infestation ratings used for aerial classification were the same as 1964, i.e. light- from 1 to 5% of stems attacked; medium- 6 to 30% of stems attacked; heavy- over 30% of stems attacked.

Ten ground strips were run in September and spruce trees over seven inches in diameter were tallied in two-inch diameter classes under the following categories: green healthy (i.e. no beetle attack) green attacked (i.e. current attack) partial attack 1964, dead attacked 1954 and dead attacked 1963 or earlier. Volume figures of spruce affected were presented in the 1964 spruce beetle report. No volume figures are included in this report as 10 strips over widely scattered areas were not sufficient for this purpose.

RESULTS

Spruce beetle damage observed in 1965 is shown on Maps 1, 2 and 3. Data from strips chosen as likely to contain current attacks are shown in Table 1. Of 4,285 trees on the strips only 0.6% were attacked in 1965 as compared with 2.9% in 1964. Many of these were partial attacks which cannot be tallied as such until their effect on the tree is apparent the year following attack. New windfalls were found to be about 30% infested and these beetles probably represent a greater hazard than the populations in standing trees since they are not exposed to extreme temperature variations and predation by woodpeckers.

The numbers of spruce beetle adults and larvae in trap logs are shown in Table 2. No beetles were attracted at Smithers Landing in 1965 although attacks were found on standing trees at nearby Chapman Lake and adjacent areas. Trap trees at Taltapin Lake and Morice Access Road, both chronic areas, attracted less beetles than in 1964. Variations in the ratio of adults and larvae probably reflect differences in climatic conditions.

DISCUSSION AND CONCLUSIONS

The infestation of spruce beetles has declined to a low level but several hazardous situations remain. Increased blowdown will provide a beetle breeding site for several years. Heaviest blowdown encountered was on the strips at Binta, Chapman and Goosely lakes. Sanitation related to logging operations is a continuing problem. Salvage cutting in more severely damaged areas will decrease losses if promptly initiated.

Table 1

Percentage Spruce Trees Attacked by Spruce Beetles,

Prince Rupert Forest District, 1965

Location	Region	Total no. trees	Attacked 1965	Partial 1964	Dead 1964	Dead 1963	New windfalls (No.) attacked	New windfalls (No.) not attacked
Binta Lake	60	409	0	0	0.2	4.4	2	4
East Parrot Lake		1,014	0.3	1.6	0.3	5.7	0	0
Total		1,423	0.2	1.1	0.3	5.3	2	4
Burdick Cr.	65	211	2.8	1.4	0.9	21.9	0	0
McDonnell Lake		421	1.2	2.4	0	6.9	1	4
Total		632	1.8	2.1	0.3	11.9	1	4
Sunnyside (Babine Lake)	66	98	2.0	0	0	5.1	0	0
W. Helene Lake		505	0.2	11.3	0	10.1	0	0
Chapman Lake		569	0.4	3.5	0.2	7.2	5	2
Cronin Mine Road		129	0	0	0	10.1	0	0
Total		1,301	0.4	5.9	0.1	8.5	5	2
Erickson Lake	67	305	1.0	3.6	0	10.8	0	2
Goosely Lake		624	0.3	0	0	11.2	4	13
Total		929	0.5	1.2	0	11.1	4	15
GRAND TOTAL		4,285	0.6	2.7	0.2	8.5	12	25

Table 2

Spruce Beetle Development in Logs,

Prince Rupert Forest District

Location	Position of log	Total no. of insects 1964	Total no. of insects 1965	Per cent living insects Adults 1964	Adults 1965	Larvae 1964	Larvae 1965
Smithers Landing	Open	853	- 1/	9.4	-	90.6	-
	Shade	471	-	17.8	-	82.2	-
Taltapin Lake	Open	214	55	43.4	90.9	56.6	9.1
	Shade	409	31	35.2	90.3	64.8	9.7
Morice Access Road	Open	305	50	32.8	22.0	67.2	78.0
	Shade	343	76	16.3	8.0	83.7	92.0
Totals		2,595	212	21.5	52.0	78.5	47.2

1/ Not attacked

Balsam Mortality Caused by the *Dryocetes-Ceratocystis* Complex

D. H. Ruppel and A. K. Jardine

INTRODUCTION

Balsam mortality was recorded again in 1965 in conjunction with the spruce beetle survey but the time allotted to the survey was reduced from 1964. Current damage to balsam stands appeared to be somewhat reduced. In addition to previously known infested areas it was noted during a regular survey flight that balsam mortality was quite extensive along the Bell-Irving River, tributary of the Nass River.

Several long term study plots and cruise strips were established by a special crew to obtain information on balsam mortality in the Prince Rupert District as part of a detailed study of the problem .

METHODS

Observations made during the aerial survey in late August were mapped as previously using the following intensity classes: Light - from 1 to 5% of stems dead; Medium - from 6 to 30% of stems dead; Heavy - over 30% of stems dead. Areas and volumes were not calculated for this report as the number of comparative ground strips was small. Eight of the 10 ground strips run contained sufficient balsam for inclusion in a mortality table. Balsam were tabulated as in previous reports; green, green attacked, dead red-topped, etc.

RESULTS AND DISCUSSION

Current mortality of balsam generally appeared to be somewhat reduced. Fresh attacks were found on seven of eight strips (Table 3). It is not presently known what percentage of freshly attacked trees may die. Current mortality varied between and within areas.

Areas shown on Maps 1, 2 and 3 (in conjunction with spruce beetle infested areas) will complement maps shown in the 1964 report. A large area in the northwest portion of the District was added to the known infestation.

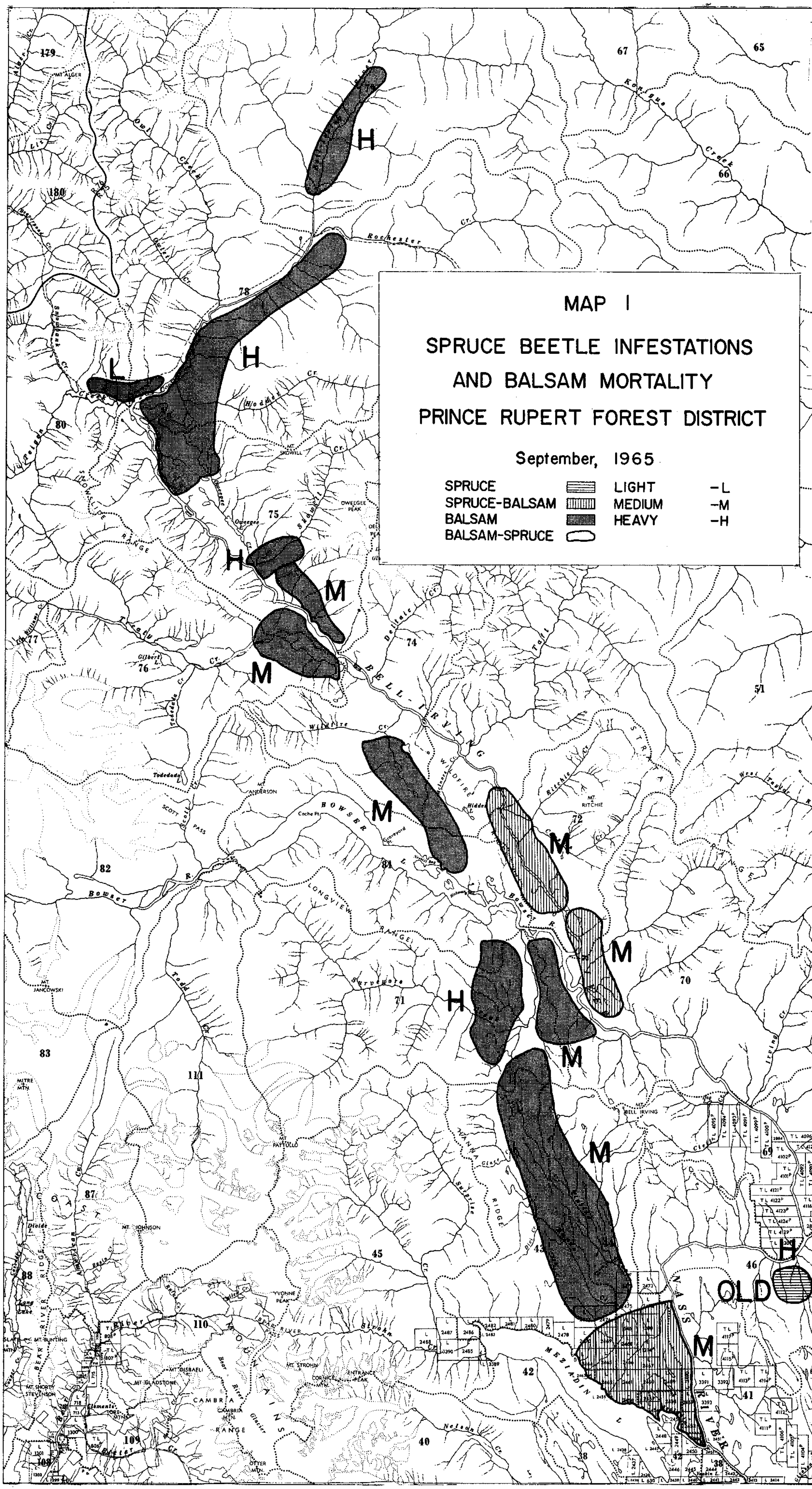
Probable future losses are not at present predictable and will be influenced considerably by weather and other environmental factors.

Table 3

Summary of Balsam Mortality Ground Survey Data,

Prince Rupert Forest District, 1965

Location of strip	Region	Compart-ment	No. of trees	% green attack	% trees dead
E. Parrot Lake	60	134	550	14.6	19.9
Burdick Creek	65	46	106	0	28.3
McDonnell Lake	65	17 N	342	16.1	2.3
Sunnyside (Babine L.)	66	50	195	2.6	13.3
Helene Lake	66	10	703	17.8	28.7
Chapman Lake	66	48	368	9.2	21.2
Cronin Mine Road	66	48	257	10.1	35.0
Erickson Lake	67	4	348	23.3	20.1


MAP I
SPRUCE BEETLE INFESTATIONS
AND BALSAM MORTALITY
PRINCE RUPERT FOREST DISTRICT
September, 1965
SPRUCE
SPRUCE-BALSAM
BALSAM
BALSAM-SPRUCE
LIGHT -L
MEDIUM -M
HEAVY -H
OLD

FOREST INSECT AND DISEASE SURVEY

SOUTH PRINCE RUPERT DISTRICT

1965

FOREST INSECT AND DISEASE SURVEY

SOUTH PRINCE RUPERT DISTRICT

1965

D.S. Ruth and J.S. Monts

INTRODUCTION

The 1965 Forest Insect and Disease Survey of the District was carried out between July 7th and July 20th. A float-equipped plane was used along the coast and a vehicle was used to cover the Bella Coola valley.

A cool spring prevailed throughout most of the district, followed by the warmest summer since 1961.

A total of 145 forest insect and 16 forest disease collections were submitted to the Victoria Laboratory. Insect and disease collections by hosts are shown in table I and the locations of these collections are shown on Map I .

Table I

Collections by Hosts

South Prince Rupert District 1965

Coniferous hosts	Forest insects	Forest diseases	Broad-leaved hosts	Forest insects	Forest diseases
Cedar, western red	16	1	Alder, red	5	
Cedar, yellow	2		Birch, western white	5	
Douglas fir	12	3	Cottonwood, black	2	1
Fir, alpine	1		Willow, spp.	5	
Fir, amabilis	5		Miscellaneous	2	2
Hemlock, western	44	4			
Hemlock, mountain	1				
Pine, lodgepole	7	1			
Pine, whitebark	1	1			
Spruce, Sitka	37	2			
Yew, western		1			
Total	126	13		19	3
			Grand total	145	16

FOREST INSECT CONDITIONS

Important Insects

Green-striped Forest Looper, *Melanolophia imitata* Wlk.

The Green-striped forest looper populations increased slightly in 1965. Fourteen larvae were collected from nine samples in 1965 compared to five larvae from two samples in the previous year.

Spruce Budworm, *Choristoneura fumiferana* (Clem.)

The population level of spruce budworm in the District remained low in 1965. Six larvae were collected from one sample made on Sitka Spruce 1/4 mile South of Kitimat wharf. As in previous years, collections were made after the peak larval period.

Willow Leaf Miner, *Lithocolletis salicifoliella* Cham.

Willow trees in the Bella Coola valley were again infested by the willow leaf miner. The heaviest infestation occurred between Firvale and Stuie, a distance of 17 miles. The incidence of infested willow trees ranged from 95 to 100 per cent within this area. Foliage attacks at other locations in the valley varied from 0 to 40 per cent.

Western Hemlock Looper, *Lambdina fiscellaria lugubrosa* (Hlst.)

There was a noticeable increase in population levels of the hemlock looper this year. A majority of the larvae were taken from drainage 082. A total of 33 larvae was collected in the Bella Coola valley and South Bentinck Arm areas. Samples were taken from western hemlock, western red cedar, Douglas-fir, Sitka spruce and amabilis fir.

Other Noteworthy Insects

Insect	Host	Number of Collections	Remarks
Acleris variana (Fern.)	H	1	Very low population level.
Neodiprion spp.	H, C, S, F, B, Pl, Bi.	28	Common in most collections, largest contained 131 larvae.
Zeiraphera spp.	S, D	5	6 larvae collected.
Ectropis crepuscularia Schiff.	H, C	4	8 larvae from 4 collections. First collection in past 2 years.
Neophasia menapia F. & F.	F	1	4 larvae collected. Very low level.
Adelges cooleyi (Gill.)	F	1	Heavy attack in Saloomt valley, light elsewhere.
Nyctobia limitaria Wlk.	H, B, F, S, C	14	Found in all drainages but in small numbers.
Orgyia antiqua badia (Hy. Edw.)	S, H	3	Found only in drainage 083. 5 larvae collected.
Pikonema dimmockii Cress.	S	8	Found in all drainages in small numbers. Collections averaged 2.9 larvae each.
Pissodes sitchensis Hopk.	S		Light damage noted in Bella Coola valley.

FOREST DISEASE CONDITIONS

None of the diseases collected in South Prince Rupert District were known to cause serious damage to healthy trees. A total of 16 disease collections were made in the District, six of which have not yet been identified. Collections are listed under other noteworthy diseases.

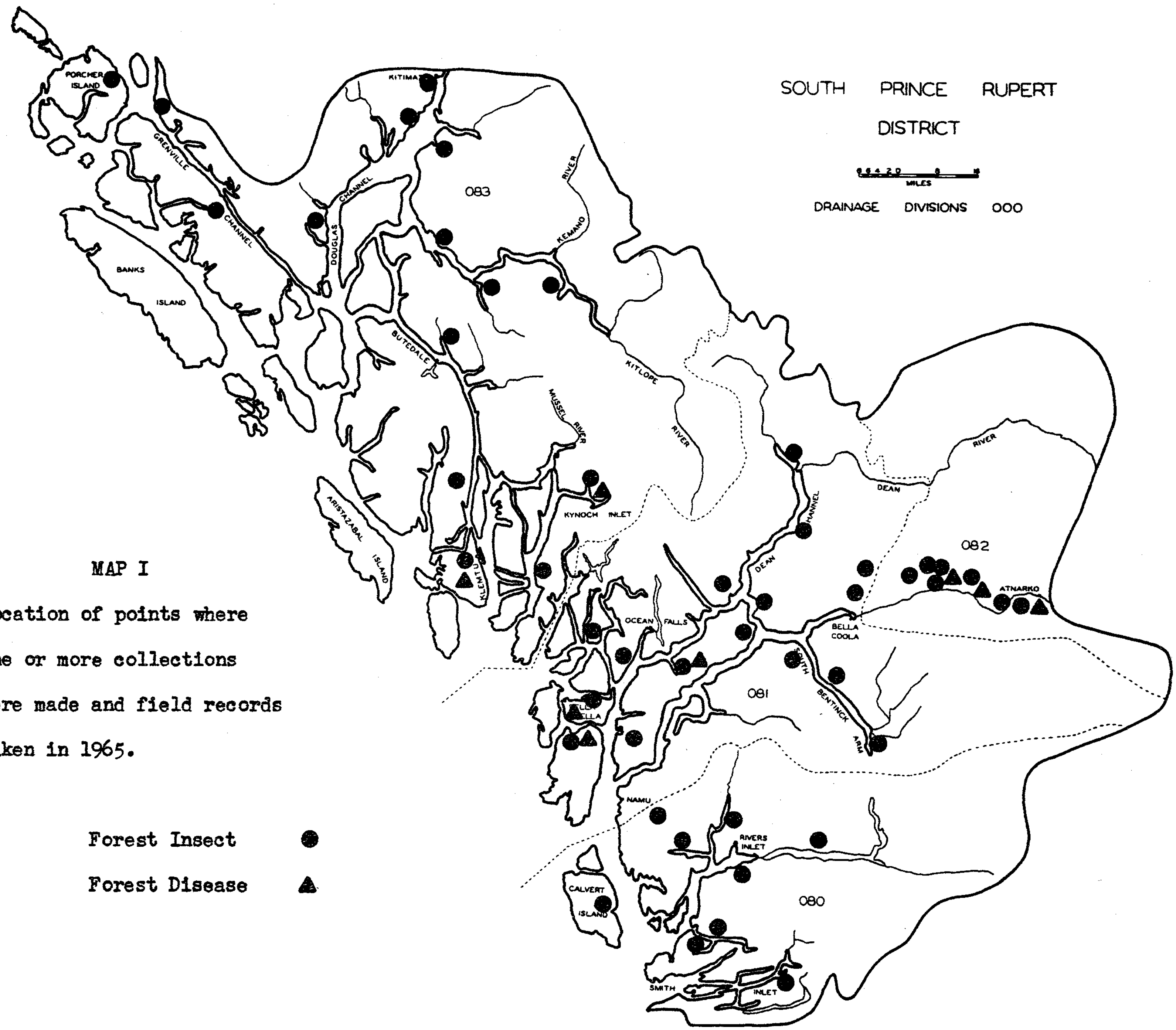
Important Diseases

Climatic Injury

Western red cedar trees in the Dean Channel and King Island areas were affected by winter frost injury. Depending on exposure, from 20 to 75% of the foliage had turned brown. Below zero temperatures and high winds experienced in these areas last winter may have caused this foliage loss.

Other Noteworthy Diseases

Host	Organism	Locality	Remarks
Hemlock, western	Dimerosporium tsugae Dearn.	Thorsen Cr., Stuie, Gardner Canal.	Common infection causing sooty mold on needles. Found in 3 collections
Douglas-fir	Retinocyclus spp.	Snootley Creek.	A common resin fungus .
Spruce, Sitka	Dasyscyphus spp.	Kishkosh Inlet	Causes a resinous canker, found in 2 collections.



MAP I

Location of points where one or more collections were made and field records taken in 1965.

Forest Insect ●

Forest Disease ▲

FOREST INSECT AND DISEASE SURVEY

WEST PRINCE RUPERT DISTRICT

1965

FOREST INSECT AND DISEASE SURVEY

WEST PRINCE RUPERT DISTRICT

1965

D. H. Ruppel

INTRODUCTION

The field season in the District extended from early May to late September.

Special surveys, including spruce beetle and green-striped forest looper mortality and others were carried out in addition to the normal insect and disease survey.

Weather conditions were characterized by a cool spring, followed by a warm dry summer.

A total of 363 forest insect and 14 forest disease collections was made during the season. Table 1 lists collections by host and Maps 1 and 2 indicate locations where one or more collections and field records were made.

Some periodically important insect pests have been omitted from the text of the report but included in the list of "Other Noteworthy Insects."

Table 1

Collections by Hosts

West Prince Rupert District, 1965

Coniferous hosts	Forest insects	Forest diseases	Broad-leaved hosts	Forest insects	Forest diseases
Cedar, western red	33		Alder, red	2	
Cedar, yellow	1		Alder, sp.	1	
Cedar sp.	1		Aspen, trembling	3	
Douglas-fir	1	1	Birch, white	2	
Fir, alpine	16	3	Cherry, domestic		1
Fir, amabilis	24		Cottonwood, black	2	
Fir, balsam	1		Willow spp.	11	
Hemlock, western	168	3	Miscellaneous hosts	3	1
Pine, lodgepole	13	1			
Pine, shore	3				
Spruce, Sitka	66	4			
Spruce, white	12				
Totals	339	12	Totals	24	2
			Grand Totals	363	14

FOREST INSECT CONDITIONS

Balsam Mortality Caused by the Dryocoetes-Ceratocystis Complex

Balsam mortality was discussed in the introduction to the Prince Rupert Forest District section of the report. Several extensions in known range were observed. Current mortality was noted near Mill Creek west of Kitwanga and extensive damage extended along the Bell-Irving River.

Spruce Beetle, Dendroctonus obesus (Mann.)

Spruce beetle activity was discussed in the introduction to the Prince Rupert District section of the report. Damage to spruce in the West Prince Rupert District was light.

Green-striped Forest Looper, Melanolophia imitata Wlk.

Green-striped forest looper populations in the District declined to a very low level in 1965. No larvae were found in the recent outbreak areas on the Queen Charlotte Islands (Table 2).

Seven study plots established on the Charlottes to obtain data on tree damage resulting from the 1963-64 looper outbreak were examined in 1965 (Table 3). Figures apply to western red cedar and western hemlock. Sitka spruce and lodgepole pine were omitted as they sustained little feeding and formed a minor part of the stands involved.

Top-kill and mortality were heavy in plot 1 but were quite light in the remaining plots. Many individual trees in plot 1 had been 100% defoliated and some of them were still living. A number of heavily defoliated trees, particularly cedar, put out adventitious growth along the main stem but this recovery was partially defeated by unusually warm, dry weather during late summer. The foliage complement improved on trees on all the plots as indicated under the heading " Defoliation %" in the table. Defoliation was not recorded on plot 7 as tree recovery was good and meaningful estimates were difficult to determine.

Green-striped forest loopers are expected to remain at a low level in 1966. Damage from the 1963-64 outbreak will probably cause further tree mortality and top-kill, particularly if the summer weather is warmer and drier than normal for another year or two.

Table 2

Summary of Green-striped Forest Looper Collections by Drainage Divisions,

West Prince Rupert District

Drainage division	Number of samples taken during larval period			% samples containing larvae			Average number of larvae per sample		
	1963	1964	1965	1963	1964	1965	1963	1964	1965
100	43	27	24	16.3	3.7	0	3.4	1.0	-
101	30	31	42	53.3	29.0	0	18.5	133.7	-
102	14	14	9	42.9	64.3	11.1	8.2	3.0	1.0
103	22	7	20	27.3	0	0	4.5	-	-
104	4	5	12	25.0	0	0	3.0	-	-
105	9	8	9	44.4	37.5	22.2	3.5	1.7	1.0
106	32	43	15	6.3	7.0	6.7	5.5	1.7	3.5
Total	154	135	131	27.3	18.5	3.1	10.1	49.6	1.6

Table 3

Ocular Estimate by Crown Classes of Defoliation, Top-kill, and Mortality Caused

by Green-striped Forest Looper, Queen Charlotte Islands

Plot	Crown class	Tree sp.	No. trees	Defoliation % 1963	1964	1965	Top-killed /65 no.	av. ft.	Dead /65 insects	Other
1	D	C	34	98	98	91	6	14.1	18	0
		H	27	91	91	81	12	15.7	3	0
Port	CD	C	18	98	98	93	4	5.0	9	0
Clements,		H	16	94	97	89	6	16.6	4	0
West end	I	C	23	97	97	93	3	7.3	9	0
of		H	15	86	90	83	4	8.0	1	0
Lot 1828	S	C	33	88	92	90	3	6.0	10	0
		H	18	74	85	78	1	5.0	0	0
Totals			184	92	94	86	39	11.9	54	0

Table 3- Cont'd.

Plot	Crown class	Tree sp.	No. trees	Defoliation % 1963	1964	1965	Top-killed /65 no.	av. ft.	Dead /65 insects	Other
2	D	C	0	-	-	-	-	-	-	-
Port		H	15	25	60	44	3	8.0	0	0
Clements,	CD	C	1	25	63	63	0	-	0	0
Masset		H	17	17	51	37	2	5.0	0	0
Rd.	I	C	0	-	-	-	-	-	-	-
Lot 412		H	12	12	39	25	0	-	0	0
	S	C	4	10	46	33	0	-	0	0
		H	7	7	43	30	0	-	-	-
Totals			56	17	50	36	5	6.8	0	0
3	D	C	11	53	49	41	0	-	0	0
		H	7	35	57	52	2	15.5	0	0
Lot	CD	C	2	46	55	50	0	-	0	0
424		H	9	50	69	57	3	5.4	0	0
	I	C	1	33	30	25	0	-	0	0
		H	7	51	55	50	1	7.0	0	0
	S	C	1	50	50	45	0	-	0	0
		H	25	36	47	45	4	12.5	1	1
Totals			63	46	53	47	10	10.5	1	1
4	D	C	4	37	37	21	0	-	0	0
		H	0	-	-	-	-	-	-	-
	CD	C	5	54	57	42	0	-	0	0
Lot		H	8	46	51	34	0	-	0	0
404	I	C	4	46	42	35	0	-	0	0
		H	42	42	45	32	0	-	0	0
	S	C	1	50	75	46	0	-	0	0
		H	19	38	48	36	0	-	0	0
Totals			83	42	47	33	0	-	0	0
5	D	C	3	38	37	28	0		0	0
Port		H	1	50	40	32	0	-	0	0
Clements,	CD	C	6	53	46	38	0	-	0	0
East end		H	7	46	43	36	0	-	0	0
of Lot	I	C	13	48	45	36	0	-	0	0
1828		H	45	36	39	38	1	8.0	1	1
	S	C	4	34	40	31	0	-	0	0
		H	25	29	34	31	0		0	1
Totals			104	38	39	35	1	8.0	1	2

Table 3- Cont'd.

Plot	Crown class	Tree sp.	No. trees	Defoliation % 1963	1964	1965	Top-killed /65 no.	av. ft	Dead/65 insects	Other
6	D	C	7	60	30	21	0	-	0	0
East of		H	5	47	30	13	0	-	-	-
Kumdis	CD	C	0	-	-	-	-	-	-	-
Cr.		H	17	41	29	18	0	-	0	0
Lot	I	C	6	53	36	29	0	-	0	0
405		H	28	38	32	20	0	-	0	0
	S	C	0	-	-	-	-	-	-	-
		H	29	28	23	17	0	-	0	1
Totals			92	40	29	18	0	-	0	1
7	D	C	14	31	26	-	0	-	0	0
South		H	13	30	16	-	0	-	0	0
end of	CD	C	13	28	26	-	0	-	0	0
Mayer		H	10	34	25	-	0	-	1	0
Lake	I	C	20	28	29	-	4	5.8	0	0
		H	5	20	23	-	1	8.0	0	0
	S	C	12	19	24	-	2	3.5	0	0
		H	4	18	25	-	0	-	0	1
Totals			91	28	25	-	7	5.5	1	1

Saddle-backed Looper, *Ectropis crepuscularia* (Schiff.)

There was only one saddle-backed looper larva found in the District in 1965. None were found at Kitimat where trees were still dying as a result of heavy defoliation by this looper from 1959 to 1961, followed by spruce budworm and balsam bark beetle attacks. Table 4 shows the cumulative mortality in the study plots in this area.

Some salvage logging has been done in the Kitimat area and further extensive cutting is anticipated. Mortality may be expected to continue in damaged stands if heavily attacked trees are not harvested. Many remaining trees have a poor complement of foliage and will probably re-act unfavorably to stand openings caused by the tree mortality. Deterioration of dead trees is being accelerated by flat-headed borers and ambrosia beetles.

Table 4

Cumulative Tree Mortality in Saddle-backed Looper Plots, Kitimat,

West Prince Rupert District

Location	Tree species	No. of trees	Dead trees to date 1960	1961	1962	1963	1964	1965
Fume plot 2	H	22	8	16	19	19	19	19
Anderson Creek	B	31	8	25	27	30	31	31
	C	8	1	3	3	3	3	4
Total		61	17	44	49	52	53	54
Fume plot 3	H	122	9	48	50	54	61	67
Sandhill	B	13	0	5	7	12	12	12
	C	1	0	1	1	1	1	1
	Pl	1	0	0	0	0	0	0
Total		137	9	54	58	67	74	80
Fume plot 4	H	10	0	1	1	1	2	2
N. Kitimat	B	20	1	1	2	3	4	7
Total		30	1	2	3	4	6	9
Mortality Plot 1	H	29	0	16	18	29	29	29
Sandhill	B	4	0	4	4	4	4	4
Total		33	0	20	22	33	33	33
Mortality Plot 2	H	30	0	14	16	19	21	21
Sandhill	B	17	0	3	15	16	16	16
	C	3	0	1	1	1	1	1
Total		50	0	18	32	36	38	38
GRAND TOTAL		311	27	138	164	192	204	214

Mountain Pine Beetle, Dendroctonus ponderosae Hopk.

Mountain pine beetles killed lodgepole pines in scattered groups between Burdick Creek and Kitwanga River about five miles northeast of Kitwanga. Ground examinations, followed by an aerial survey, disclosed about 850 red-topped pines, mostly in Region 65, Compartment 42. Trees ranged in size from 8 - 14 dbh and 60 - 90 in height.

The 1965 attack, if any, had not caused any discernible discoloration when the area was flown in mid-August.

Spruce Terminal Damage

Terminal damage by Zeiraphera sp. Rhabdophaga sp., and Epinotia sp. to Sitka spruce on the Queen Charlotte Islands continued at a reduced rate in 1965 on plots at Sandspit and East Narrows. Plots at Skidegate Lake and Maude Island were not examined in 1965 but damage appeared at a reduced level in 1964.

The recovery over the past 10 years of leader-damaged Sitka spruce on four study plots indicated that very little permanent damage results from the injury (Table 5). Only 28 of 224 sample trees escaped leader damage during a period of approximately 10 years. Eight trees on Plot 2 had superficial stem deformities which will probably not affect their future merchantable value, 74 trees were currently damaged when last examined, and 150 had outgrown the damage. Lost or very badly deformed leaders were replaced by adventitious leaders, often multiple, but a single leader tended to take over. The full effect on tree heights was not established but height growth was fairly good.

Injury to leaders had been at a low level in 1964 in Plots 3 and 4 and there was a further decrease in damage in 1965 in the other two plots. Feeding was evident on branch tips in the lower crown of trees in Plot 2, Sandspit. If the insects continue to feed at lower crown levels in the stands, as appears to be the case, damage to leaders will probably continue to decline as tree heights increase.

Table 5

Summary of Sitka Spruce Trees with Leader Insect Damage and Recovery for the Past Ten Years, Queen Charlotte Islands Plots, West Prince Rupert, 1965

Plot no.1/	Total	Not damaged	Damaged during period	Presently damaged	Presently recovered or undamaged
1	58	17	41	3	55 2/
2	77	3	74	42	35
3	40	6	34	9	31
4	49	2	47	20	29
Total	224	28	196	74	150

Plot locations

1. East Narrows
2. Sandspit
3. Skidegate Lake
4. Maude Island

2/ Eight trees with moderately deformed stems will probably recover merchantable form.

Spruce Budworm, Choristoneura fumiferana (Clem.)

The spruce budworm declined to a low population level throughout the District (Table 6). The only larvae found were at Kitimat, east of Terrace and on Graham Island. Little change is expected in the status of this insect in 1966.

Table 6

Summary of Spruce Budworm Collections by Drainage Divisions,

West Prince Rupert District

Drainage division	Number of samples taken during larval period			% samples containing larvae			Average number of larvae per sample		
	1963	1964	1965	1963	1964	1965	1963	1964	1965
100	43	26	22	2.3	0	0	1.0	-	-
101	31	29	21	3.2	3.4	4.8	1.0	1.0	1.0
102	24	28	20	87.5	39.3	15.0	46.0	12.3	1.0
103	15	14	12	0	14.3	0	-	2.0	-
104	32	30	10	37.5	10.0	0	7.7	1.0	-
105	24	35	33	12.5	0	3.0	1.0	-	1.0
106	16	39	21	12.5	2.6	0	2.0	1.0	-
Total	185	201	139	21.6	9.0	3.6	26.7	8.0	1.0

Aspen Leaf Miner, Phyllocnistis populiella (Chamb.)

Aspen leaf miners continued to damage aspen foliage in the District. Current damage on plots was medium at Cedarvale, heavy at Oliver Creek and light at Terrace and Beam Station Road (Table 7). Emergence of moths, as indicated in sample plots, suggested low 1966 populations in the western plots and high populations in the eastern plots.

Parasitism of the aspen leaf miner was high at Terrace and Beam Station Road and below average at Cedarvale and Oliver Cr. (Table 8).

Accurate forecasts of this insect are difficult as weather plays an important part in their population fluctuations. The infestation will probably continue in 1966

Table 7

Aspen Leaf Surfaces Mined and Number of Adults

Produced per 100 Leaf Surfaces, West Prince Rupert District

Plot location	Total no. of leaves				Percentage of leaf surfaces mined				No. adults per 100 leaf surfaces 1/			
	1962	1963	1964	1965	1962	1963	1964	1965	1962	1963	1964	1965
Cedarvale	673	563	624	390	91.2	40.8	16.1	65.0	34	14	10	55
Oliver Cr.	385	449	579	484	96.2	70.8	55.8	81.7	33	2	5	58
Terrace	488	490	636	454	97.9	70.9	93.2	38.9	49	18	45	7
Beam Stn. Rd.	455	525	669	645	73.6	25.6	41.0	49.5	69	16	47	2
Average	500	507	627	494	89.7	52.0	51.5	64.0	46	12	27	30

1/ The figures given in this section replace those published in previous years in the corresponding table.

Table 8

Mortality of Aspen Leaf Miner in 100 Cocoon Samples

at Four Locations, West Prince Rupert District

Plot location	% emerged				% parasitized				% Dead			
	1962	1963	1964	1965	1962	1963	1964	1965	1962	1963	1964	1965
Cedarvale	33	39	19	48	52	42	45	36	15	19	36	16
Oliver Cr.	37	43	36	49	52	22	23	20	11	35	41	31
Terrace	45	40	64	18	43	30	16	55	12	30	20	27
Beam Stn. Rd.	68	47	63	6	17	12	14	57	15	41	23	37
Average	45.8	42.2	45.5	30.2	41.0	26.5	24.5	42.0	13.2	31.2	30.0	27.7

A Hemlock Bark Beetle, *Hylurgops rugipennis* (Mann.)

During flights over the Queen Charlotte Islands in early July light but widespread current western hemlock mortality was observed. Most of the trees appeared to be mature or overmature and heavily infected with mistletoe. Examinations at Skidegate Lake showed *Hylurgops rugipennis* to be present in some dying trees. Beetles were recovered in small numbers near ground level but a number of trees had obvious resinosis on the stem in the upper crown. There was some indication of disease lesions associated with galleries in the cambium layer. The insect is generally considered to be secondary.

Other Noteworthy Insects

Insect	Hosts	No. of collections	Remarks
Acleris variana (Fern.)	conifers	1	Black-headed budworm defoliator. Very low level. Only 1.0% of 104 collections contained an average of 1.0 larvae.
Caripeta divisata Wlk.	H, S	15	Grey spruce looper, defoliator, low level, max. collection six larvae.
Epirrita autumnata Harr.	B, Ba, H, S.	11	Defoliator, max. collection seven larvae. Increase over last year.
Lambdina fiscellaria lugubrosa (Hulst)	H, S, C	9	Western hemlock looper, defoliator. Low population level, 2.9% of 310 collections contained an average of 1.6 larvae, max. two larvae.
Malacosoma disstria Hbn.	A	0	Forest tent caterpillar, defoliator. Very low level, one or two colonies seen.
Neodiprion spp.	H, Ba, Pl, S, Sw	22	Sawflies at a very low level, max. collection 30 larvae from western hemlock.
Neomyzaphis abietina (Wlk.)	S	0	Spruce aphid. No noticeable damage in 1965.
Orgyia a. badia (Hy. Ed.)	H, C, S, B	7	Tussock moth, defoliator. Seven collections mostly at Kitimat, max. collection 18 larvae.
Pikonema alaskensis Roh.	S, Sw	11	Yellow-headed spruce sawfly, common. Max. collection eight larvae.
Pikonema dimmockii Cress.	S. Sw	20	Green-headed spruce sawfly, common. Max. collection 18 larvae.
Sthenopis quadriguttatus Grt.	W	1	A large root-boring lepidoptera of the family Hepialidae. Larvae boring in roots and root crowns of native willows at Terrace. Larvae seldom collected.

FOREST DISEASE CONDITIONS

Important Diseases

A Dieback of Douglas-fir, Sclerophoma sp.

A Dieback of Douglas-fir caused by Sclerlphoma sp. increased in incidence and severity in plantations north of Terrace. The trees were planted in 1958 and at intervals since then. Records indicate periodic heavy infestations of the Cooley spruce gall aphid, Adelges cooleyi (Gill.) but the aphid was at a low population level in 1965. There were light symptoms of weather injury to Douglas-fir and other planted trees in the area. Dieback infection in plots was as follows:

XP 126 Sec. A	- 10 of 50 sample trees heavily infected
XP 126 Sec. B	- all of 50 " " " "
XP 128	- all of 50 " " " "
XP 146	- 50 trees very lightly infected
XP 160	- 50 trees very lightly infected
XP 161	- 50 trees very lightly infected
XP 206	- 50 trees no symptoms found
XP 207	- 50 trees no symptoms found

Flood Damage Caused by Beavers, Castor sp.

Flood damage caused by Castor sp. has become increasingly evident in much of the Prince Rupert Forest District including Graham Island. During aerial surveys, patches of flood-killed trees from one half to several acres in extent were observed. The areas increased noticeably in the past few years.

Balsam Mortality, Dryocoetes- Ceratocystis complex

The widespread mortality of balsam caused by the Dryocoetes-Ceratocystis complex is reported in the introduction to the Prince Rupert Forest District report .

Exotic plantations

Eighteen exotic plantations were examined in the Terrace area (Table 9). A severe dieback condition of Douglas-fir plantings was included in the previous section. With the exception of Douglas-fir and assorted hybrid poplars, most exotic species were growing satisfactorily in 1965.

Table 9

Exotic Plantations Examined, West Prince Rupert District, 1965

XP No.	Location	Tree sp.	Remarks
123	Terrace	Mixed conifers, nursery	Very light weather injury but no other symptoms found
124	"	Mixed poplars, nursery	Heavy mortality but no signs found.
126 Sec A	"	Douglas-fir	Heavy dieback, <u>Sclerophoma</u> sp., see text.
126 Sec B	"	Douglas-fir	" " " "
128,129	"	Larch, European	No symptoms found.
130	"	Larch, Japanese	" " "
131	"	Larch, hybrid	" " "
132	"	Larch, European	" " "
133	"	Poplar, mixed	" " "
145	"	Poplar, mixed	" " "
146	"	Douglas-fir	Dieback, see XP 126
147	"	Spruce, white	No symptoms found.
160	"	Douglas-fir	Dieback, see XP 126
161	"	Douglas-fir	" " "
206	"	Douglas-fir	No symptoms found.
207	"	Douglas-fir	" " "
231	"	Larch, Japanese	" " "

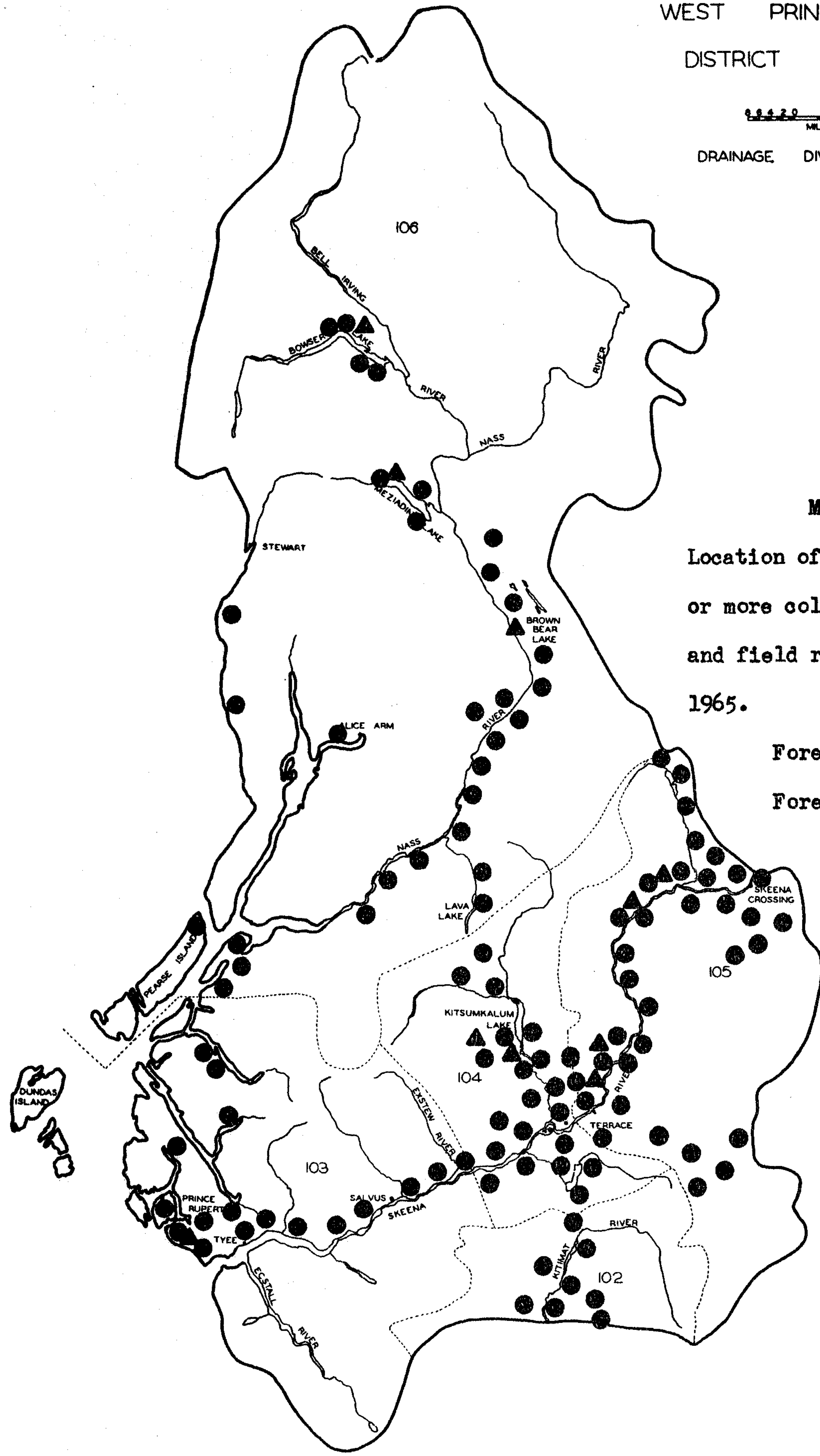
Other Noteworthy Diseases

Host	Organism	Locality	Remarks
Fir, alpine	Delphinella balsameae (Waterm.)	Meziadin and Bowser lakes	Tip blight, severe on lower crowns of occasional living trees. New record
Hemlock, western	Stilbum sp.	Prince Rupert	Associated with the resinosis on a branch lesion.
Spruce Sitka	Botryosphaeria piceae Funk	Queen Charlotte Islands and Terrace	Twig canker. Collected by E.G. Harvey.
Spruce Sitka	Lophodermium piceae (Fckl.) Höhn. and Lophodermium macrosporium (Harting) Rehm	Queen Charlotte Islands	Needle cast on lower crown foliage. Neomyzaphis abietina Wlk. prevalent previous year.

WEST PRINCE RUPERT DISTRICT (MAINLAND)

MILES

DRAINAGE DIVISIONS 000

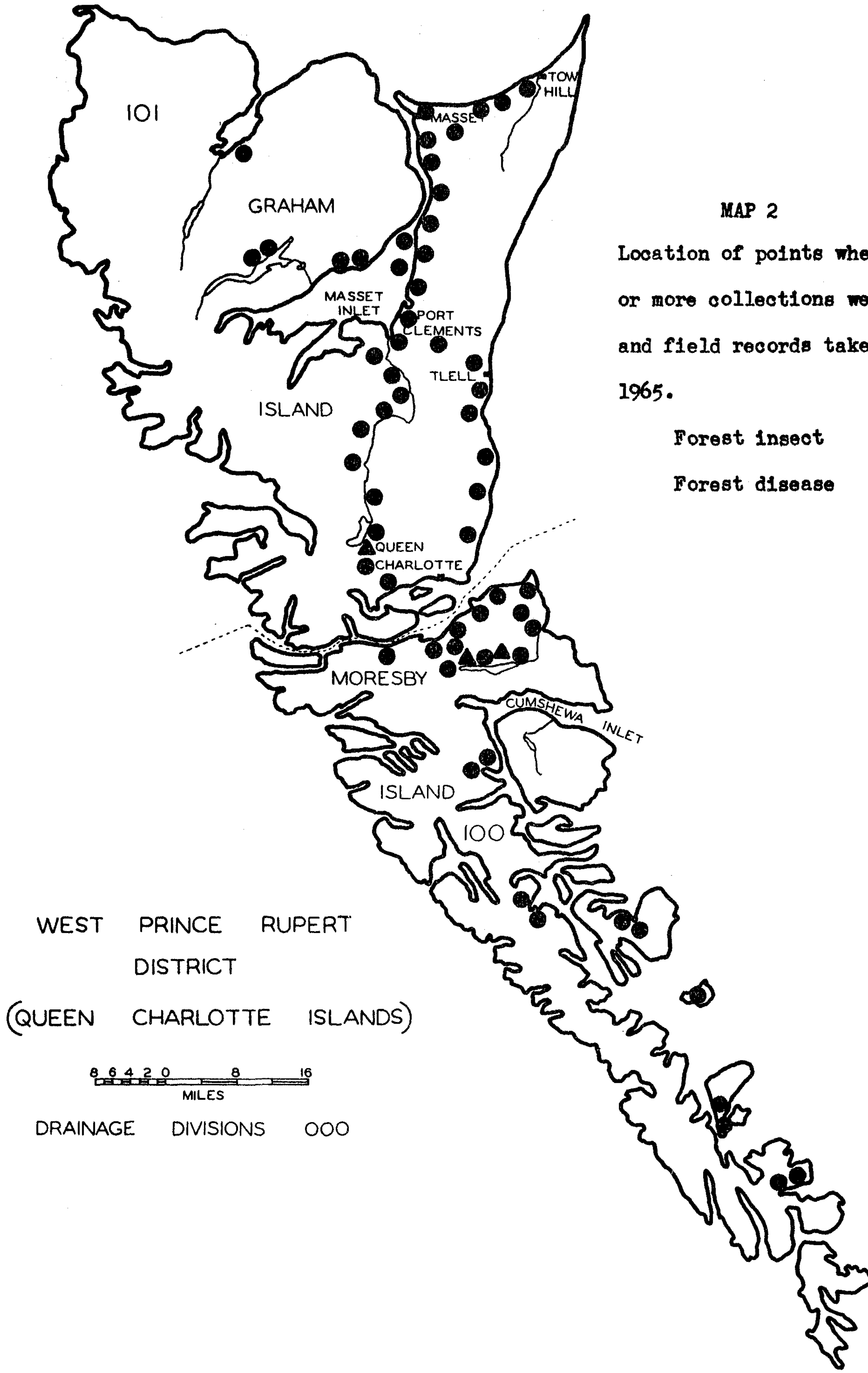


MAP 1

Location of points where one or more collections were made and field records taken in 1965.

Forest insect ●

Forest disease ▲



MAP 2

Location of points where one or more collections were made and field records taken in 1965.

Forest insect ●

Forest disease ▲

FOREST INSECT AND DISEASE SURVEY

EAST PRINCE RUPERT DISTRICT

1965

FOREST INSECT AND DISEASE SURVEY

EAST PRINCE RUPERT DISTRICT

1965

A. K. Jardine

INTRODUCTION

Field work in the East Prince Rupert District commenced on May 24 and ended Sept. 24 . A cool May was followed by a generally warm and dry summer and there was very little insect activity. A report on the spruce bark beetle and balsam fir mortality in the District is included in the introduction to the Prince Rupert District Report. A total of 432 forest insect and 12 forest disease collections were made (Table I). The location of points where collections were made and field records taken are shown in Map I.

Table I

Collections by Hosts

East Prince Rupert District, 1965

Coniferous hosts	Forest insects	Forest diseases	Broad-leaved hosts	Forest insects	Forest diseases
Cedar, red	6		Aspen, trembling	2	2
Douglas-fir	4		Alder, red	3	
Fir, alpine	78	3	Alder, Sitka	1	
Fir, amabilis	18		Birch, white	4	
Hemlock, mountain	3		Cottonwood, black	1	
Hemlock, western	22	1	Hazelnut	1	
Pine, lodgepole	98	3	Willow spp.	6	
Pine, whitebark	1		No host	1	
Spruce, black	1		Miscellaneous	3	3
Spruce, Sitka	21				
Spruce, western white	158				
Totals	410	7	Totals	22	5
			GRAND TOTALS	432	12

FOREST INSECT CONDITIONS

Important Insects

Two-year-cycle Spruce Budworm, *Choristoneura fumiferana* (Clem.)

The spruce budworm population in the District continued to decline in 1965. Current defoliation was very light and mortality of spruce and balsam caused by the prolonged infestation was low. Some top-kill of balsam occurred in several areas and many trees had not regained a full complement of foliage. Considerable dead understory balsam was encountered during the spruce bark beetle cruises in these areas. Only nine of a total of 236 collections taken from western white spruce and alpine fir contained spruce budworm larvae. The highest larval sample taken in 1965 was seven, from spruce, on the Taltapin Lake road. There was no sign of defoliation in the Helene Lake area in 1965 where budworm had caused up to 90 per cent defoliation of current growth in 1964. The status of the population is not expected to change in 1966. The condition of the trees in the three plots in 1965 as compared with 1961 is shown in Table 2.

Forest Tent Caterpillar, *Malacosoma disstria* Hbn.

The extensive forest tent caterpillar infestations in the East Prince Rupert District collapsed. The outbreak began in 1959 and caused considerable annual defoliation of aspen and other deciduous growth between Hazelton and Telkwa. In 1963 the outbreak disappeared in the Hazelton area and moved eastward from Telkwa to Houston.

The infestation caused heavy, and in many spots, total defoliation of aspen for five consecutive years. After being heavily defoliated the trees were often able to produce a new crop of foliage the same year and this, no doubt, helped to prevent tree mortality. There was, however, some top and branch kill.

Egg counts made in study plots in 1964 indicated that the outbreak would be heavy again in 1965. However, the predicted population did not appear, possibly as a result of reduced vigor or unfavorable weather conditions. The insect is expected to remain at a low population level in 1966.

Black-headed Budworm, *Acleris variana* (Fern.)

The black-headed budworm population in the District declined slightly in 1965. The largest sample, of seven larvae, was found on spruce near Fifteen Mile Creek on Taltapin Lake. The following is a summary of black-headed budworm collections in the District:

Total number of samples taken during larval period			Percentage of samples containing larvae			Average number of larvae per sample		
1963	1964	1965	1963	1964	1965	1963	1964	1965
57	119	140	3.5	15.9	15.7	1.0	3.9	3.1

Table 2

Spruce Budworm Mortality Plots Showing Progress of the Trees for Each Crown Class,

East Prince Rupert District

	No. trees in plot	Crown class	No. trees living				No. trees with top kill				Average % defoliation			
			1961		1965		1961		1965		1961		1965	
Location			Sw	Ba	Sw	Ba	Sw	Ba	Sw	Ba	Sw	Ba	Sw	Ba
Chapman Lake Plot No. 12	87	D	8	1	8	1	0	0	0	0	32.2	0	31.4	70.0
		CD	0	5	0	5	0	0	0	1	0	83.0	0	59.0
		I	1	21	1	16	0	5	0	9	50.0	88.0	40.0	73.6
		S	29	22	28	16	0	3	1	3	54.8	84.7	37.7	86.7
TOTALS			38	49	37	38	0	8	1	13	49.3	86.0	39.3	75.8
Fisheries Fence Plot No. 3	120	D	29	0	26	0	0	0	1	0	43.6	0	44.4	0
		CD	9	3	9	0	0	1	0	0	38.8	62.5	51.2	41.6
		I	4	26	1	25	0	14	0	9	72.0	72.4	71.6	60.9
		S	1	48	0	44	1	30	0	18	90.0	81.3	0	71.7
TOTALS			43	77	36	69	1	45	1	27	52.0	77.1	48.1	66.3
Cronin Mine Road Plot No. 5	158	D	1	3	1	4	0	0	0	0	40.0	60.0	20.0	43.7
		CD	1	5	1	4	0	0	0	0	30.0	58.0	25.0	25.0
		I	7	27	7	19	0	1	0	2	45.7	82.7	15.0	49.2
		S	15	99	15	69	0	7	1	21	45.3	84.4	31.6	72.8
TOTALS			24	134	24	96	0	8	1	23	44.5	83.2	26.0	65.9

Western Hemlock Looper, Lambdina fiscellaria lugubrosa (Hulst)

There was no appreciable increase in the population of this insect in the East Prince Rupert District in the past year (Table 3). The largest sample, of ten larvae, was taken from spruce in a small localized mature stand near Moricetown.

Table 3

Summary of Western Hemlock Looper Collections by

Drainage Divisions, East Prince Rupert District

Drainage division	Total number of samples taken during larval period			Percentage of samples containing larvae			Average number of larvae per sample		
	1963	1964	1965	1963	1964	1965	1963	1964	1965
120	8	50	79	0	0	0	-	-	-
121	11	37	60	0	8.0	5.0	-	2.0	4.2
122	25	35	122	6.0	0	1.6	1.0	0	1.0
123	2	2	19	0	0	10.5	-	-	2.3
TOTAL	46	124	280	4.3	7.4	2.5	1.0	2.0	2.7

Mountain Pine Beetle, Dendroctonus ponderosae Hopk.

The activity of this beetle appears to have decreased in the District in 1965 as indicated by aerial survey counts of red-topped trees. Very few new attacks were noticed during ground examinations in stands near Wright Bay and Hagan Arm.

A Cutworm, Noctuidae sp.

No signs of cutworm damage were found at Gooseley Lake or Southbank where in 1964 there had been considerable defoliation of white spruce seedlings by this pest. In that year, all larvae collected were parasitized and died before being identified.

A Spruce Tip Moth, Zeiraphera sp.

Distribution of this insect remained as in previous years but the average number of larvae declined in 1965. Fifty-seven samples in 1964 and 54 in 1965 contained Zeiraphera sp. The largest collections, of 8 larvae, came from Forestdale and Doughty. Although few larvae were found, in many cases there was evidence of heavy bud feeding.

Engelmann Spruce Weevil, Pissodes engelmann Hopk.

No extensive sampling was done for this weevil in 1965 but observations indicated it was still active in the majority of spruce regeneration areas. It caused severe damage to young regeneration spruce over a two mile area commencing about 1/2 mile from the entrance of the Morice West Forest Development road, south of Houston.

Aspen Leaf Miner, Phyllocnistis populiella (Chamb.)

The aspen leaf miner infestation in the East Prince Rupert District continued wherever the host tree, trembling aspen, was found. The four study plots, established in 1963, were again examined in 1965. The percentage of leaf surfaces mined in 1965 increased considerably over that of 1964 in all four plots (Table 4). The average number of cocoons produced decreased slightly. The increase in parasitism does not entirely account for the lower percentage of adult emergence (Table 5) and adverse climatic conditions probably contributed to the fluctuations in population of this insect. The aspen leaf miner infestation will probably remain widespread in 1966 at varying levels of intensity.

Table 4

Aspen Leaf Surfaces Mined and Number of Cocoons Produced per 100 Leaf Surfaces

East Prince Rupert District

Plot location	Total no. of leaves		% leaf surfaces mined		Average no. cocoons per 100 leaf surfaces	
	1964	1965	1964	1965	1964	1965
Priestly Stn. Road	408	447	26.2	38.9	100	78
Babine Lake	467	597	31.6	93.2	114	130
Moricetown	431	452	75.1	81.4	140	99
2 Mi. W. of Telkwa	379	476	69.6	82.7	158	83
Average	421	493	50.6	75.7	128	97

Table 5

Mortality of Aspen Leaf Miner in 100-cocoon Samples at Four Localities

East Prince Rupert District

Location	% Emerged		% Parasitized		% Dead	
	1964	1965	1964	1965	1964	1965
Priestly Stn.Rd.	78	38	0	49	22	13
Babine Lake	81	60	10	32	9	8
Moricetown	62	41	21	30	17	29
2 Mi.W. of Telkwa	60	39	24	41	16	20
Average	70.2	44.5	13.7	38.0	16	17.5

Other Noteworthy Insects

Insect	Host	No. of Collections	Remarks
Caripeta divisata Wlk.	Pl	5	Grey spruce looper, defoliator.Continued low population.
Epirrita autumnata (Gn.)	S, Ba, H	7	Defoliator.No population increase over 1964.
Griselda radicana Wlshm.	S, Sw, Ba, Pl	16	Tip feeder,population and distribution remain static.
Neodiprion spp.	S, Sw, B	8	Defoliator. No population increase over 1964,average 1.2 larvae per collection.
Nyctobia limitaria (Wlk.)	Ba, S	8	Green balsam looper, defoliator. Continued low population.
Pikonema alaskensis (Roh.)	S, Sw	16	Yellow-headed spruce sawfly, defoliator. Common in small numbers in spruce collections throughout District.
Pikonema dimmockii (Cress.)	S, Sw, B	22	Green-headed spruce sawfly, defoliator. Common in small numbers in collection throughout District. Slight increase in distribution over 1964.
Pineus abietinus Underwood & Balch	Ba	1	Woolly aphid, sap feeder. A single stem attack found in the Parrot Lakes area.

FOREST DISEASE CONDITIONS

Important Diseases

A Branch Canker on Alpine Fir, _Scleroderris abieticola_ A. Funk

Damage to the branches of alpine fir was common in many stands throughout the District this year. Branch cankers girdling stems and leaders resulted in noticeable "red flagging." The canker usually occurred about a foot or so from the tip of the branch or at the tops of smaller trees causing mortality of the outward portion. Many of the infections probably occurred in or before 1964 and the flagging was not noticed until the 1965 season. Climatic damage may influence the incidence of infection. It is believed that the same pathogen was responsible for similar damage in the Nanika, Buck River, and Babine Lake areas this year.

A Foliage Disease on Lodgepole Pine, _Hendersonia pinicola_ Wehm.

Heavy infections of this foliage disease were found on young lodgepole pine along the Priestly station road and in a small localized area of lodgepole pine regeneration two miles north of Kispiox. The infected trees had a heavy needle drop. This damage was common on many other similar stand sites in the District.

A Foliage Disease on Aspen, _Venturia tremulae_ Aderh.

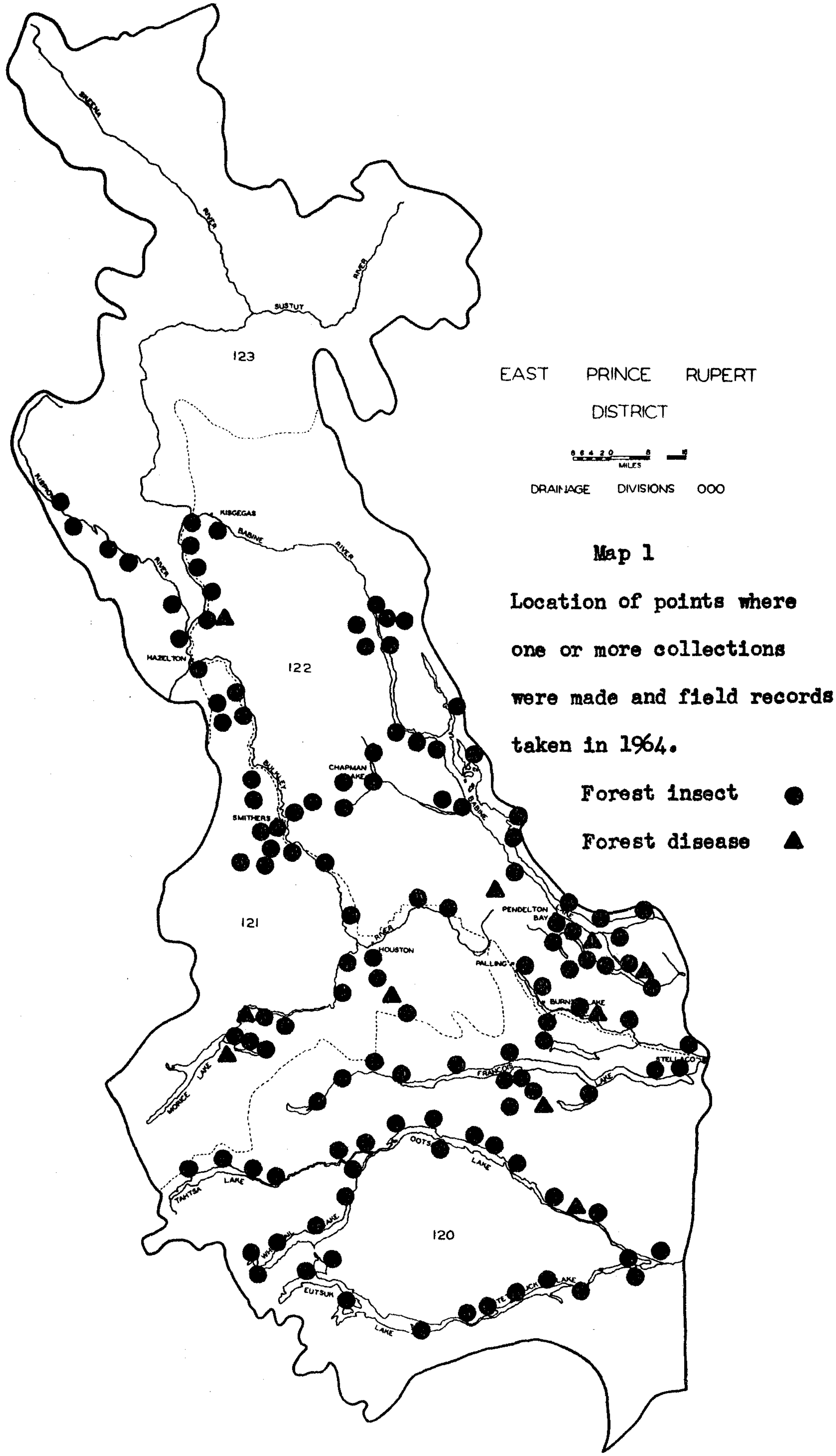
Heavy infections of this foliage disease occurred over most of the District in 1964, giving the trees a very bare and reddish-brown appearance. This disease was not observed in the District in 1965.

Mistletoe on Lodgepole Pine, _Arceuthobium americanum_ Nutt ex Engelm.

This parasite was common in many stands of lodgepole pine throughout the District, causing stunting and deformation of the trees. Heavy infections occurred in the vicinity of Ootsa Lake, at other locations throughout the Park, and around Morice Lake.

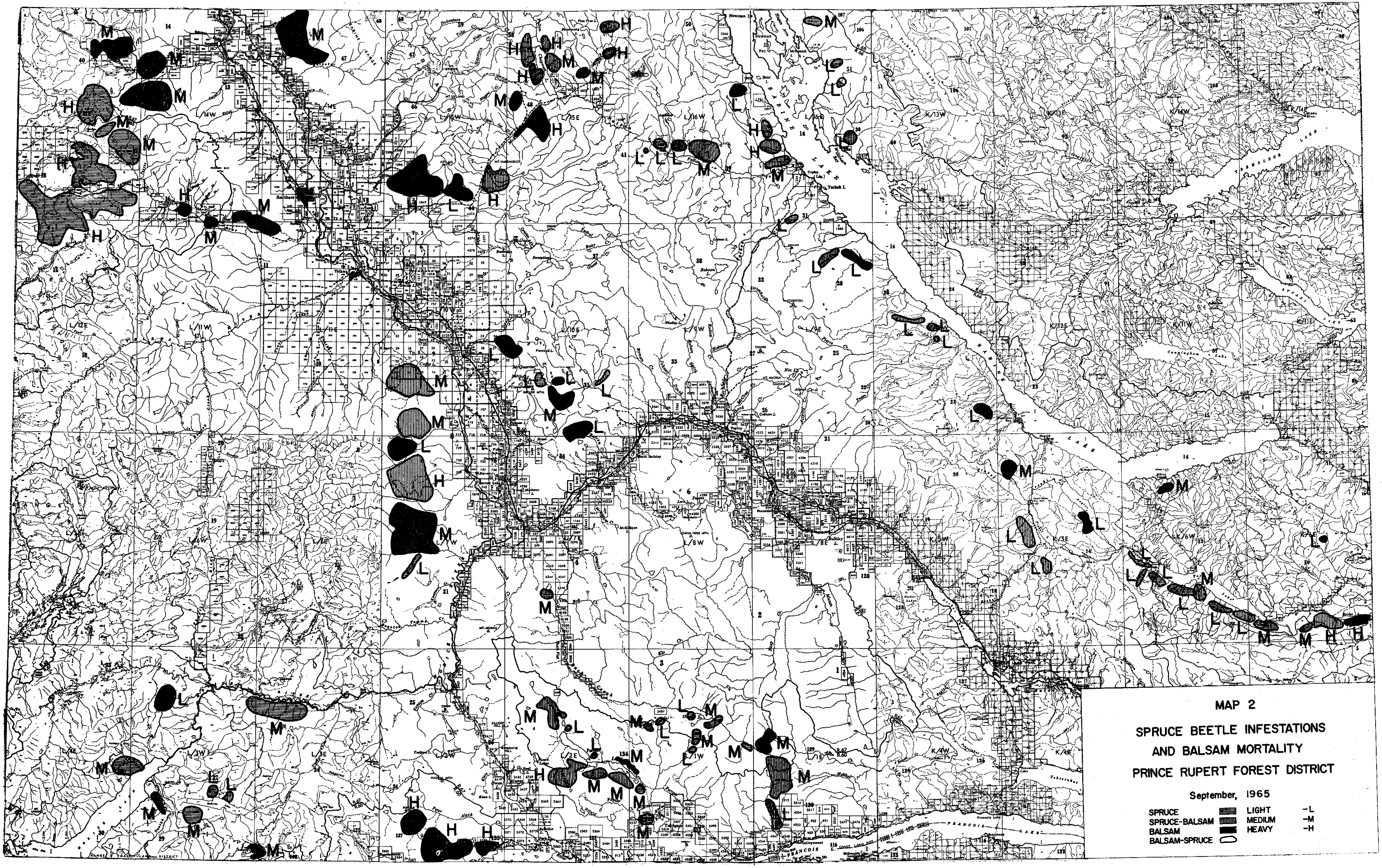
Other Noteworthy Diseases

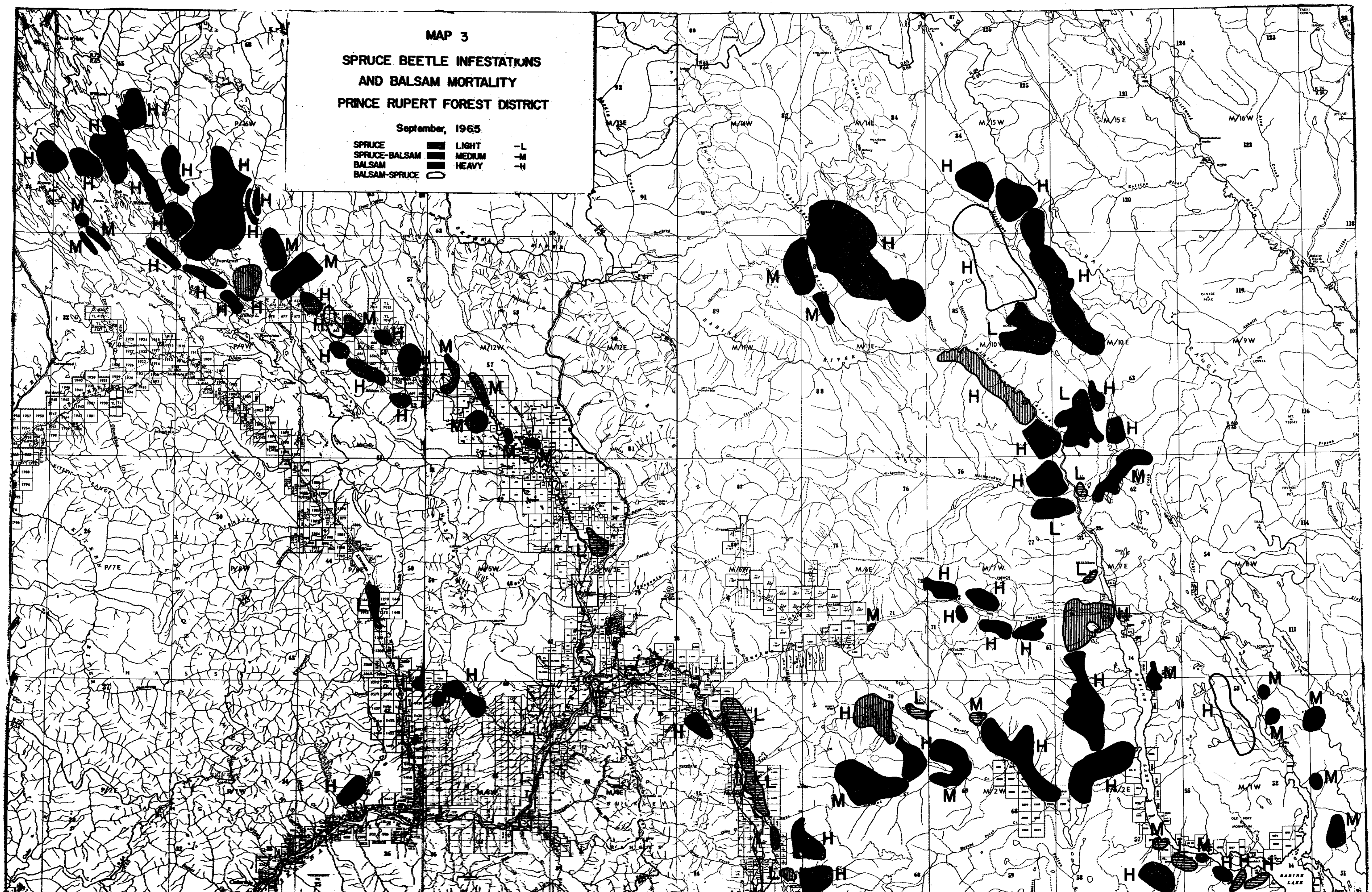
Host	Organism	Locality	Remarks
Aspen, trembling	_Ciborina whetzelli_ (Seaver)	Cheslatta & Wisteria	Leaf spot of aspen. Light infections in this area compared to 1963-1964 .
Currant, black	_Cronartium ribicola_ J. C. Fisch ex Rab.	Euchu Reach Tweedsmuir Pk.	White pine blister rust. Light infections.
Hemlock, mountain	_Myxomycete_	Nanika River	Slime mould single light infection.
Nettles	_Puccinia caricina_ D.C.	Taltapin Lake	A rust. Heavy infections in area examined.
Wintergreen	_Chrysomyxa pirolata_ Wint.	Topley Ldg. Road	Heavy infections in this area, alternate host for spruce cone rust. Often destroys entire seed crop.



Map 1

Location of points where one or more collections were made and field records taken in 1964.


MAP 2
SPRUCE BEETLE INFESTATIONS
AND BALSAM MORTALITY
PRINCE RUPERT FOREST DISTRICT
September, 1965
SPRUCE
SPRUCE-BALSAM
BALSAM
BALSAM-SPRUCE
LIGHT -L
MEDIUM -M
HEAVY -H
BABINE LAKE
FRANCOIS LAKE


MAP 3
SPRUCE BEETLE INFESTATIONS
AND BALSAM MORTALITY
PRINCE RUPERT FOREST DISTRICT
September, 1965
SPRUCE
SPRUCE-BALSAM
BALSAM
BALSAM-SPRUCE
LIGHT -L
MEDIUM -M
HEAVY -H

FOREST INSECT AND DISEASE SURVEY

BRITISH COLUMBIA

1965

KAMLOOPS FOREST DISTRICT

FOREST INSECT AND DISEASE SURVEY

KAMLOOPS FOREST DISTRICT

1965

J. Grant

INTRODUCTION

There were no changes in ranger personnel in the Kamloops Forest District in 1965; T. A. D. Woods was in West Kamloops, R. J. Andrews in Central Kamloops and J. Grant in East Kamloops.

Losses caused by the Douglas-fir beetle in the period 1962-1964 as determined in 1965 were lower than in the preceding three-year period. This was believed to be attributable to a comparatively small number of fresh attacks in 1964.

Mountain pine beetle damage continued to increase. The major infestations in lodgepole pine were in the Williams Lake district, while the most extensive outbreaks in ponderosa pine were near Chapperon Lake, Clinton, Princeton, and Nocola River. The majority of white pine losses occurred in the Shuswap-Adams lake area and in the Blue River, Enderby and Lumby districts.

The black-headed budworm reached epidemic level in hemlock stands of Interior British Columbia in 1965. There was light to moderate defoliation of mature hemlock stands in many localities in the Shuswap River drainage, north of Shuswap Lake, and near Blue River. Egg surveys in October indicated that infestations in most localities will continue in 1966.

Populations of the larch sawfly continued to increase in the eastern part of the District, and moderate to heavy defoliation occurred in parts of the Lumby, Vernon, Kelowna and Penticton districts. Infestations are expected to expand in 1966, particularly in the North Okanagan.

The Douglas-fir tussock moth, western hemlock looper and false hemlock looper were scarce in 1965 and no damage was reported.

A survey for the European pine shoot moth was conducted in nurseries, planted ornamentals and mature pine stands in the Kamloops-Okanagan region in the spring of 1965, by personnel of the Plant Inspection Division and the Department of Forestry. The only shoot moths found were in nursery stock recently imported from Holland.

Foliage discoloration of ponderosa pine caused by a needle cast disease was quite widespread in 1965. Larch needle cast was much less severe than in 1964. Many conifers, especially ponderosa pine in the Okanagan Valley, suffered foliage injury believed to have been caused by strong winds and sub-zero temperatures in December, 1964.

FOREST INSECT AND DISEASE SURVEY

EAST KAMLOOPS DISTRICT

1965

FOREST INSECT AND DISEASE SURVEY

EAST KAMLOOPS DISTRICT

1965

J..Grant

INTRODUCTION

Except for occasional trips, field work in the East Kamloops District began on April 21 and ended late in October. During 1965, 438 forest insect collections and 25 forest disease collections were made. Of the former, 123 were submitted by personnel other than the writer; they were mostly collected during the European pine shoot moth survey in May and June.

Map 1 shows localities where collections were made and field records taken, and Table 1 lists collections by host.

Table 1

Collections by Hosts,

East Kamloops District, 1965

Coniferous hosts	Forest insects	Forest diseases	Broad-leaved hosts	Forest insects	Forest diseases
Cedar, western red	3	-	Alder, Sitka	2	-
Douglas-fir	84	2	Aspen, trembling	7	1
Fir, alpine	19	2	Birch, western white	6	-
Fir, grand	1	-	Cottonwood, black	6	1
Hemlock, western	68	1	Maple, Douglas	1	-
Juniper, Rocky Mtn.	3	-	Willow spp.	4	2
Larch, western	29	1	Miscellaneous	9	3
Pine, lodgepole	26	4			
Pine, ponderosa	112	2			
Pine, western white	15	2			
Pine, whitebark	1	-			
Pine, spp.	6	-			
Spruce, Engelmann	36	3			
Spruce, Norway	-	1			
Total	403	18		35	7
			GRAND TOTAL	438	25

FOREST INSECT CONDITIONS

Important Insects

Douglas-fir Beetle, Dendroctonus pseudotsugae Hopk.

Populations of the Douglas-fir beetle have remained comparatively low for the past three years in most of the District with the result that in 1965 red-tops were scarcer than at any time since 1961. Quick loss of foliage of trees killed in 1963, and to some extent, in 1964, was also partly responsible for the small numbers of red-tops counted on aerial and ground surveys in 1965; many trees were almost bare two years after attack. For example, 51 trees killed in 1963 on two colour change plots in the Salmon River Valley had lost an average of over 95% of their foliage by midsummer, 1965; as they appeared to be typical of the beetle-killed trees of that region it is obvious that few of the 1963-attacked trees were included in the 1965 figures derived from aerial and ground surveys.

Few trees were found which had been attacked in 1964, but observations at two plots indicated that foliage loss was abnormally rapid. Four 1964-attacked trees near Olalla had lost an average of 66% of their needles by June 1, 1965, and 12 trees on Mission Creek had lost 60%.

Table 2 shows, by locality, the number and estimated volume of trees killed by the Douglas-fir beetle in 1962 to 1964, as determined by aerial and ground surveys in 1965. For the reasons outlined above, and in spite of the fact that, where possible, compensation was made for the inability to detect all of the 1963-attacked trees, the figures are probably conservative.

Table 2

Douglas-fir Trees Killed by the Douglas-fir Beetle in the Period 1962-64, as Determined in 1965, East Kamloops Distirct

Locality	No. of trees	Volume (cu. ft.)
Adams Lake-Humamilt L.	510	35,700
Shuswap Lake	465	32,550
Monte Creek-Upper Salmon River	110	6,600
Falkland-Chase	40	2,400
Lumby-Cherryville	120	7,200
Squaw Valley-Upper Shuswap	100	6,000
Whiteman Creek	34	2,040
Mission Creek	70	4,200
Lambly Creek	40	2,400
Penticton Creek	40	2,400
Shatford Creek	150	9,000
Inkaneep Creek	30	1,800
Shuttleworth Creek	60	3,600
Keremeos-Yellow Lake	150	9,000
Paul Creek	200	12,000
Otter Lake-Lawless Creek	60	3,600
Missezoula Lake-Alleyne Lake	51	3,060
Total	2,230	143,550

Improved logging practices and increased enforcement of slash disposal clauses in timber sale contracts are undoubtedly beginning to reduce the beetle toll in the vicinity of logging operations. In 1965, the heaviest recent losses observed were in the area east of Adams Lake, remote from any woods operations.

Mountain Pine Beetle, Dendroctonus ponderosae Hopk.

The mountain pine beetle continued as the most widespread and important destroyer of commercial timber in the District. Due to the almost complete collapse of an infestation near Peachland, the toll of lodgepole pine in the period 1963-1964 was smaller than in 1962-1963, but mortality of white and ponderosa pines increased. Location of tree mortality caused by the mountain pine beetle in 1963-64 is shown in Map 2.

Heaviest losses of white pine in the period 1963-1964 occurred between the northern end of Adams Lake and the Seymour River Valley, north of Shuswap Lake. Several separate infestations totalling approximately 3,400 trees were mapped, the most extensive one being in the vicinity of Humamilt and Momich lakes.

Mountain pine beetle infestations in white pine increased in the Upper Shuswap River Valley from Sugar to Greenbush lakes, but were smaller in the Mabel Lake area. There has been a marked trend towards lower populations in the white pine stands in Manning Park in the past three years.

The localized outbreak in lodgepole pine at the head of Venner Creek near Peachland had almost died out in 1965, as had a small infestation south of Whiteman Creek. The largest infestation remaining active was in the Valley of Lambly Creek but salvage logging had accounted for most of the trees infested prior to 1965. Localized infestations in lodgepole pine ranging from 100 to 500 red-tops were situated at Vance Creek in Trinity Valley, Rush Lake, Joe Rich Creek, Whelan Creek, Deschamps Creek, and Ashnola River. Logging in Heckman Creek Valley southeast of Lumby effectively reduced that infestation.

Infestations in ponderosa pine, with one exception, were relatively insignificant. Approximately 1,000 pole-sized trees were killed in an isolated stand near Jura, north of Princeton. In the last two years, 200 young trees were killed in the vicinity of Allenby, 150 in Mission Creek Valley east of Kelowna, 500 trees scattered over the Inkaneep Creek drainage southeast of Oliver, and 150 near Rush Lake. Scattered mature ponderosa pine, totalling about 125 trees, were killed by mountain pine beetles, or, in some instances, by a combination of this species and the western pine beetle Dendroctonus brevicomis Lec., in the Allison Creek Valley north of Princeton and in several localities north to Aspen Grove.

Table 3 shows the numbers and estimated volume of pine killed by mountain pine beetles in 1963 and 1964 as determined by ground and aerial surveys in 1965.

Table 3

Number of Trees and Volume Killed by Mountain Pine Beetle in East Kamloops District, 1963 and 1964

Pine Species	Locality	No. of trees killed	Volume (cu. ft.)
Western white	Momich L. - Humamilt L.	2,150	86,000
	S. of Humamilt L.	600	24,000
	Tsikwustum Cr.	200	8,000
	Seymour R. - Anstey R.	375	15,000
	Ross Cr. - Scotch Cr.	400	16,000
	Shuswap L. (south end)	250	10,000
	Mabel L. - Three Valley	525	21,000
	Squaw Valley - Sugar L.	200	8,000
	Sugar L. - Upper Shuswap R.	1,200	48,000
	Manning Park	100	4,000
		6,000	
Lodgepole	Salmon R.	200	4,000
	Whiteman Cr.	50	1,000
	Trinity Valley - Cherryville	175	3,500
	Winfield - Joe Rich Cr.	350	7,000
	Lambly Cr.	2,000	40,000
	Venner Cr.	25	500
	Southwest of Summerland	650	13,000
	Ashnola R.	300	6,000
	Summers Cr.	100	2,000
	Tulameen	50	1,000
	Chute L.	25	500
		3,925	
Ponderosa	Salmon R.	150	3,000
	Mission Cr.	150	3,000
	Oliver - Southeast	500	10,000
	Jura	1,150	23,000
	Otter L. - Alleyne L.	75	1,500
	Allenby	200	4,000
		2,225	363,000

Western Pine Beetle, Dendroctonus brevicomis Lec.

Very few trees were killed by the western pine beetle in the past two years. A few mature ponderosa pine in Allison Creek Valley near Princeton were attacked in 1964 and 1965, in most cases in conjunction with mountain pine beetle. A few galleries of the western pine beetle were found in ponderosa pine killed by a small forest fire in Marron Valley in July, 1965.

Spruce Beetle, Dendroctonus obesus (Mann.)

A total of approximately 40 Engelmann spruce killed in the past three years were noted in several "leave" strips near Spa Lake. No other recent attacks were observed.

Western Balsam Bark Beetle, Dryocoetes confusus Swaine

The outbreak in high-elevation stands of alpine fir continued on Hunters Range in the Enderby district. Infestations were scattered from Blurton Creek northeastward approximately 22 miles to the headwaters of Yard Creek.

Lesser amounts of alpine fir mortality were observed at several localities in the mountains north of Shuswap Lake and on the plateaux east and west of Okanagan Lake.

Black-headed Budworm, Acleris variana (Fern.)

Following two years at moderate levels, black-headed budworm populations increased to outbreak proportions in many of the District's western hemlock stands in 1965. The trend of occurrence and abundance of black-headed budworm in western hemlock collections for the years 1963 to 1965 is as follows:

No. of samples taken during larval period			% samples containing larvae			No. of larvae per sample		
1963	1964	1965	1963	1964	1965	1963	1964	1965
67	47	48	54	51	90	5.5	5.9	65.1

All infestations were in stands where mature or overmature western hemlock predominated; a few were at elevations as low as 2,500 feet but the majority were between the 3,000 and 4,000 foot levels. The location of infestations is shown on Map 3. Beginning in the north, they were near Tumtum Lake, in the Ratchford Creek and Anstey River valleys and near the headwaters of Sim Creek in the Shuswap Lake District, on South Pass Creek near Three Valley, in several of the creek drainages tributary to Mabel Lake and adjacent parts of the Shuswap River, notably Wap, Noisy, Kingfisher, Cook, Cottonwood and Tsuius creeks, and in the upper Shuswap River drainage at Holstein, Reiter, Curwen, Vanwyk, Gates and Lindmark creeks and near Greenbush Lake. Extent of visible defoliation ranged from a few hundred acres to several square miles. One of the largest extended from Holstein Creek along the southeast slope of the Silver Hills to the upper valley of Ireland Creek, approximately eight miles.

The first foliage discoloration was noted on July 14 at 2,800 feet elevation near Noisy Creek. The first pupa was collected at Reiter Creek on July 15, when last instar larvae comprised 60% of the understory population at the lower edge of the infestation, and 40% at the upper levels near 4,000 feet. On August 3, two collections near the centre of this infestation yielded 26 and 29% pupae, but these figures were probably low due to the fact that pupae were more difficult to dislodge from the foliage than larvae.

Although browning of the current year's growth of overstory hemlock rendered most infestations readily visible from the air, damage was light in most of the localities that could be visited. The heaviest damage known to have occurred in 1965 was near Sim Creek in the Sicamous district at elevations ranging from 3,800 to 4,100 feet. Overstory hemlock had suffered an estimated 25 to 30% defoliation, and the most heavily defoliated understory trees, up to 15 feet in height, were almost bare.

Mortality was high in six mass collections reared in the insectary and in material from two localities; polyhedral virus and/or bacteria were partly responsible. No evidence of heavy mortality due to disease was observed in the field, however, and egg populations in the autumn indicated that none of the infestations had collapsed. Table 4 shows results of mass rearings.

Table 4

Mass Rearing of Black-headed Budworm, East Kamloops District, 1965

Locality	Date	No. and stage reared	% pupation	% parasitism larvae	% parasitism pupae	% adult emergence	Diagnosis of dead larvae
Noisy Creek	July 14	65L	15.4	0	0	12.3	Polyhedrosis virus and bacteria.
Noisy Creek	July 14	170L	12.4	0.6	0	5.3	Bacteria.
Reiter Creek	July 15	197L	38.6	1.0	0	25.8	Negative.
Sicamous	July 20	61L	41.0	3.3	0	32.8	-
Sicamous	July 20	39L, 3P	23.1	0	0	7.1	-
Reiter Creek	Aug. 3	200P	-	0	24.0	34.0	-

Larval parasitism was apparently negligible, but almost one quarter of the pupae collected at Reiter Creek produced hymenopterous parasites.

Egg sampling for black-headed budworm began on September 20 and ended on October 20. Sampling consisted of felling three dominant, co-dominant or intermediate hemlocks at each plot and removing a 10-inch branch end from five crown levels of each tree. The foliage was searched for eggs at the laboratory. Defoliation at each plot was estimated by binocular observations of 10 standing dominant trees and examination of the three felled trees. Table 5 shows the average 1965 defoliation of overstory trees at each plot, the average number of eggs per 10-inch branch tip, and the predicted 1966 defoliation based on the criteria that one to seven eggs per tip result in light defoliation, eight to 15 in moderate, and over 15, heavy defoliation.

Table 5

Black-headed Budworm Defoliation Estimates and Egg Samples, East Kamloops District, September-October, 1965

Locality	Elevation, (feet)	% defoliation (1965)	Av. no. eggs per 10-inch tip	Defoliation prediction (1966)
Kingfisher Cr.	3500	16	3.0	light
Noisy Cr.	3000	6	9.7	moderate
Reiter Cr. No. 1	3600	21	16.0	moderate - heavy
" " No. 2	4100	7	5.1	light
Holstein Cr.				
No. 1	4200	4	7.1	light
" " " 2	4300	6	4.8	light
Tsuius Cr.	2600	-	2.1	light
Wap Lake	2300	-	5.1	light
S. Pass Cr.	3400	-	9.8	moderate
Sim Cr. No. 1	4200	5	3.4	light
" " " 2	3900	29	12.0	moderate
" " " 3	4050	25	10.2	moderate

Defoliation in 1966 will probably be about the same as in 1965 providing that larval survival is comparable; however, in the areas that have already sustained significant defoliation, the cumulative effect of two years' feeding may have more serious results. At Sim Creek some understory trees will probably be killed if defoliation recurs in 1966 at the same level of severity as in 1965.

Larch Sawfly, <u>Pristiphora erichsonii</u> (Htg.)

For the first time since the late 1940's, larch sawfly populations reached outbreak proportions in 1965 in parts of the East Kamloops District.

Moderate to heavy defoliation was mostly confined to the Vernon and Lumby Ranger districts, with smaller infestations east of Kelowna and Oliver. Heaviest damage occurred on Vernon Hill and on the southern and southeastern slopes of Aberdeen Mountain, along the northern edge of the plateau south of Coldstream Creek Valley, and from the northern edge of Harris Creek Plateau northward to Cherry Creek. Defoliation was largely confined to the higher larch stands between elevations of 3,500 and 4,500 feet, but on a north-facing slope at Lavington most of the larches were stripped almost to the valley floor at 1,800 feet. Location of infestations is shown on Map 4.

Defoliation ranging up to 90% was noted at Lavington on July 14, and by July 28 damage was conspicuous at elevations up to 4,500 feet. No larval mortality was observed in the field, except near Aberdeen and Nicklen lakes on July 29 and 30. Numerous dead larvae under heavily defoliated trees were believed to have succumbed to starvation and exposure after falling from the trees; no pathogens were found in larvae submitted to the Insect Disease Survey.

Two plots for gathering information on cocoon populations and on the effect of defoliation were established, one near Becker Lake and the other near Aberdeen Lake. Elevations were 3,800 and 4,500 feet, respectively. Ten pole-sized trees at each plot were tagged, degree of defoliation recorded, and cocoon samples consisting of one square foot of duff and soil removed from near the base of each tree. This material was sorted, and all cocoons classified as "sound" (unopened) or "unsound" (empty). All unsound cocoons were examined to determine how many had produced sawflies, and, if possible, the cause of mortality of the remainder. Sound cocoons were retained for rearing except for 100 from each plot, which were opened and the larvae dissected to determine the percentage parasitized by *Mesoleius tenthredinus* Morley.

Sound cocoons averaged 51 per square foot at Becker Lake and 33 at Aberdeen Lake; there were 32 and 26 unsound cocoons per square foot respectively. It is noteworthy that at both localities sound cocoons outnumbered empty ones. Since empty cocoons were accumulations from the past several years except for those 1965 cocoons already opened by mammals, it is obvious that sawflies increased tremendously in the past year.

Only the most recent of the unsound cocoons could be classified with certainty; many were so decomposed that characteristics of successful emergence, predation and parasitism had been destroyed. The percentage of successful emergence, percentage of mortality attributed to various causes and the number of unclassifiable cocoons in the unsound cocoons from the two plots were as follows:

Locality	No. of unsound cocoons (10 sq. ft. samples)		% of classifiable unsound cocoons					
	Classifiable	Unclassifiable	Emerged	Mammal predation	*Mesoleius tenthredinus*	Elaterid predation	Mould	*Isaria fungus*
Becker L.	170	151	18.8	58.8	1.2	10.0	10.6	0.6
Aberdeen L.	147	114	39.3	21.9	8.2	9.5	21.1	0

The following table shows results of dissections of overwintering larvae from 10 sound cocoons in each of 10 samples per plot.

Locality	Healthy	*Mesoleius tenthredinus*	Dead, cause unknown
Becker Lake	92	8	0
Aberdeen Lake	92	7	1

No encapsulated eggs of *Mesoleius* were found. The apparent absence of *Tritneptis klugii* (Ratz.) is noteworthy, for this parasite was abundant during the late stages of the outbreak in the 1940's, and in 1965 was found in several localities in the Nelson Forest District.

On the basis of the high overwintering population, it is expected that larch sawfly defoliation in 1966 will be heavy at the sites of 1965 infestations and that there will be expansion into adjacent stands.

Western Hemlock Looper, *Lambdina fiscellaria lugubrosa* (Hulst)

There were no hemlock looper infestations in 1965; larvae were generally scarcer than in the past three years. The population trend indicated by western hemlock collections in the period 1963 to 1965 was as follows:

No. of samples taken during larval period			% samples containing larvae			Av. no. of larvae per sample		
1963	1964	1965	1963	1964	1965	1963	1964	1965
70	50	47	90.0	92.0	53.2	48.2	42.4	2.3

Although the occurrence of larvae in 1965 collections was reduced only 42% from the 1964 level, the average number of larvae per collection dropped 95%. The maximum number taken was 12 in one collection near Sicamous Creek on July 16.

There was a very low population in the Lost Lake area where phosphamidon at the rate of one pound per acre was applied on July 7, 1964. Four collections from near the centre of the 50-acre spray plot yielded only two larvae on July 13, 1965, and three collections in the adjacent check area also yielded a total of two larvae.

False Hemlock Looper, *Nepytia freemani* Munroe

False hemlock looper was much scarcer in 1965 than in the period 1962 to 1964; 18 early-instar larvae taken in one Douglas-fir collection near

Summerland on June 1 represented the highest number encountered during the season. The trend of populations as indicated by Douglas-fir collections was as follows:

No. of samples during larval period			% samples containing larvae			Av. no. of larvae per sample		
1963	1964	1965	1963	1964	1965	1963	1964	1965
95	93	59	89	86	41	22.0	24.8	2.9

As in the populations of hemlock looper on western hemlock, the frequency of occurrence of Neptyia in collections was about half that of 1964, while the average number per collection was greatly reduced.

Pine Butterfly, Neophasia menapia (F. & F.)

The decline of the pine butterfly infestation in ponderosa pine near Okanagan Landing continued in 1965, but above-average numbers persisted. On July 19 many butterflies were in flight, with a maximum of eight males visible at one time flying about the crown of a single tree. Defoliation was negligible.

A light, localized infestation was reported in the city of Vernon. No defoliation was visible on ponderosa pines growing in a residential district, or on pines on an adjacent, open, south facing slope, but on July 23 as many as 100 butterflies were said to be in flight around the crowns of dominant trees.

Very few eggs were found in October; samples were collected with pole clippers from heights up to 30 feet. The mid and upper crowns of the dominant trees were not sampled.

Larvae were unusually numerous in an isolated group of about 50 mature ponderosa pines two miles east of Winfield. On June 22, an average of 16 larvae was taken in two three-tree beating collections, and on July 23 up to 12 butterflies per tree were in flight.

Douglas-fir Tussock Moth, Orgyia pseudotsugata (McD.)

No larvae were collected in 1965.

Most of the Douglas-fir stands defoliated in the outbreak period 1961-1964 were recovering in 1965. Stands defoliated for two consecutive years suffered mortality ranging up to 50%; those where defoliation, although heavy, occurred only in one year had light or negligible losses. The most spectacular recovery was in the Similkameen Valley between Hedley and Keremeos, where there was extensive heavy defoliation in 1963. Of a total of 103 heavily defoliated Douglas-fir on two mortality plots in this area, only three had died by October, 1965. Eighteen trees had lost 95% or more of the foliage of the upper two thirds of the crown in 1963, and 38 trees had the upper third denuded, but top-kill was negligible. Although most of the Similkameen Valley stands still had scanty foliage, 1965 growth was much more vigorous than that of 1964 and it appears that there will be little mortality.

By October 1965, there were 48 dead trees in a 100-tree plot in a dense pole-sized stand near Okanagan Landing defoliated in 1961 and 1962. Ten per cent of the trees died in a plot established in a nearby stand which was heavily defoliated in 1963.

European Pine Shoot Moth, Rhyacionia buoliana (Schiff.)

From late April to June 1965, a survey for the European pine shoot moth was conducted by personnel of the Plant Protection Division, Department of Agriculture and the Department of Forestry. Over 25,200 pines were examined, including exotic species in nurseries, home gardens and various ornamental plantings, and plots of native pines.

The only evidence of the European pine shoot moth discovered in the East Kamloops District was at Oliver, where one larva was found on a Scots pine, and in Kelowna where a mugho pine had been infested. In both instances, the host trees were in nurseries and had been imported from Holland.

Spruce Budworm, Choristoneura fumiferana (Clem.)

One-year cycle spruce budworm on Douglas-fir were collected more frequently than in 1963 or 1964, but numbers remained low, as shown by the following data:

No. of samples taken during larval period			% samples containing larvae			Av. no. of larvae per sample		
1963	1964	1965	1963	1964	1965	1963	1964	1965
53	63	52	7.6	7.9	21.2	3.0	1.4	1.5

The one-year cycle budworm on western hemlock continued to decline in numbers:

No. of samples taken during larval period			% samples containing larvae			Av. no. of larvae per sample		
1963	1964	1965	1963	1964	1965	1963	1964	1965
65	43	49	46.2	58.1	16.3	9.7	2.5	1.4

No two-year cycle spruce budworm were collected in 1965.

Aspen Leaf Miner, Phyllocnistis populiella Cham.

Aspen leaf miner populations were unevenly distributed in 1965, with most of the heavy infestations being confined to the northeastern part of the District. The most extensive infestation was along the Eagle River Valley from Sicamous to Three Valley. Most aspen groves in the grassland areas of the Okanagan Valley and the Princeton district had fewer mined leaves than in the previous four years.

Leaf samples were examined at four plots. A foot-long branch was cut from each of 10 trees at each locality, and the leaves examined. Table 5 shows the percentage of leaf surfaces mined and Table 6 shows the results of cocoon examinations.

Table 5

Aspen Leaf Surfaces Mined and Number of Adults Produced per 100 Leaf Surfaces, East Kamloops District, 1962 to 1965

Locality	Percentage leaf surfaces with mines				No. of adults produced per 100 leaf surfaces			
	1962	1963	1964	1965	1962	1963	1964	1965
Carlin	65	63	76	26	20	24	14	13
Phillips Lake	61	77	76	34	19	30	33	14
McCulloch Road	51	57	59	48	17	7	14	13
Aspen Grove	40	16	45	5	9	8	9	0.4

At Aspen Grove, the population was so small that additional mined leaves were gathered from adjacent trees to obtain a 100-cocoon sample.

Table 6

Mortality of Aspen Leaf Miners in 100-cocoon Samples, East Kamloops District, 1962-1965

Locality	Percentage mortality							
	Parasitism				Other causes			
	1962	1963	1964	1965	1962	1963	1964	1965
Carlin	22	21	49	26	6	12	6	3
Phillips Lake	32	20	25	37	7	3	4	3
McCulloch Road	28	42	36	30	10	14	3	4
Aspen Grove	17	7	3	44	24	5	8	9

Populations will probably continue to be very uneven in 1966 with the majority of infestations persisting in the northern part of the District.

Spotless Fall Webworm, Hyphantria cunea (Drury)

Fall webworms, perennial pests in the Okanagan Valley, remained numerous in most localities although their numbers declined for the second consecutive year.

The two roadside strips showed opposite trends. The number of tents decreased for the fourth consecutive year in the moist valley bottom at Woods Lake, but increased on chokecherry on dry grassland south of O'Keefe. Sampling consisted of counting all tents on both sides of the road from a slow-moving vehicle over a prescribed route. The following table shows the number of tents on four miles of road on Indian Reserve No. 1 south of O'Keefe in 1964 and 1965:

Host	No. of tents per mile								Av. per mile	
	Mile 0-1		1-2		2-3		3-4			
	1964	1965	1964	1965	1964	1965	19			
Chokecherry	60	67	37	58	40	21	132	225	67.2	92.7
Rose	1	0	1	0	0	0	4	0	1.5	0
Totals	61	67	38	58	40	21	136	225	68.7	92.7

Table 7 shows number of tents counted on the Woodsdale strip from 1963 to 1965.

Table 7

Spotless Fall Webworm Strip Counts, Woodsdale,
East Kamloops District, 1963-1965

Host	No. of tents per mile						Av. per mile		
	Mile 0-1			1-2					
	'63	'64	'65	'63	'64	'65	'63	'64	'65
Chokecherry	35	9	11	172	122	84	103.5	65.5	47.5
Mountain alder	82	39	28	3	3	0	42.5	21.0	14.0
Black walnut	0	0	0	12	5	9	6.0	2.5	4.5
Black cottonwood	0	0	1	8	2	1	4.0	2.5	1.0
Crabapple	0	6	0	0	0	0	0	3.0	0
Rose	1	0	0	0	0	0	0.5	0	0
Weeping willow	0	0	0	6	1	0	3.0	0.5	0
White birch	3	0	0	0	0	1	1.5	0	0.5
Lombardy poplar	0	0	0	4	0	0	2.0	0	0
Chinese elm	0	0	0	1	0	0	0.5	0	0
Lilac	1	1	0	0	0	0	0.5	0	0
Blueberry elder	0	0	0	0	1	0	0	0.5	0
Filbert	0	0	3	0	0	0	0	0	1.5
Manitoba maple	0	0	1	0	0	1	0	0	1.0
Pear	0	0	0	3	0	0	1.5	0	0
Totals	122	55	44	209	134	96	165	95	70

A Mealy Bug on Conifers, Puto cupressi Colem.

The infestation in the Asp Creek drainage was not visited in 1965 as the road was impassable except for four-wheel drive vehicles. Forest Ranger F. Baker reported the discovery of a small patch of infested timber one quarter mile north of the main infestation.

Status of the light infestation on Beaconsfield Mountain, Penticton District, remained unchanged in 1965.

During an aerial survey of Manning Park on October 23, 1965, a suspected mealy bug infestation was seen on a mountain ridge immediately north of the upper part of Memaloose Creek. Open-grown alpine fir and white-bark pine between 5,000 and 6,000 feet appeared to be dwarfed and the foliage blackened. It was not feasible to walk into the area to confirm the observation.

One mealy bug nymph was collected on alpine fir at 5,400 feet elevation near Goat Mountain Lake in the Lumby District on July 29.

Satin Moth, Stilpnotia salicis (L.)

The only locality where satin moth caused heavy defoliation in 1965 was two miles northwest of Hedley, where an infestation in a small grove of black cottonwood persisted for the third consecutive year. There were small "spots" of moderate defoliation between this locality and Princeton.

Three mass collections of 200 larvae, and one of 200 pupae, were taken at the Hedley infestation and reared at the Vernon laboratory. Table 8 shows results.

Table 8

Mass Rearing of Satin Moth, Hedley, East Kamloops District, 1965

Date	No. and stage collected	% survival to adult stage	% mortality	
			Parasites	Other causes
May 18	200 III and IV instar	57	31.5	11.5
June 3	200 IV and V instar	73.5	10.5	16.0
June 16	200 V and VI instar	96.3	0.5	0
June 30	200 pupae	83.5	6.5	10.0

Survival was high, with only the May 18 collection yielding significant numbers of parasites; all were Apanteles sp. Parasites reared from other collections included one Meteorus versicolor (Wesm.) which issued from a last-instar larva in the June 16 collection, and one Pseudosarcophaga affinis (Fall), which emerged from a pupa.

Starvation may have reduced the infestation in the latter part of June, as the trees were almost stripped before many of the larvae had spun up. However, it seems probable that defoliation will recur in 1966.

Douglas-fir Needle Midges, Contarinia spp.

Douglas-fir needle midges were scarcer in most localities than in 1964; the only heavy infestation in a forested area was in the lower part of the Ashnola River Valley where an average of 59% of the 1965 needles were infested. The infestation at Peachland persisted, but at a much lower level than in the previous two years; on five plot trees in this locality, 29% of the needles were mined. Some very heavy infestations were noted on ornamental Douglas-fir in Kelowna and Glenmore.

Pine Needle Scale, Phenacaspis pinifoliae (Fitch)

Ponderosa pines, chiefly in the central and southern parts of the Okanagan Valley were the only trees with significant scale infestations. The heaviest damage was confined to poor sites, the vicinity of orchards, or along dusty roads. Tree mortality, attributed in part to bark beetle attacks on scale-infested pines, was noted at Winfield, Glenmore, East Kelowna and Carr's Landing.

Black Pine-leaf Scale, Nuculaspis californica (Colem.)

Black pine-leaf scale continued to increase in the scattered ponderosa pines between Penticton and Naramata. Abnormally short needles on the new growth and premature loss of foliage was evident on many of the most heavily infested trees. Resurgence of the black pine-leaf scale was apparently confined to the area northeast of Penticton; pines at Skaha Lake and east of Penticton where an infestation died out in the late 1950's, remained relatively free of the pest.

A local infestation on mature ponderosa pines in a park in Keremeos persisted at a reduced level in 1965, after heavy mortality in 1964.

Spruce Spider Mite, Oligonychus ununguis (Jac.)

Foliage discoloration caused by spruce spider mite was less conspicuous on Douglas-fir south of Okanagan Landing than in 1963 or 1964; however, a high population persisted. Damage was evident in much of the Douglas-fir forest on the lower slopes between Chase and Harper Lake and on many isolated groves of conifers and ornamentals in the agricultural areas of the Okanagan Valley. Mature Norway spruce planted as windbreaks in Coldstream Municipality were heavily infested.

A Larch Bud Moth, Zeiraphera sp.

A larch bud moth which caused widespread defoliation in the Nelson Forest District in 1965 was collected in two high-elevation larch stands in Lumby Ranger District but damage was negligible. These localities were near

Aberdeen Lake and west of Vance Creek.

Sawflies on Douglas-fir, Neodiprion spp.

Sawflies on Douglas-fir were comparatively scarce in 1965. The following table shows the population trend over the past three years:

No. of samples taken during larval period			% samples containing larvae			Av. no. of larvae per sample		
1963	1964	1965	1963	1964	1965	1963	1964	1965
96	95	57	68	68	61	17.2	12.0	6.5

Sawflies on Western Hemlock, Neodiprion sp.

Sawflies on western hemlock were comparatively scarce in 1965. The following table shows the decline in numbers collected since 1963.

No. of samples taken during larval period			% samples containing larvae			Av. no. of larvae per sample		
1963	1964	1965	1963	1964	1965	1963	1964	1965
57	54	44	80	80	25	45	24	5

Yellow-headed Spruce Sawfly, Pikonema alaskensis (Roh.)

There was no damage in 1965 in the Mara Meadows area where a few young Engelmann spruce trees were partly defoliated in 1964. Populations were low throughout the District.

Poplar-and-willow Borer, Sternochetus lapathi (L.)

Poplar-and-willow borers continued to cause willow mortality in the Enderby and Sicamous districts. One complaint was received concerning damage to a native willow growing in a garden at Princeton where borers are comparatively scarce.

European Fruit Scale, Aspidiotus ostreaeformis Curt.

An infestation of European fruit scale was discovered in 1965 in an isolated grove of aspen in Richter Pass, six miles northwest of Osoyoos. Open grown trees around the edge of the stand had light populations of scale on the main stems and branches causing bark deformities. Damage was considerably heavier than that caused by similar concentrations of the common native scales, Lecanium spp.

Other Noteworthy Insects

Insect	Host	No. of collections	Remarks
Altica spp.	Cot, D	0	Scarcer than in 1964.
Cryphalus salicis Hopk.	Cot	1	Scarce.
Dichomeris marginella F.	J. spp.	2	Heavy infestations in ornamentals, Kelowna; some damage in Vernon.
Dioryctria ponderosae Dyar	Py	8	On new growth of young trees, central and south Okanagan.
Hemichroa crocea Fourc.	D	0	None collected in 1965.
Ips pini (Say)	Py	0	200 young trees killed in 1964, Anarchist Mtn.
Mindarus abietinus Koch	Ba	1	Common, Goat Mtn. Lake, Lumby district.
Zelleria haimbachi Busck	Py	2	30% of tips infested, Gallagher Lake.

FOREST DISEASE CONDITIONS

Important Diseases

Climatic Injury

Weather conditions during the winter of 1964-1965 severely damaged the foliage of some conifers, and caused varying degrees of injury to broad-leaved trees and shrubs. Sub-zero temperatures accompanied by strong winds on December 15 and 16, 1964 were responsible for heavy losses in orchards of the Central and South Okanagan, and it is probable that these conditions also affected native trees; further damage may have resulted from very cold temperatures in the latter part of March after warm weather had broken dormancy of some early-flushing species.

Ponderosa pine in the Okanagan Valley, mostly in exposed locations at low elevations, suffered severe foliage damage. Affected trees began to turn colour early in April, first fading to dull greyish green, and then gradually turning to reddish brown.

On most trees, older foliage suffered the greatest damage, while in many instances the 1964 foliage was barely discoloured. Except for a few badly damaged trees near Summerland which were attacked by red turpentine beetles Dendroctonus valens Lec. in May, and numerous "flagged" branch ends in some localities, ponderosa pine damage was apparently restricted to foliage loss. There was abnormally heavy needle drop in the Okanagan Valley and in the Princeton district in late summer and early autumn.

Douglas-fir also suffered winter injury, but the effect was different from that on ponderosa pine. Very little serious foliage discoloration was noted, but in some localities, particularly in the Central Okanagan, there was heavy bud mortality. Some understory trees near Peachland failed to produce any foliage whatever in 1965, although adventitious buds were produced by midsummer. Other trees produced only a few new shoots; these were unusually vigorous. This condition was also prevalent in the Similkameen Valley and, to a lesser degree, in exposed places in the North Okanagan.

Western red cedar in the northern part of the District shed abnormal quantities of foliage in late summer; this may have been a result of winter damage, or the effect of the first hot summer in four years.

Aspens and black cottonwoods in exposed places in the Okanagan Valley suffered varying degrees of injury. A few were killed. The most frequently observed evidence of injury was branch die-back and clustering of abnormally large leaves. Some of the injury was apparently caused by near-zero temperatures late in March; a grove of trembling aspens on Anarchist Mountain had many branches killed back after the male catkins were fully expanded.

Evergreen and red-stem ceanothus suffered the heaviest mortality of any native shrubs; ocean-spray and tall Oregon grape were damaged, the former being killed back extensively and the latter suffering severe leaf scorch.

Needle Cast of Ponderosa Pine

Infections of Elytroderma deformans (Weir) Darker caused conspicuous foliage discoloration and needle drop in several chronic areas and in a few stands where damage is usually light. Heavy infections were observed at Westwold, Falkland, Carr's Landing, Winfield, Mission Creek Valley, Lambly Creek, Westbank, Kaleden, southeast of Oliver, Anarchist Mountain and near the upper limits of ponderosa pine types around Princeton.

The condition of trees in some of the chronic areas has deteriorated greatly in the past five years, and an infestation of mountain pine beetles southeast of Oliver is believed to have developed largely as a result of repeated Elytroderma infections.

Although most of the ponderosa pines between Schwebb's Bridge and Falkland still appeared to be vigorous in 1965, many had numerous large brooms; it appeared that the level of infection was rising in this valley.

Summaries of the results of examinations of two Elytroderma plots are presented in the Disease Progress Plots section of this report.

Larch Needle Cast

Infections of Hypodermella laricis Tub. were much less widespread in 1965 than in 1964, and were generally restricted to larch stands at higher elevations. Discoloration in the Shuswap River Valley east of Enderby was negligible for the first time in four years.

Larches in the mountains east of Oliver were quite heavily infected, and some local heavy infections were noted during aerial surveys of some of the valleys east of Okanagan Lake. Heavy needle mortality of understory trees and on the lower crowns of the overstory occurred between elevations of 4,000 and 4,700 feet on Vernon Hill, Aberdeen Mountain, near Aberdeen and Nicklen lakes, and on Terrace Mountain.

Wind Damage

Wind breakage, apparently caused during the winter of 1964-1965, was prevalent along a ridge between the valleys of Salmon River and Equesis Creek. Winds funneling through passes along the top of the ridge had snapped the tops off at least 70% of overstory Douglas-fir, Engelmann spruce, alpine fir and lodgepole pine over about 100 acres. Most of the tops were broken off at diameters of from four to six inches, and few wind-thrown trees were observed.

High winds on August 9, 1965 felled many trees in the Upper Shuswap River drainage, particularly in the vicinity of Mabel and Sugar lakes.

Melampsora Rust on Black Cottonwood

Black cottonwoods of all ages growing along the lower 12 miles of Ashnola River Valley were heavily infected with Melampsora occidentalis Jacks. On August 27, with a light wind turning the leaves, the trees presented a uniform pale orange appearance.

Rust infections were lighter than in 1964 on cottonwoods in Shatford Creek Valley near Penticton.

Ink Spot of Aspen

Infections of Ciborinia whetzelii (Seaver) Seaver increased in intensity and extent at Osprey Lake in 1965, but the level of damage on McNulty Creek road was lower than in 1964. Ink spots cached on the ground in the latter locality in the autumn of 1964 failed to produce any fructifications, possibly due to excessive moisture.

A Disease of Sitka Alder Foliage

A fungus causing patchy necrotic areas on Sitka alder leaves at Hidden Lake in 1964 and 1965 has been identified as Septoria alni (Sacc.). Heavy infections caused premature leaf drop in 1964.

"Brown Rot" of Chokecherry

Infections of *Monilinia demissa* (Dan.) Honey on chokecherry were not much in evidence in 1965. However, a few heavily infected thickets were observed at Ellison Park, and damage attributed to this pathogen was collected near Chase. Symptoms are withering and death of leaves and young shoots before the foliage is fully expanded.

Rodent Damage to Douglas-fir Seedlings

Localized but heavy mortality of Douglas-fir seedlings 18 miles southwest of Westwold was attributed to voles, probably *Microtus* sp. Seedlings on a grassy sidehill had been de-barked close to the ground during the winter of 1964-65. In one acre, about 40 trees less than three feet high had been killed.

Exotic Plantations

Only two exotic plantations are examined annually.

Table 9

Summary of Disease Condidions on Exotic Plantations

XP No.	Location	Exotic Species	Remarks
222	Tamarack Lake, Kelowna	*Pinus sylvestris*	Only a few trees found; too large for 1958-60 plantings.
223	Terrace Mountain	*Larix decidua* *Larix* hybrid	36 trees examined. Healthy except for a few flattened by snow.

Disease Progress Plots

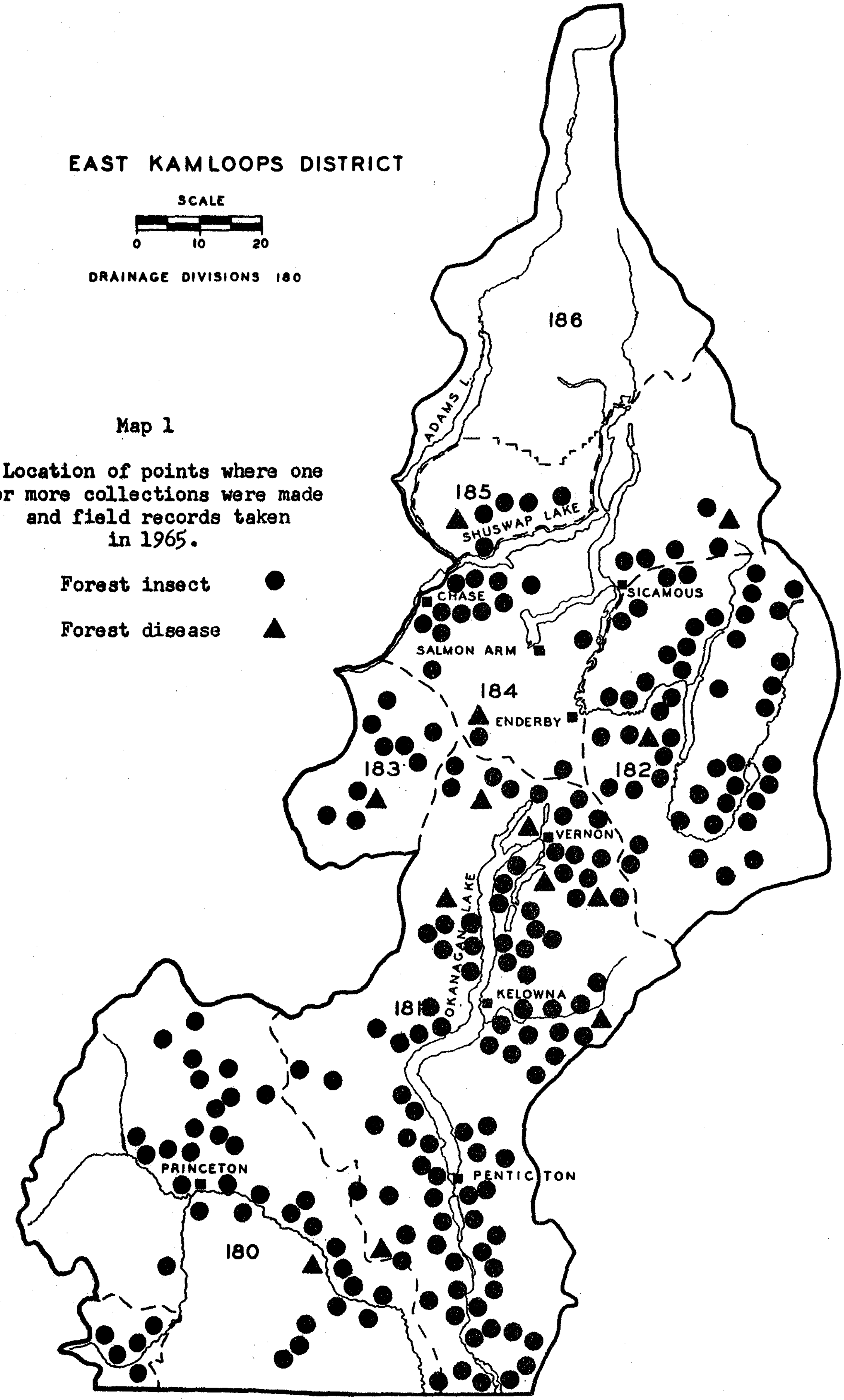
Two plots established near Carr's Landing and at Glenemma in 1960 to follow the trend of needle cast infections of ponderosa pine were examined in 1965. Infections were light at both plots, although some stands near Carr's Landing were heavily damaged.

Tree mortality has been light since the plots were established, but further losses undoubtedly will occur as the more heavily infected understory trees are outstripped by the overstory. Percentage of foliage infected and the number of living trees in each plot were as follows:

Locality	No. of living trees					% foliage infected				
	'61	'62	'63	'64	'65	'61	'62	'63	'64	'6
Carr's Landing	66	63	63	63	62	30	41	35	19	22
Glenemma	56	56	56	56	56	37	30	40	28	29

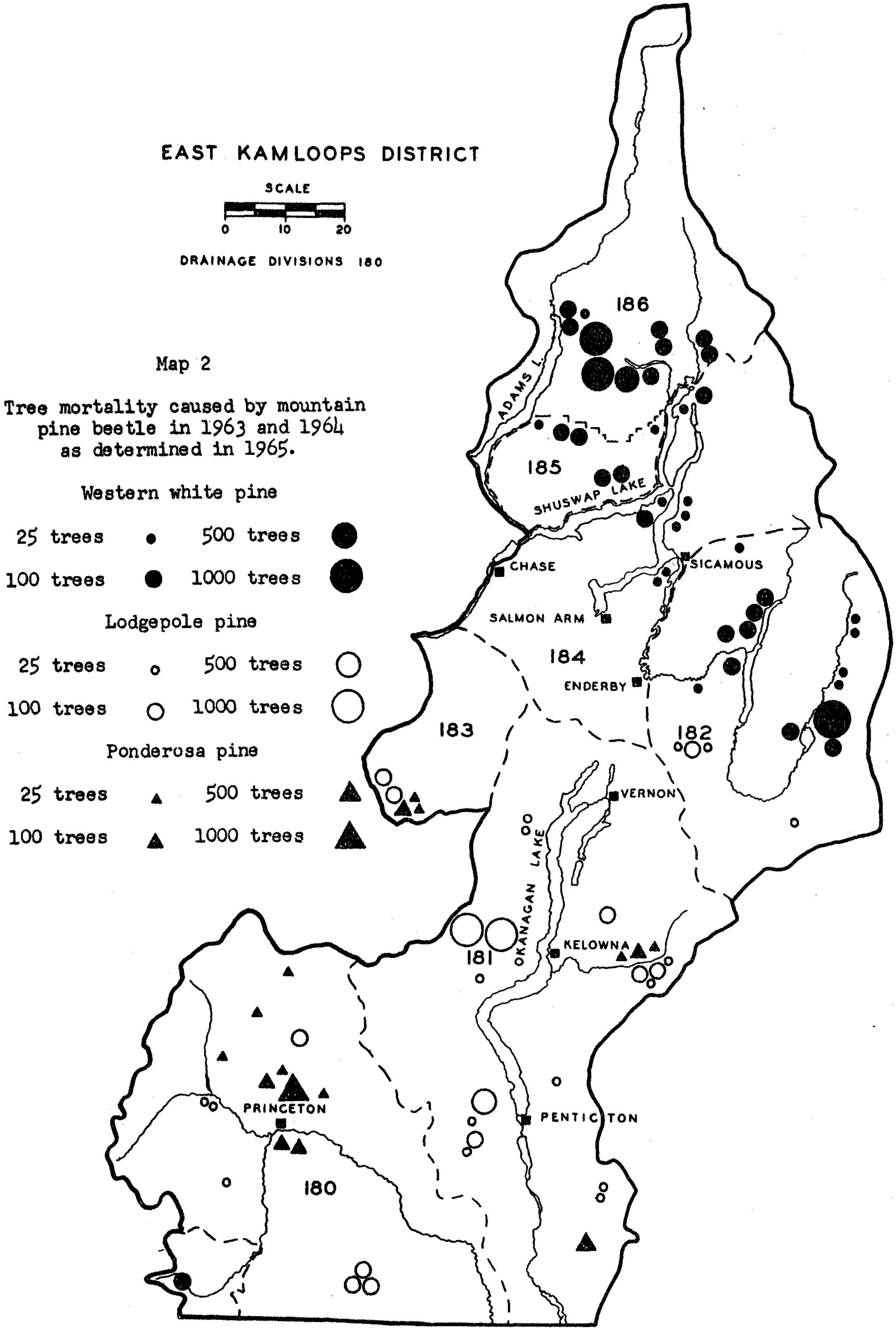
Other Noteworthy Diseases

Host	Organism	Locality	Remarks
Juniper, common	*Herpotrichia nigra* Hartig	Trinity Valley	Snow blight.
Pine, lodgepole	*Coleosporium asterum* (Diet.) Syd.	Terrace Mtn.	Needle rust.
	Atropellis piniphila (Weir) Lohm. and Cash	Nicklen Lake	Common in pole sized stand.
	Peridermium stalactiforme Arth. & Kern	Nicklen Lake	Common; causing light mortality.
Spruce, Engelmann	*Botryosphaeria piceae* Funk	Trinity Valley	Stem and branch cankers.
Wintergreen, *Pyrola virens* Schweigg.	*Chrysomyxa pirolata* Wint.	Vernon	Alternate host of spruce cone rust.

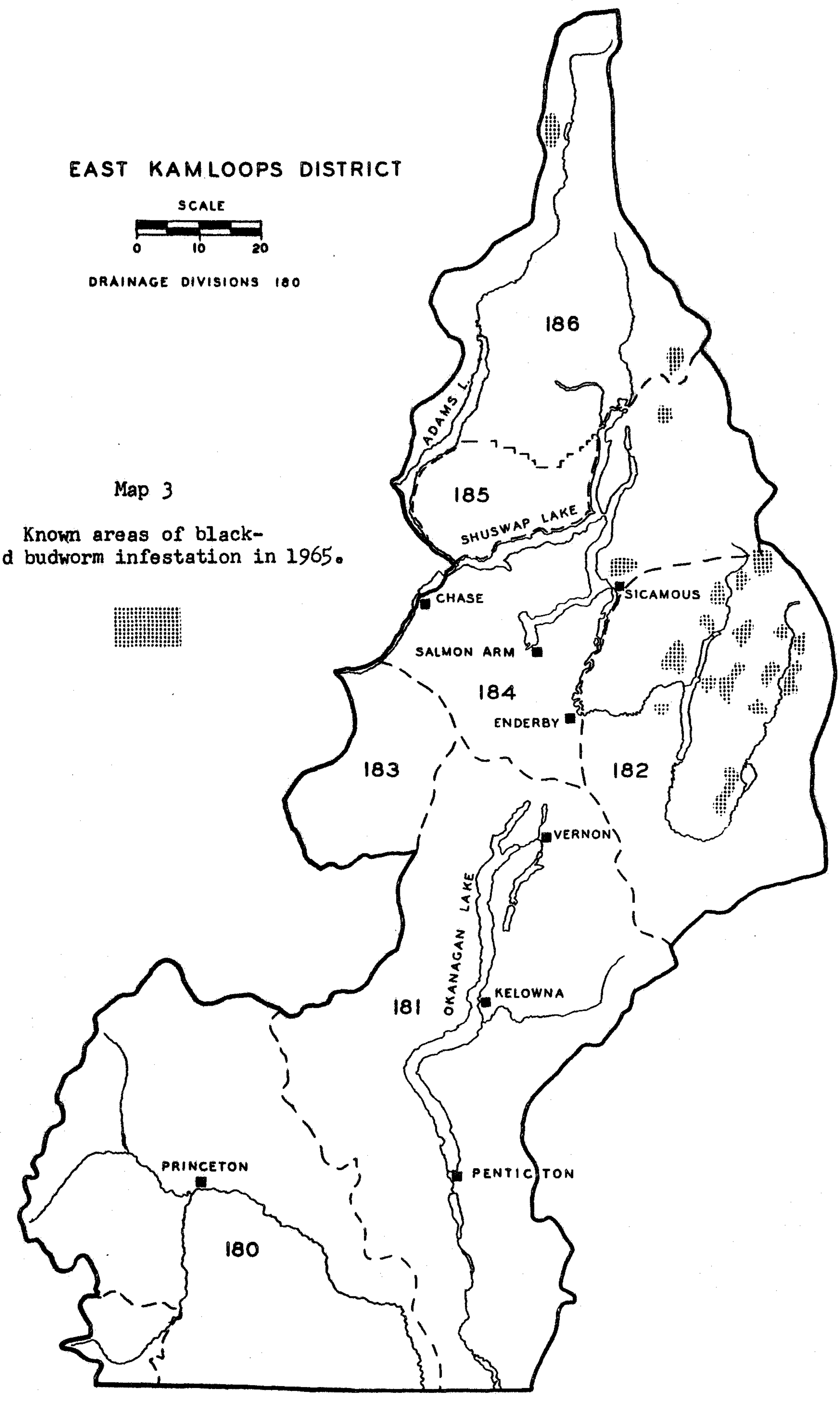


Map 1

Location of points where one or more collections were made and field records taken in 1965.

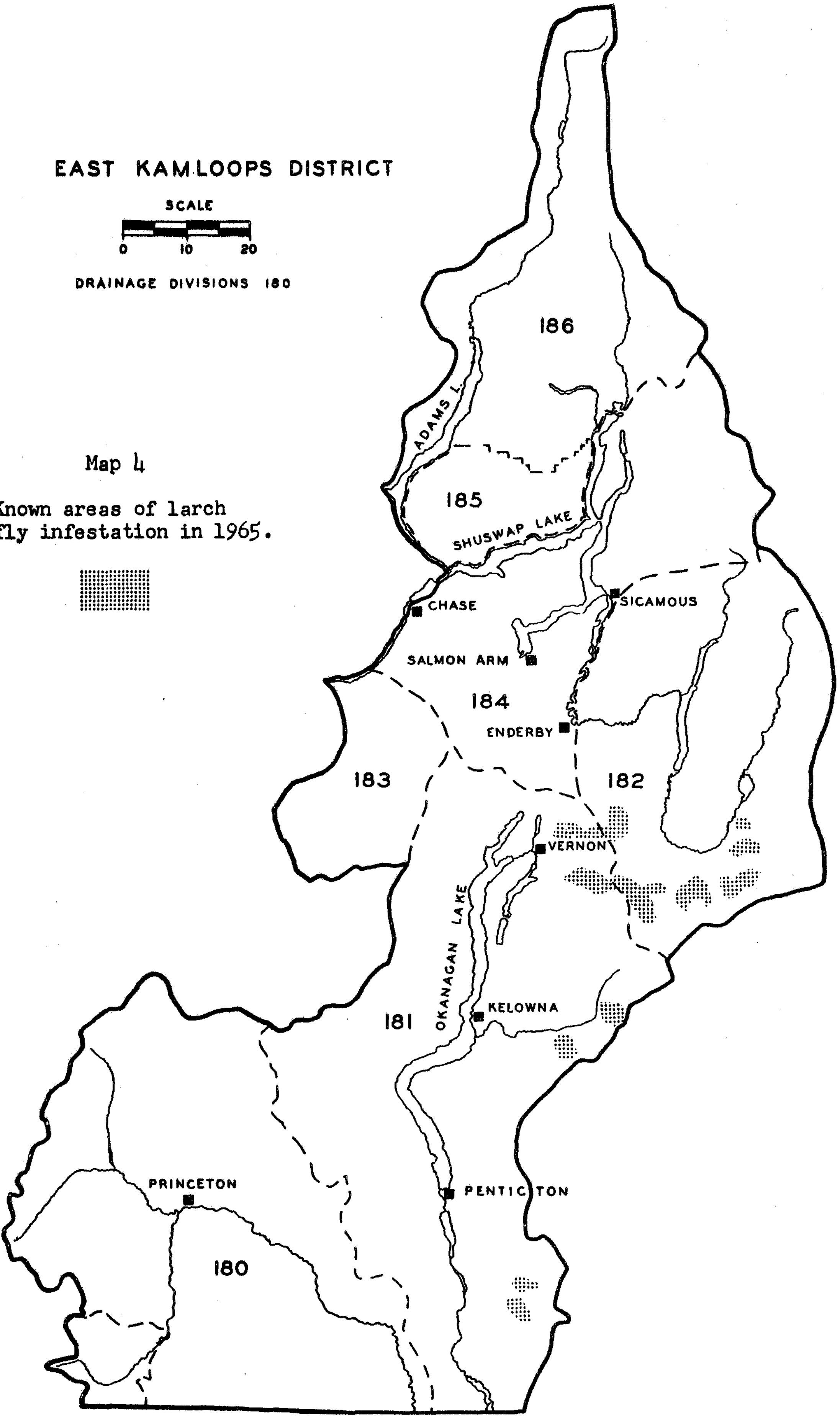


EAST KAMLOOPS DISTRICT
SCALE
0
10
20
DRAINAGE DIVISIONS 180
Map 2
Tree mortality caused by mountain pine beetle in 1963 and 1964 as determined in 1965.
Western white pine
25 trees
500 trees
100 trees
1000 trees
Lodgepole pine
25 trees
500 trees
100 trees
1000 trees
Ponderosa pine
25 trees
500 trees
100 trees
1000 trees
186
ADAMS L.
185
SHUSWAP LAKE
CHASE
SICAMOUS
SALMON ARM
184
ENDERBY
183
182
VERNON
OKANAGAN LAKE
KELOWNA
181
PRINCETON
PENTICTON
180



Map 3

Known areas of black-headed budworm infestation in 1965.



Map 4

Known areas of larch sawfly infestation in 1965.

FOREST INSECT AND DISEASE SURVEY

CENTRAL KAMLOOPS DISTRICT

1965

FOREST INSECT AND DISEASE SURVEY

CENTRAL KAMLOOPS DISTRICT

1965

R. J. Andrews

INTRODUCTION

Forest insect and disease sampling started in the last week of May and continued to the end of August. Damage appraisal surveys for the spruce beetle and the mountain pine beetle were carried out in the first two weeks of October and egg surveys of the black-headed budworm and Douglas-fir sawfly were completed during the last half of that month. One week of August was spent in the West Kamloops District assisting with Douglas-fir beetle strips; three weeks of September in the Prince George District with the spruce beetle survey, and two weeks in the Nelson Forest District with the larch sawfly survey.

A total of 20 hours flying time, 12 of which were contracted by the Department of Forestry and eight by the British Columbia Forest Service, were used for bark beetle and black-headed budworm damage appraisal surveys within the District.

Totals of 312 insect and 18 forest disease collections were taken in the District. Table 1 shows the collections by host. Map 1 shows the locations where one or more collections were made and field records taken in 1965.

Table 1

Collections by Hosts

Central Kamloops District, 1965

Coniferous hosts	Forest insects	Forest diseases	Broad-leaved hosts	Forest insects	Forest diseases
Cedar, western red	5	-	Aspen, trembling	6	2
Douglas-fir	153	4	Birch spp.	6	-
Fir, alpine	17	5	Cottonwood, black	1	-
Hemlock, western	49	-	Willow spp.	7	-
Juniper, Rocky Mtn.	8	-	Miscellaneous	5	1
Pine, lodgepole	-	2			
Pine, mugho	2	-			
Pine, ponderosa	18	4			
Pine, western white	2	-			
Spruce, Engelmann	33				
Totals	287	15		25	3
			GRAND TOTAL	312	18

FOREST INSECT CONDITIONS

Important Insects

Douglas-fir Beetle, *Dendroctonus pseudotsugae* Hopk.

Damage appraisal flights for counting red-topped Douglas-fir trees took place during the second week of July. The number of trees killed during the period 1962-1964 was 8,216; this was 6,178 trees less than for 1961-1963. A three-year period was used for consistency in recording killed trees even though a number of trees attacked in 1963 might have been missed from the count due to rapid needle loss. The largest decrease took place on the Douglas Plateau. Map 2 shows the location of estimated numbers of beetle-killed Douglas-fir trees. Table 2 shows the locations, number of trees counted and the volume attacked in each locality for the period 1962 to 1964.

Table 2

Douglas-fir Trees Killed by Douglas-fir Beetle from 1962 to 1964, Central Kamloops District

Location	No. of trees	Est. volume of timber (cu. ft.)
Barriere to Kamloops	14	1,260
Chase	19	1,900
Johnson Lake	28	2,800
Barriere Lake	100	10,000
Nicola River	113	9,040
Paul Lake	135	12,150
Walhachin	135	12,150
Barnes Lake	140	12,600
Pennask Lake	177	8,850
Criss Creek	229	20,710
Highland Valley	257	23,130
East of Shumway Lake	432	38,880
Copper Creek	542	48,780
Deadman River	609	48,720
Tranquille Creek	638	63,800
Chapperon Lake	897	80,730
Loon Lake	1,866	167,400
Bonaparte River	1,885	169,650
Totals	8,216	732,550

Foliage colour change studies of beetle-attacked trees were continued. The study assesses foliage colour change and needle loss that has taken place on beetle-killed trees for the past three years, thus enabling a more ready recognition of beetle-killed trees at flight time. One plot near Chapperon Lake was abandoned and two new plots, one in Highland Valley and the other near Loon Lake, were added to the existing plot near Tranquille Creek. Table 3 shows the average rate of foliage colour change and foliage loss for 103 Douglas-fir trees attacked in 1963 and 1964.

Table 3

A Progressive Record of Colour Change of Douglas-fir Foliage, Central Kamloops District, 1963 and 1964

Date of examination	Tree condition				
	Green	Fading	Red	100% needle shed	% needle loss
	Trees attacked in 1963				
1964: May	15	6	6	1	13
July	2	4	20	2	50
August	1	1	24	2	60
November	0	0	17	11	72
1965: June	0	0	9	19	93
	Trees attacked in 1964				
1965: May	16	57	2	0	2
June	10	11	54	0	22
August	1	1	73	0	54
October	0	0	67	8	66

Recorded observations of needle loss in the two plots show that 67% of the trees attacked in 1963 would have been missed in the 1965 aerial survey. The last recorded observation in 1964 indicated that 39% of the previous years' attacked trees had dropped all of their foliage while the last observation in 1965 showed only 10% of the 1964 attacked trees had dropped their complete needle complement.

Mountain Pine Beetle, Dendroctonus ponderosae Hopk.

Populations of mountain pine beetle in ponderosa pine stands increased in most areas of the District. The Chapperon and Barnes lakes infestations showed an increase in the numbers of red-topped trees and from 100 to 1,000 attacked trees were recorded in several new areas (Table 4). Strip cruise sampling was carried out at Chapperon Lake (190 chains) and near Chase (76 chains) to determine the density of attack. An additional 30 attacked trees near Chapperon Lake and 25 attacked trees near Chase were added to the existing plots of 20, 13 and 18 ponderosa pines being used for observations of foliage colour change.

Table 4

Number, Species, and Locations of Mountain Pine Beetle-killed Trees, Central Kamloops District 1963 and 1964

Locality	Tree species	No. of dead trees
Criss Creek	Py	12
Copper Creek	Py	42
Walhachin	Py	15
Barnes Lake	Py	429
Highland Valley	Py	50
Tranquille Creek	Py	56
Deadman River	Py	50
Pennask Lake to Merritt	Py	128
Nicola River	Py	1,070
Chase	Py	104
Chapperon Lake	Py	5,750
Barriere Lake	Pw	160
Blue River	Pw	1,000
Total		8,866

One chain wide cruise strips were run to determine density of attack. Data were recorded on healthy and 1965-attacked trees (current attack), trees attacked previous to 1965 having red foliage, and trees that had shed 90% or all of their foliage (old grey). Volume figures were derived from tree heights and diameters measured at the strip locations and applied to "Standard Cubic-foot Volume Tables for Western Yellow Pine (all Ages), British Columbia Forest Survey and Inventory Division, 1962."

At Chapperon Lake three strips were run totalling 190 chains. The average number o stems per acre was 86 of which 43% had been attacked by the mountain pine beetle in the past four years (Table 5).

Table 5

Results of Three Strip Cruises in Ponderosa Pine, Chapperon Lake, Central Kamloops District, 1965

Strip no.	Acres cruised	Total volume (cu. ft.)	Av. vol. per acre (cu. ft.)	% of trees			
				Healthy	Old grey	Red	Current attack
1	7	15,134	2,162	77	2	5	16
2	4	6,895	1,724	39	22	30	9
3	8	15,505	1,938	45	16	16	23
Average			1,964	56	12	14	18

Table 6

A Progressive Record of Foliage Colour Change of Ponderosa Pine, Central Kamloops District, 1962 - 1964

Trees attacked in 1962					Trees attacked in 1963					Trees attacked in 1964				
Date of examination	Green	Fading	Red	Av. % needle loss	Date of examination	Green	Fading	Red	Av. % needle loss	Date of examination	Green	Fading	Red	Av. % needle loss
1962														
Aug.	20			0										
1963					1963									
May	11	9		0	May									
June	7	13		0	June									
July	6	0	14	0	July									
Sept.	4	1	15	5	Sept.	13	0	0	0					
1964					1964					1964				
May	1	2	17	25	May	4	5	4	3	May				
June	1	0	19	36	June	0	5	8	4	June				
Aug.	1	0	19	59	Aug.	0	4	9	8	Aug.	18	0	0	0
Nov.		1	19	75	Nov.	0	0	13	28	Nov.	5	12	1	0
1965					1965					1965				
May			10*	85	May	0	0	13	37	May	0	5	13	0
July			7*	90	July	0	0	13	69	July	0	1	17	2
Aug.			3*	94	Aug.	0	0	13	79	Aug.	0	0	18	4
Oct.			3*	95	Oct.	0	0	13	94	Oct.	0	0	18	20

*Remainder of trees had lost 100% of their needle complement.

Near Chase, 104 red-topped ponderosa pine trees in an estimated 100 acre area were observed during an aerial survey. A subsequent ground check revealed that of an average of 87 stems per acre, 40% had been killed by the mountain pine beetle. The following data are the results from a 76 chain strip.

Acres cruised	Total volume (cu.ft.)	Av. vol. per acre (cu.ft.)	% of trees			
			Healthy	Old grey	Red	Current attack
7.6	12,602	1,658	58	12	13	17

Studies of colour change of beetle-killed ponderosa pine reveal that trees retain some red foliage for up to four years. Twenty trees attacked in 1962 shed an estimated 95% of their needle complement by the end of four years whereas trees attacked in 1963 took only three years to shed the same amount. The largest percentage of needles dropped two years after attack. Table 6 shows the progressive record of foliage colour change on attacked ponderosa pine near Chapperon Lake.

Spruce Beetle, Dendroctonus obesus (Mann.)

Spruce beetle populations remained low in most of the district in 1965. A preliminary inspection of a reported outbreak in the Moira Lake area was made in September and a strip cruise of the infested portion of the spruce stand was made in October. The infestation was within the Clearwater Tree Farm License north of Moira Lake (Region 57, Compartment 9). The area surrounding the infested timber was strip-logged in 1962.

One cruise strip, 90 chains long by one chain wide, was run south of the logged area and a second strip 40 chains long was cruised in a leave strip. Records were taken of all standing spruce trees eight inches dbh and over and of windfalls in the chain-wide strips. Information recorded included diameters of healthy and attacked trees, year of attack, whether or not attack was complete or partial, and presence or absence of beetles in dead trees and windfalls. Square-foot bark samples were taken from infested trees and windfalls to determine brood development and population densities.

The beetle population occurred mainly within 10 chains of the logged area. In the large block of timber south of the logged area, 11% of the spruce trees were infested while in the leave strip 12% were infested. The number of windfalls was small but 87% were infested and contained a potentially destructive population. The majority of progeny found in square-foot bark samples were larvae, with occasional teneral adults and pupae, suggesting a two-year life cycle. The largest attack may be expected in 1967. Stand data are shown in the following table. Table 7 shows the data obtained from square-foot bark samples.

Strip no.	No. acres	No. trees	Total volume (cu. ft.)	% volume attacked	% trees attacked 1962-63	1964	1965
1	9	502	32,576	11	1.5	2.5	1.3
2	4	197	11,914	12	1.0	3.5	3.5

Table 7

Summary of Data from Square-foot Bark Samples Taken from Windfalls and Standing Infested Trees, Moira Lake, Central Kamloops District, 1965

Strip no.	Host material	No. of trees examined	Av. no. of progeny per sq. ft. Adults	Larvae	Pupae
1	Standing trees	6	1.0	23.5	0.5
2	" "	6	13.6	23.3	1.0
1	Windfalls	3	5.3	31.8	0
2	"	5	3.6	11.4	0.4

Western Balsam Bark Beetle, *Dryocoetes confusus* Sw.

Infestations in alpine fir stands continued in the following areas: Cariboo Range, Badger Lake, Barriere lakes, and Jamieson Creek.

Black-headed Budworm, *Acleris variana* (Fern.)

Above normal populations of the black-headed budworm were confined to the wet-belt forest of the North Thompson Valley. Two areas of light defoliation were recorded near Blue River. Near Mud Lake, at 3,600 feet elevation, collections in June yielded up to 96 larvae per three-tree beating sample. During an aerial survey in August, defoliation was observed southwest of Blue River. Beating samples in this area yielded up to 200 larvae per sample; mass collections of larvae were reared in the Vernon insectary for parasite information (Table 8).

Table 8

Results of Mass Rearing of Black-headed Budworm Larvae and Pupae, Blue River, Central Kamloops District, 1965

Locality	Date collected	No. of larvae	% pupation	% parasitism Larvae	% parasitism Pupae	% adult emergence
Mud Lake	July 7	40	13	15	0	10
	Aug. 9	159	26	20	17	14
Blue R.	Aug. 3	147	28	18	40	7
	Aug. 9	183	28	35	3	21

Egg sampling was carried out in October to estimate possible population levels for 1966. Six trees were felled in two locations and five branches, 10 inches long, were cut randomly from each tree. The eggs on each branch were counted and defoliation of current and previous year's growth was estimated. The samples indicated that in 1966 black-headed budworm populations will be much the same as in 1965: light near Mud Lake and medium southwest of Blue River. The following table shows the results of the egg survey.

Location	% defoliation	Range in no. eggs per 10-inch branch	Av. no. eggs per branch
Mud Lake	5-10	1-12	4.4
Blue River	10	1-23	8.1

A Sawfly on Douglas-fir, Neodiprion sp.

Collections containing small numbers of Neodiprion larvae were common in most areas of the District. The second year of epidemic numbers of sawfly larvae, however, resulted in light to medium defoliation of Douglas-fir near Little Shuswap Lake. Medium defoliation was predominant in the closer growing immature portion of the stand.

In May, 16 groups of from 39 to 236 eggs were collected on branch samples; 70% of the 1,399 eggs hatched. During the larval period, three-tree beating samples yielded up to 400 larvae per sample. Mass collections of larvae were gathered to determine the percentage of parasitism and the influence of a virus on the population. Eleven larvae showing virus symptoms were sent to Victoria for identification. Table 9 shows the results of the rearing program.

Table 9

Results of Mass Rearing of Neodiprion Larvae and Cocoons, Little Shuswap Lake, Central Kamloops District, 1965

No. of larvae collected	% survival to cocoon stage	% mortality caused by parasitism		% adults emerged
		Larvae	Cocoons	
200	68	0	0	65
100	60	0	5	61
100	87	0	8	21

Duff samples were taken from within the infested area to determine the cocoon population. These consisted of square-foot samples of duff and soil from the cardinal points beneath one tree in each of two medium and one lightly defoliated areas. Table 10 shows a comparison of the numbers of cocoons in duff samples in the past two years.

Table 10

Summary of Duff Samples containing Neodiprion Cocoons at Three Locations, Little Shuswap Lake, 1964 and 1965

Station	Defoliation class		Av. no. cocoons per sq. ft.			
			New		Old	
	1964	1965	1964	1965	1964	1965
1	heavy	light	6.3	1.5	12.2	0.7
2	heavy	medium	6.0	6.0	13.0	12.0
3	heavy	medium	1.0	1.0	10.0	4.7

It will be noted that there was a decrease in defoliation and the number of cocoons per square foot. A decrease in the number of eggs per square foot of foliage was expected and substantiated by branch samples in October. Egg sampling consisted of cutting four branches from each of five trees at three locations within the infestation. Table 11 shows the results of the egg survey.

Table 11

Summary of Branch Samples Containing *Neodiprion* Eggs at Three Locations, Little Shuswap Lake, 1964-1965

Plot no.	Area of foliage examined (sq. ft.)		Total no. of eggs		Av. no. eggs per sq. ft. of foliage	
	1964	1965	1964	1965	1964	1965
1	30.9	23.6	952	77	30.4	3.3
2	44.8	19.9	1,153	20	25.7	1.0
3	39.4	24.5	767	371	19.4	15.1
Total	115.1	68.0	2,872	468	Av. 24.9	6.8

Little damage is expected as a result of *Neodiprion* feeding on Douglas-fir in the Little Shuswap Lake area in 1966.

Western Hemlock Looper, *Lambdina fiscellaria lugubrosa* (Hulst)

The average number of larvae collected in three-tree beating samples from western hemlock in the North Thompson Valley in June and July decreased from 73.6 in 1964 to 3.0 in 1965. In 1964, 100% of the collections yielded hemlock looper larvae; in 1965 only 67% were positive.

The number of Douglas-fir collections containing hemlock looper larvae and the number of larvae in collections also decreased in 1965. The following is a summary of hemlock looper collections on Douglas-fir.

Number of samples taken during larval period			% samples containing larvae			Av. no. of larvae per sample		
1963	1964	1965	1963	1964	1965	1963	1964	1965
112	138	181	21	46	23	2.9	4.0	1.7

False Hemlock Looper, *Nepytia freemani* Munroe

The percentage of positive collections and the average number of false hemlock looper larvae per collection decreased throughout the District in 1965. Forty-two per cent of all Douglas-fir collections taken in the District contained false hemlock looper. The average number of larvae per positive sample was 3.6. In 1964, 63% of the collections were positive and averaged 21.8 larvae. Table 12 shows the information on the false hemlock looper gathered from Douglas-fir samples in each drainage division for the past three years.

Table 12

Summary of False Hemlock Looper Collections from Douglas-fir by Drainage Divisions, Central Kamloops District, 1963-1965

Drainage division	No. of samples taken during larval period			% of samples containing larvae			Av. no. of larvae per sample		
	1963	1964	1965	1963	1964	1965	1963	1964	1965
161	6	5	6	0	0	0	-	-	-
162	40	28	14	17.5	14.0	35.7	3.2	2.5	1.7
163	71	98	47	53.5	75.0	48.9	11.7	25.7	1.9
164	10	16	19	40.0	75.0	57.8	3.5	13.3	1.6
165	25	6	16	40.0	100	50.0	9.9	6.3	1.6

Spruce Budworm, *Choristoneura fumiferana* (Clem.)

Douglas-fir collections containing spruce budworm were few in 1965. In June 19% of 89 Douglas-fir collections averaged 1.4 larvae per sample.

Two-year-cycle spruce budworm were collected only at Jamieson Creek in 1965 where 12% of buds of alpine fir regeneration were mined. Examination of spruce and alpine fir at the two other permanent plots near McGillivray and Grizzly lakes yielded no larvae.

Engelmann Spruce Weevil, *Pissodes engelmanni* Hopk.

Weevil damage to regeneration Engelmann spruce was generally confined to the Clearwater area.

A new plot was established near Grizzly Lake for observation and counts of weevil-infested regeneration spruce leaders. There was an increase in current attack in the three existing plots near Candle Creek. Table 13 shows the data obtained from the four 100-tree plots.

Table 13

Percentage of Regeneration Spruce Infested by Engelmann Spruce Weevil, Candle Creek and Grizzly Lake, 1964 and 1965

Location	% spruce trees attacked					
	Current attack		Old attack		Uninfested	
	1964	1965	1964	1965	1964	1965
Candle Creek	8	16	16	22	76	62
" "	13	15	22	13	65	63
" "	13	18	29	16	58	67
Grizzly Lake	-	28	-	2	-	70
Averages	11	19	22	13	66	65

Douglas-fir Needle Midges, Contarinia spp.

Needle midge damage to Douglas-fir in Christmas-tree cutting areas was light in 1965. Four plots were examined at Heffley Creek, Monte Creek, Cherry Creek and near Barriere to find the percentage of needles infested. The infested and non-infested needles were counted on five current years' terminals from each of five randomly selected trees at each plot. Table 14 shows the amount of foliage examined and the percentage of needles infested by needle midges.

Table 14

Number of Needles Examined and the Percentage of Needles Infested by Contarinia at Four Locations, Central Kamloops District, 1964 - 1965

Location	No. of needles examined		% needles infested	
	1964	1965	1964	1965
Monte Creek	2,845	2,580	14	0.3
Cherry Creek	-	2,431	-	0.1
Heffley Creek	2,847	2,142	26	9.2
Barriere	1,897	2,695	28	0.7

A Sawfly, Xyela sp.

Three of the four plots examined for sawfly-infested ponderosa pine staminate flowers showed a decrease in 1965 (Table 15).

Table 15

Percentage of Ponderosa Pine Staminate Flowers Infested by Xyela sp., Central Kamloops District, 1963-1965

Location	Percentage flowers infested		
	1963	1964	1965
Little Shuswap Lake	12	24	89
Kamloops	62	98	71
Savona	49	60	-
Nicola	47	86	11
Mamette Lake	38	59	3

European Pine Shoot Moth, Rhyacionia buoliana (Schiff.)

An inspection of Westsyde Nursery in May 1965 revealed 17% of a 100-tree shipment of mugho pine received from Holland were infested by the

European pine shoot moth. The trees were brought to the Vernon insectary for rearing of the insects; two adults only successfully emerged. None of 374 exotic pines examined in the cities of North Kamloops and Kamloops were infested.

Three 100-tree ponderosa pine plots were examined within a radius of three miles of Westsyde Nursery to determine if native trees species were infested, but no infested trees were found.

Spotless Fall Webworm, Hyphantria cunea Drury

Spotless fall webworm tents were observed near Spences Bridge, Savona, Chase, and near Monte Creek. The number of tents on both sides of the road were counted from a slow moving vehicle for three miles west of Savona and for eight miles along the Nicola River Road east of Spences Bridge. The number of tents increased near Savona, while near Spences Bridge the population declined. Tables 16 and 17 show the data procured from these surveys.

Table 16

Roadside Web Counts of Spotless Fall Webworm near
Savona, Central Kamloops District, 1965

Host	No. of webs			Av. per mile
	Mile 0-1	1-2	2-3	
Chokecherry	20	-	4	8.0
Black Cottonwood	0	6	6	4.0
Apple	2	2	0	1.3
Lombardy poplar	0	6	0	2.0
Total 1965	22	14	10	15.0
Total 1964	11	6	3	6.6
1963	0	8	4	4.0
1962	0	2	2	1.3

Table 17

Roadside Web Counts of Spotless Fall Webworm Along
Nicola River, Central Kamloops District, 1965

Host	No. of webs Mile 0-1	1-2	2-3	3-4	4-5	5-6	6-7	Av. per mile
Black Cottonwood	3	1	4	2	4	0	1	2.1
Chokecherry	8	3	3	0	15	0	3	4.5
Rose	0	0	0	0	0	0	0	0
Willow	0	0	2	0	0	0	1	0.4
Saskatoon	0	0	2	22	3	3	4	4.8
Total 1965	11	4	11	24	22	3	9	11.8
Total 1964	30	12	26	30	37	16	12	21.8
1963	20	10	56	25	41	35	29	32.8
1962	19	0	11	7	39	20	10	15.2

Aspen Leaf Miner, Phyllocnistis populiella Cham.

Infestations of the aspen leaf miner were lighter in the District in 1965. As a result of increased parasitism fewer adults were produced per 100-leaf surfaces in four of the five plots examined. A three year comparison of the number of infested leaf surfaces and the number of adults produced per 100-leaf surfaces in samples taken from five plots is shown in Table 18. Table 19 shows the percentage mortality in 100 randomly selected cocoons at each location.

Table 18

Aspen Leaf surfaces Mined and Number of Adults produced
per 100 Leaf Surfaces, Central Kamloops District, 1965

Location	Percentage of leaf surfaces with mines			No. adults produced per 100 leaf surfaces		
	1963	1964	1965	1963	1964	1965
Paul Lake	52	47	26	2	1	0.7
Cache Creek	50	18	29	25	6	1.7
Campbell Range	50	41	28	15	19	2.1
Coldwater River	36	29	44	10	1	4.0
Deadman River	-	29	36	-	6	2.4

Table 19

Mortality of Aspen Leaf Miner in 100-cocoon Samples, Central Kamloops District, 1965

Location	Percentage mortality					
	Parasitism			Other causes		
	1963	1964	1965	1963	1964	1965
Paul Lake	42	42	46	13	18	14
Cache Creek	8	36	55	11	10	5
Cambpell Range	23	23	69	10	8	14
Coldwater River	24	48	42	14	16	20
Deadman River	-	30	60	-	5	12

A Cone Moth, Dioryctria auranticella Dyar

Ponderosa pine cones were numerous in 1965. Twenty cones were examined from five trees at Nocola, Mamette Lake road, Little Shuswap Lake, and near Savona. An average of 50% of the cones were infested by a cone moth. Table 20 shows the results of this survey.

Table 20

Percentage of Ponderosa Pine Cones Infested by a Cone Moth at Four Localities, Central Kamloops District, 1965

Location	Percentage of cones infested
Nicola	54
Mamette Lake Rd.	58
Little Shuswap L.	63
Savona	26

Table 20

Percentage of Ponderosa Pine Cones Infested by a Cone Moth at Four Localities, Central Kamloops District, 1965

Location	Percentage of cones infested
Nicola	54
Mamette Lake Rd.	58
Little Shuswap L.	63
Savona	26

Other Noteworthy Insects

Insect	Host	No. of collections	Remarks
Dichelonyx sp.	F	24	Green rose chafer. Numerous; light defoliation at Heffley Cr., Knouff Lake Rd.
Dioryctria cambiicola Dyar	Py	2	Flagging of terminals, Savona, Kamloops, Little Shuswap L. and Nicola
Ectropis crepuscularia Schiff.	H	5	Saddle-back looper; small number of larvae collected.
Feralia deceptiva McD.	H	32	A forest cutworm. Common; up to nine larvae per collection.
Stilpnotia salicis (L.)	A	7	Satin moth. Light feeding near Campbell Lake.
Zeiraphera fortunana Kft.	Se	7	A spruce tip moth. Increase from 1964.

FOREST DISEASE CONDITIONS

Important Diseases

Needle Cast of Ponderosa Pine

Severe browning of ponderosa pine foliage caused by Elytroderma deformans (Weir) Darker was more widespread in 1965. The largest area of extensive browning was along the south face of Promontory Mountain. In June a request was made by logging operators, through the British Columbia Forest Service, for an examination of the affected area. Logging companies applying for sales in this area were under the impression that the stand was dying and salvage of the timber was called for. Examination of the stand revealed heavy infection of the foliage by the needle cast fungus. Chain wide strips totalling 80 chains in length were cruised in October to determine if the disease-weakened trees were attacked by mountain pine beetle; none was recorded.

The two permanent sample plots established to record observations of damage to ponderosa pines by needle cast were inspected in July. The two additional trees recorded as dead in 1965 were infested by mountain pine beetle. This is the first recorded occurrence of beetle damage in disease weakened trees since the plots were established in 1959. Table 21 shows the data recorded for the past three years.

Table 21

Needle Cast Damage on Ponderosa Pine in Two Sample Plots, Central Kamloops District, 1965

Est. % foliage infected	No. of trees and infection class					
	Lower Nicola			Lac le Jeune		
	1963	1964	1965	1963	1964	1965
0	1	1	0	2	0	4
10	1	4	8	16	18	22
20	1	5	3	5	10	4
30	3	4	0	5	6	6
40	4	1	0	0	0	1
50	5	3	6	4	4	3
60	6	1	0	1	1	1
70	5	0	4	2	1	4
80	3	1	0	4	3	0
90	1	9	8	11	10	6
100	0	0	0	2	1	0
Dead	1	1	1	17	17	19
Total	30	30	30	71	71	71

Physiological Damage

Occurrence of disease symptoms, apparently of physiological origin, was more prevalent in 1965. The largest area, involving heavy browning of western red cedar foliage, extended from Johnson and Barriere Lakes to the north end of Adams Lake. Near Chase, heavy browning of ponderosa pines was observed. Samples sent to Victoria were diagnosed as physiological damage but could not be related to specific cause. The latter area covers approximately 20 acres along a west slope near the edge of range land.

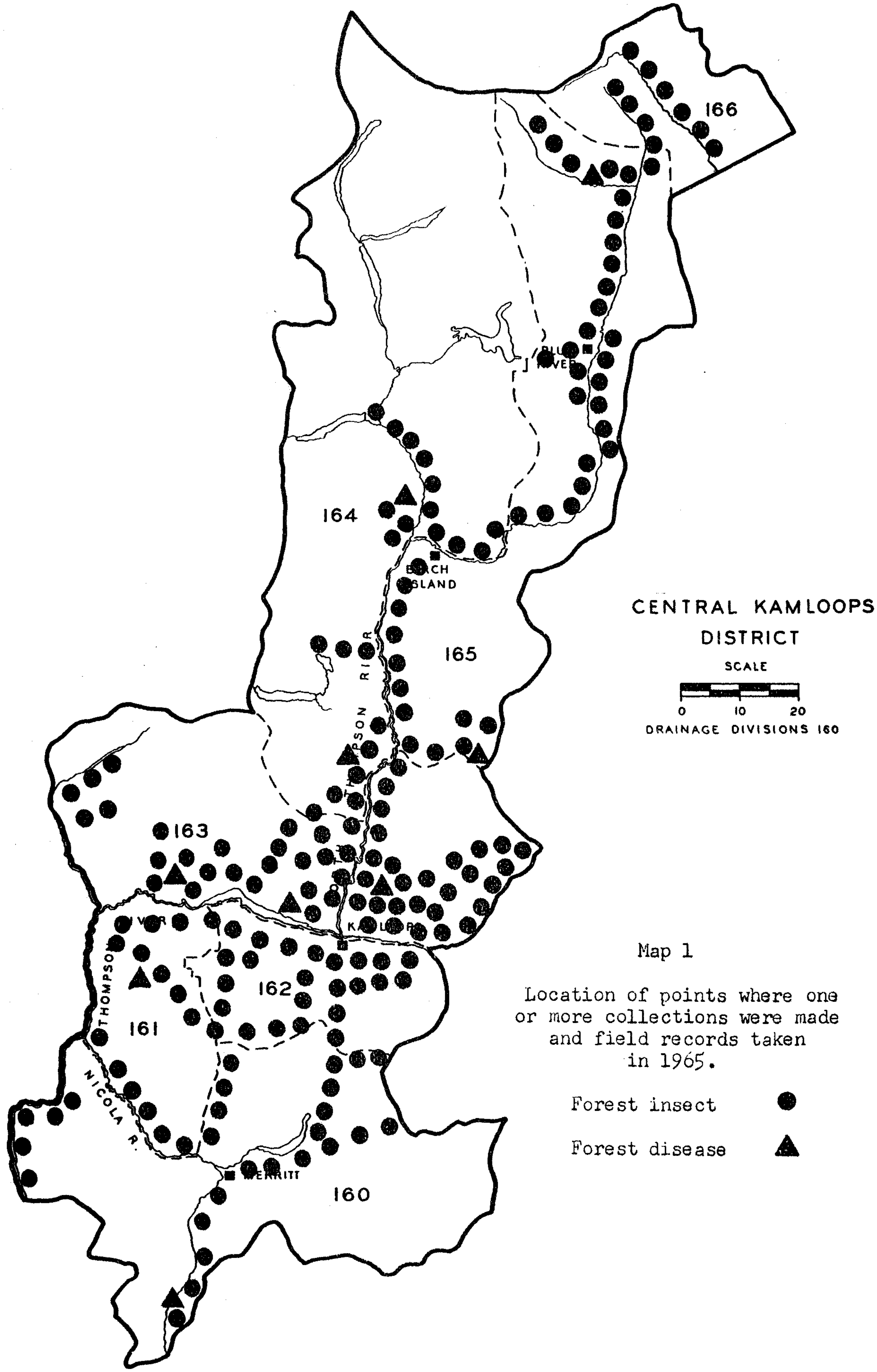
Discoloration of Douglas-fir foliage was observed at two locations, near Savona and near Pinantan.

A Lodgepole Pine Needle Blight

An estimated 200 acres of lodgepole pine heavily infected by *Hendersonia pinicola* Wehm. were observed near Tunkwa Lake. Near Little Shuswap Lake an additional 20 acres were infected.

Other Noteworthy Diseases

Host	Organism	Locality	Remarks
Alder	*Apiosporina collinsii* (Schw.) Hoehn.	Westsyde	Causing witches' broom on serviceberry.
Aspen	*Melampsora medusae* Thuem.	Knouff L. Rd.	Rust on aspen. Decrease in 1965.
Fir, alpine	*Pucciniastrum epilobii* Otth.	Jamieson Creek	Rust on balsam. Common but decreased in 1965.
	Peridermium holwayi Syd.	Jamieson Creek	Rust on balsam. Common.

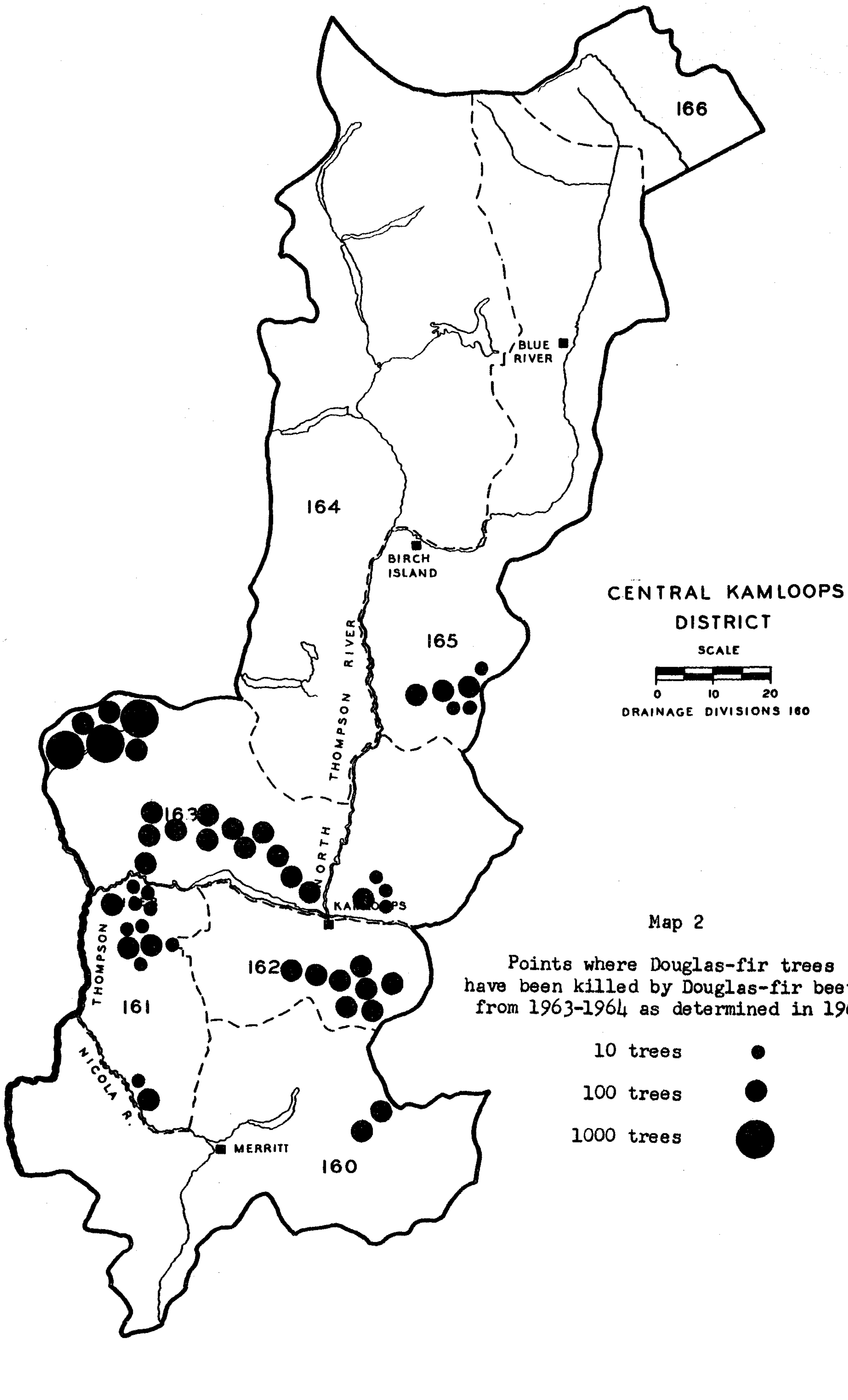


Map 1

Location of points where one
or more collections were made
and field records taken
in 1965.

Forest insect ●

Forest disease ▲



Map 2

Points where Douglas-fir trees have been killed by Douglas-fir beetle from 1963-1964 as determined in 1965.

FOREST INSECT AND DISEASE SURVEY

WEST KAMLOOPS DISTRICT

1965

FOREST INSECT AND DISEASE SURVEY

WEST KAMLOOPS DISTRICT

1965

T. A. D. Woods

INTRODUCTION

The 1965 field survey of the West Kamloops District revealed little change in the status of defoliators and an increase in the damage caused by bark beetles. More flying time than in 1965 was available with the result that additional information was obtained on the extent of bark beetle infestations.

Field work in the District began on April 26 and was completed by October 8. A total of three and one-half weeks was spent assisting in the spruce beetle survey in the Prince George Forest District in early May and September. A number of plots and permanent sampling stations were established or replaced in 1965. The writer was assisted in this work by other Vernon forest research technicians and personnel of the British Columbia Forest Service.

Table 1 shows the distribution by hosts of the 494 insect and 55 disease samples taken in the District between May 17 and September 1, 1965. Map 1 shows the location where one or more collections and field records were obtained.

Table 1

Collections by Hosts

West Kamloops District, 1965

Coniferous hosts	Forest insects	Forest diseases	Broad-leaved hosts	Forest insects	Forest diseases
Douglas-fir	145	11	Alder spp.	2	-
Fir, alpine	14	5	Aspen, trembling	56	-
Hemlock, western	4	-	Birch spp.	4	-
Juniper, common	10	3	Cherry, choke	4	-
Juniper, Rocky Mtn.	26	-	Cottonwood, black	6	1
Pine, lodgepole	85	19	Dogwood, red osier	1	-
Pine, ponderosa	33	1	Maple, Douglas	-	1
Pine, western white	-	1	Willow spp.	3	1
Pine, whitebark	1	3	Miscellaneous	8	2
Spruce, Engelmann	92	7			
Total	410	50		84	5
			GRAND TOTAL	494	55

FOREST INSECT CONDITIONS

Important Insects

Douglas-fir Beetle, Dendroctonus pseudotsugae Hopk.

The Douglas-fir beetle caused the most damage in the West Kamloops District. A summary of the data obtained from field studies including distribution, amount of timber destroyed, foliage colour change and mortality of beetle broods is given in the following text.

Tree damage appraisal survey

Nineteen hours flying were used to map beetle-killed Douglas-fir trees. Map 2 shows the general location of red-topped trees. Table 2 shows the total number of trees killed for the period 1956 to 1965 inclusive.

Table 2

Number and Volume of Douglas-fir Trees Killed by Douglas-fir Beetles by Three-year Periods, as Determined in 1956 to 1965 Inclusive, West Kamloops District

Period	Year of survey	No. of trees killed	Total volume (cu. ft.)
1953 - 1955	1956	8,800	602,800
1954 - 1956	1957	5,990	410,300
1955 - 1957	1958	11,980	820,600
1956 - 1958	1959	15,590	1,067,900
1957 - 1959	1960	28,970	1,968,200
1958 - 1960	1961	14,062	952,073
1959 - 1961	1962	19,132	1,445,426
1960 - 1962	1963	37,016	2,878,866
1961 - 1963	1964	29,590	2,227,894
1962 - 1964	1965	26,301	1,959,787

Fewer red-tops were counted in 1965 than in the two previous years; this was attributed to a smaller attack in 1964, and to the fact that some trees dropped their needles early and were not counted. As usual, the 1965 count was based on the assumption that beetle-killed trees retain some of their foliage for three years.

Strip plots

Four of the six plots used to determine the yearly stand depletion in the Lac la Hache area were logged during the winter of 1964-65. These plots, stations two, five, thirteen and the reserve, were established in 1959. The two remaining plots (north and south pipeline) were cruised in 1965 and only one currently infested Douglas-fir was found.

One new 28-acre strip was established east of Williams Lake. This plot contained 2,895 Douglas-fir totalling 141,310 cubic feet, with diameters ranging between eight and 48 inches.

The yearly stand depletion on the three plots totalling 144 acres is shown below.

	1963	1964	1965
No. trees attacked per acre	0.11	.40	.01
No. trees killed per acre	0.10	.20	

The difference between the number of trees attacked and the number ultimately killed is not known until the trees are examined the following year.

Foliage colour change

The most important function of the foliage colour change study is to obtain information on the condition of beetle-killed Douglas-fir just prior to the appraisal flights. This gives the observer an indication of the number and condition of trees killed in previous years which will be seen during the flights. Table 3 shows a comparison of needle loss in areas where plots have been established for four consecutive years.

Table 3

Douglas-fir Needle Loss Calculated in June, West Kamloops District

Year of attack	Location	No. of trees	Percentage of needle loss			
			1962	1963	1964	1965
1961	Clinton	9	48	95	100	-
	Lac la Hache	5	3	93	100	-
	Soda Creek	5	60	85	100	-
1962	Clinton	8	-	48	95	100
	Lac la Hache	8	-	47	82	100
	Soda Creek	4	-	15	78	100

Table 3 continued

Year of attack	Location	No. of trees	Percentage of needle loss 1962	1963	1964	1965
1963	Clinton	5	-	-	42	90
	Lac la Hache	10	-	-	25	74
	Soda Creek	9	-	-	40	90
1964	Clinton	12	-	-	-	22
	Lac la Hache	20	-	-	-	22
	Soda Creek	20	-	-	-	20

Table 4 shows the condition of 1964-attacked trees on four plots established in the spring of 1965 and examined four times during the field season.

Table 4

Foliage Colour Change of Douglas-fir Trees Attacked in 1964, West Kamloops District, 1965

Location	Examination date	No. of trees Green	Fading	Red	% needle loss
Clinton	May	1	4	7	13
	June	0	2	10	22
	August	0	0	12	51
	October	0	0	12	58
Fly Creek	May	2	3	5	18
	June	1	3	6	47
	August	1	0	9	84
	October	1	0	9	92
134 Mile	May	4	16	0	13
	June	4	3	13	22
	August	0	0	20	79
	October	0	0	20	84
Chimney Creek	May	8	11	1	5
	June	0	8	12	20
	August	0	0	20	36
	October	0	0	20	47

Table 5 shows the needle loss and colour change in the Lac la Hache area on the strips examined in August.

Table 5

Foliage Colour Change of Douglas-fir Trees Attacked
in 1964 on Two Strip Plots, Lac la Hache

Location	Examination date (Aug.)	No. of trees Green	Fading	Red	% needle loss
South pipeline	1964	10	0	0	0
	1965	0	0	10	60
North pipeline	1964	30	0	0	0
	1965	0	2	28	75

Winter mortality of beetle broods

There was higher brood mortality in the winter of 1964-65 than in any year since 1959. Sample trees were examined in late April at Williams Lake, Lac la Hache, and 100 Mile. Four Douglas-fir were felled and 6 x 24 inch bark samples were taken at each cardinal direction at 10-foot intervals up the boles until no further attacks were found. A total of 4,289 teneral adults were recorded and there was an average of 12.4 attacks per square foot of bark surface. Number of attacks per square foot in 1962 was 9.6 and in 1963, 10.9. The average mortality in 1965 was 35% (Table 6))

Table 6

Percentage Mortality of Overwintering Douglas-fir Beetle Broods,
West Kamloops District

Location	1960	1961	1962	1963	1964	1965
100 Mile	40.3	34.7	20.7	34.2	8.2	26.8
Lac la Hache	27.2	11.8	13.0	52.0	10.5	39.6
Williams Lake	31.6	9.2	11.0	27.7	11.4	76.7
Average	33.5	13.2	15.3	34.2	10.0	35.0

Mountain Pine Beetle, *Dendroctonus ponderosae* Hopk.

Ponderosa pine:

Damage appraisal flights in the past three years showed that the number of ponderosa pine killed by the mountain pine beetle has steadily increased (Table 7).

Table 7

Number and Volume of Ponderosa Pine Killed by Mountain Pine Beetle by Two-year Periods, as Determined in 1962 to 1965 Inclusive, West Kamloops District

Period	Year of survey	No. of trees killed	Total volume (cu. ft.)
1960 - 1961	1962	172	7,260
1961 - 1962	1963	412	20,420
1962 - 1963	1964	2,115	88,450
1963 - 1964	1965	3,075	123,980

Foliage colour change

Previously only one plot per year was established to study foliage colour change and needle loss of ponderosa pine in the West Kamloops District. Because of the higher populations of the beetle, two colour change plots were established in 1965 to study 1964-attacked trees (Table 8). The foliage of most of the trees around Clinton did not start to change colour until mid-June, whereas in other areas the change started in mid-May.

Table 8

Foliage Colour Change of 1964-attacked Ponderosa Pine, West Kamloops District, 1965

Location	Examination date	No. of trees			%
		Green	Fading	Red	needle loss
Clinton	May	35	0	0	0
	June	0	26	9	0
	August	0	0	35	5
	October	0	0	35	8
Fly Creek	May	2	7	1	1
	June	0	6	4	2
	August	0	0	10	19
	October	0	0	10	48

Table 9 compares the needle loss in three areas for three years and shows that the 1962-attacked trees lost all of their needles by the fall of the third year after they were attacked. Earlier examinations showed that 1962-attacked trees had an average needle loss of 98%, so these trees would not have been noted during the aerial survey conducted in July (Map 3).

Table 9

Ponderosa Pine Needle Loss Calculated in
Autumn, West Kamloops District

Year of attack	Locality	No. of trees	Percentage of needle loss		
			1963	1964	1965
1962	Fly Creek	15	48	80	100
1963	Clinton	10	-	18	61
1964	Fly Creek	10	-	-	48
1964	Clinton	35	-	-	8

Seven acres of the 100-acre infestation near the junction of Upper and Lower Hat creeks were cruised in July; the infestation contained 700 red-topped pine totalling 18,200 cubic feet. In 1964 only 200 red-topped pine were counted in this area.

Lodgepole pine:

The number of lodgepole pine killed by the mountain pine beetle has gradually increased since 1962. Table 10 gives the number of trees recorded from both ground and aerial surveys in the West Kamloops District from 1962 to 1965. Map 3 gives the aerial count in 1965. The largest concentrations of dead pine were still around Bull Mountain, Croan Lake and near Cuisson Lake, all northeast of Williams Lake.

Table 10

Number and Volume of Lodgepole Pine Killed by Mountain Pine
Beetle by Two-year Periods as Determined in 1962 to 1965
Inclusive, West Kamloops District

Period	Year of survey	No. of trees killed	Total volume (cu. ft.)
1960 - 1961	1962	62	1,356
1961 - 1962	1963	476	11,219
1962 - 1963	1964	15,525	373,917
1963 - 1964	1965	10,047	250,035

Foliage colour change

Table 11 shows the rate of foliage loss of trees attacked in 1962, 1963, and 1964. When the plots were examined in June 1965 all trees killed in 1962 had lost over 90% of their needles. This meant they would not be recorded in the aerial counts.

Table 11

Lodgepole Pine Needle Loss Calculated in Autumn, West Kamloops District

Year of attack	Locality	No. of trees	Percentage of needle loss		
			1963	1964	1965
1962	Fountain Valley 1.	3	15	70	100
	" " 2.	7	31	84	97
1963	Fountain Valley	15	-	17	43
	Meldrum Creek	10	-	7	27
1964	Bull Mountain	14	-	-	12

A colour change study of 1964-attacked trees was conducted in 1965 on one plot at Bull Mountain (Table 12).

Table 12

Foliage Colour Change of 1964-attacked Lodgepole Pine West Kamloops District, 1965

Location	Examination date	No. of trees			% needle loss
		Green	Fading	Red	
Bull Mountain	May	6	8	0	1
	June	1	6	7	1
	August	1	0	13	5
	October	0	1	13	12

Forty acres of the Bull Mountain infestation were cruised and 416 red-topped pine totalling 12,588 cubic feet were counted. Of the 416 trees, 39% were healthy, 19% were attacked in 1965, and 43% were killed prior to 1964. The progression of the infestation is illustrated by Table 13.

Table 13

Number and Percentage of Trees by Diameters Indicating Progression of Infestation, Bull Mountain, August 1965

Tree condition	% by diameters		
	6-10 inches	8-12 inches	10-14 inches
Healthy	51	35	24
1965-attacked (green)	21	22	19
1963-1964-attacked (red)	11	19	24
1962-attacked (grey)	17	24	33

Spruce Beetle, Dendroctonus obesus (Mann.)

The spruce beetle population in the northeast portion of the West Kamloops District rose sharply in 1965 in infested logs and standing Engelmann spruce in the Horsefly District. Attack density ranged from one to .25 attacks per square foot of bark surface in the area between Mile 12 (Crooked Lake turn-off) and Mile 20 (end of the road) Horsefly River Forest Development Road and also between Rollie Creek and the Cariboo River.

A total of 24 trees windthrown in the winter of 1964-65 and six, 1963-64 windfalls were examined; of these 15 and four respectively had been infested by beetles. All 1965-attacked spruce examined on August 24 contained large larvae or pupae.

Three 1964-standing-attacked trees contained large larvae or pupae on June 15, although one tree was only partially or strip-attacked.

Western Balsam Bark Beetle, Dryocoetes confusus Swaine

A general increase in the distribution of the western balsam bark beetle was noted in the Horsefly and 100 Mile North Districts. The largest concentration of dead alpine fir was along the south shore of Buster Lake. Groups of five to 10 trees were noted in the Crooked and Bosk Lake areas. About 30 red-topped alpine fir were counted along the Crooked Lake Road from miles one to five.

Spruce Budworm, Choristoneura fumiferana (Clem.)

One-year-cycle:

No larvae were found and there was no evidence of larval feeding in the eight permanent sampling stations in the Lillooet District in 1965. No damage has been found since the infestation collapsed in 1959.

The following table shows a comparison of results derived from standard beating samples taken from Douglas-fir during the larval period in the District, 1963-1965.

Number of samples taken during larval period			% samples containing larvae			Average number of larvae per sample		
1963	1964	1965	1963	1964	1965	1963	1964	1965
30	50	58	7	10	9	1.0	1.1	1.0

Larvae were also collected from lodgepole pine east and west of 100 Mile.

Two-year-cycle:

Collections from Engelmann spruce in the 100 Mile area averaged one larvae per sample.

Douglas-fir Tussock Moth, *Orgyia pseudotsugata* (McD.)

Fewer tussock moth larvae were collected in 1965 than in 1964. Three larvae were taken in each of two Douglas-fir samples and one from ponderosa pine near Carquile, where the same hosts yielded 17 and one larvae, respectively, in 1964.

Three 18-inch branch samples, collected on May 25 near Carquile from the mid-crown of three Douglas-fir averaging 4.5 inches dbh, did not yield any larvae or cocoons. In the fall only one old female cocoon was collected. In 1964, six male cocoons were found on the lower branches of 10 similarly-sized trees in the same area.

A Native Pine Shoot Moth, *Rhyacionia* sp.

No larvae of this shoot moth were collected from the Lillooet plot in 1965. In 1964 one per cent of the tips examined were infested. Fourteen per cent of the tips examined in 1963 were infested and 83% of the larvae collected from those tips were parasitized.

Black-headed Budworm, *Acleris variana* (Fern.)

No black-headed budworm larvae were collected from western hemlock in 1965. Fewer larvae were taken in Douglas-fir and Engelmann spruce samples. The average number of larvae per collection in 1965 was 1.5. In 1964 and 1963 it was 4.5 and 2.1, respectively, from the same hosts. Prior to 1963 only eight collections in three years contained larvae.

False Hemlock Looper, *Nepytia freemani* Munroe

A single larva taken in a standard beating sample from Douglas-fir west of Dog Creek is a northern record for the West Kamloops District. The following table compares the incidence of larvae of this looper in beating samples from Douglas-fir during the larval period, 1963-1965.

Number of samples taken during larval period			% samples containing larvae			Average number of larvae per sample		
1963	1964	1965	1963	1964	1965	1963	1964	1965
41	45	58	26.7	28.8	27.5	2.3	6.7	2.7

Western Hemlock Looper, *Lambdina fiscellaria lugubrosa* (Hulst)

The average number of larvae per Douglas-fir beating sample for the past three seasons has been: 1.4 in 1965, 1.6 in 1964 and 1.5 in 1963. The majority of the larvae were taken from Douglas-fir with a few collected from Engelmann spruce and lodgepole pine.

Aspen Leaf Miner, Phyllocnistis populiella Cham.

The aspen leaf miner population remained low throughout the West Kamloops District. Moths were ovipositing in mid-May at Pablo Creek west of Williams Lake and some eggs had hatched on May 20. The majority of the larvae died before reaching the pupal stage, an occurrence that has been noted before. Tables 14 and 15 give the results of an examination of aspen branch samples taken at four permanent sampling stations in the District. Mortality caused by parasitism and other causes remained high.

Table 14

Aspen Leaf Surfaces Mined and Number of Adults Produced per 100 Leaf Surfaces, West Kamloops District

Location	Percentage leaf surfaces with mines							No. adults produced per 100 leaf surfaces						
	'59	'60	'61	'62	'63	'64	'65	'59	'60	'61	'62	'63	'64	'65
Oregon														
Jack Cr.	21	21	37	21	-	21	26	1	6	5	3	-	1	1
Clinton	24	17	13	4	6	8	2	2	1	1	0	2	3	1
Williams L.	16	16	89	46	10	2	2	3	2	16	4	0	0	2
Soda Cr.	28	64	83	36	18	22	1	3	21	5	4	0	0	0

Table 15

Mortality of Aspen Leaf Miners in 100-cocoon Samples, West Kamloops District

Location	Percentage mortality in cocoon stage													
	Parasitism							Other causes						
	'59	'60	'61	'62	'63	'64	'65	'59	'60	'61	'62	'63	'64	'65
Oregon														
Jack Cr.	19	22	40	20	-	50	44	65	47	13	20	-	14	21
Clinton	14	16	47	55	23	29	*	64	38	19	17	4	9	*
Williams L.	0	19	29	47	*	*	*	69	51	9	22	*	*	*
Soda Cr.	4	39	54	53	*	14	*	68	34	14	20	*	2	*

* Insufficient cocoons

Jack Pine Needle Miner, Zelleria haimbachi Busck

The only needle miner larva taken in standard beating samples was on lodgepole pine at Dempsey Lake, 100 Mile District.

The large ponderosa pine trees on permanent sample plots near Lytton and Lillooet had fewer than half the number of larvae on their lower branches than small trees from 10 to 15 feet height. Twenty-five tips on each of four pines per plot were examined for mined needles; the percentage infested is shown in Table 16.

Table 16

Percentage of Ponderosa Pine Tips Infested by the Jack Pine Needle Miner, West Kamloops District

Locality	% tips infested				
	1961	1962	1963	1964	1965
Lillooet	-	2	28	16	6
Lytton	5	0	8	9	3
Spences Bridge	-	-	1	0	0
Venables Valley	1	0	2	0	0
Lower Hat Creek	1	0	2	0	0
Average	2.3	0.5	7.8	5.0	1.8

Satin Moth, Stilpnotia salicis (L.)

No defoliation was observed nor satin moth larvae collected from white poplar and black cottonwood trees at Maiden Creek. High larval parasitism during 1963 and 1964 may have caused the collapse of this small northernmost population.

Spotless Fall Webworm, Hyphantria cunea (Drury)

No webs were observed in road-side counts at Texas Creek and south of the Fraser River Bridge at Lillooet where counts in 1964 were 0.6 and 0.4 webs per mile, respectively. The webworm population in other areas was substantial and damage was greater than in 1964. At Seton Lake Public Beach in 1963, 97 webs were observed on 15 chokecherry bushes; in 1964 only 10 bushes were infested and in 1965 25 tents were counted on 18 bushes. The webworm was found near Dog Creek and as far north as Oliver Station near Williams Lake.

Other localities and hosts where webworms were observed are given in Table 17.

Table 17

Location of Spotless Fall Webworm Populations in the West Kamloops District, 1965

Location	Hosts	No. webs	No. bushes
Lytton	chokecherry	1	1
Izman Creek	"	12	7
	cottonwood	2	2
	alder	2	2
Seton Lake Canal	"	1	1
	Red osier dogwood	1	1
Seton Lake	alder	1	1
Spences Bridge	chokecherry	5	3
	cottonwood	4	4
	saskatoon	2	1
Twaal Creek	chokecherry	2	2
Oregon Jack Creek	"	1	1
Pavilion	"	3	1
Fraser River	"	10	6
(near Dog Cr.)	cottonwood	3	3
Oliver Station	chokecherry	5	2

A Pine Seed Moth, Laspeyresia prob. miscitata Heinr.

Fifty ponderosa pine cone samples were examined at each of five plots in the Cariboo for four consecutive years (Table 18). The percentage of cones infested in 1965 ranged from 12% at Lower Hat Creek to 92% at Lillooet.

Table 18

Percentage of Ponderosa Pine Cones Infested by a Pine Seed Moth, West Kamloops District

Location	% cones infested			
	1962	1963	1964	1965
Venables Valley	66	66	48	58
Lytton	64	60	80	84
Lillooet	-	24	88	92
Lower Hat Creek	64	24	24	12
Clinton	0	0	26	30
Average	48	34	53	55

A Cone Pyralid, Dioryctria abietivorella (Grote)

There were insufficient Douglas-fir cones to determine damage caused by this cone pyralid in 1965. The average percentage of infested cones in 50-cone samples from five plots in 1962-64 inclusive has been 64, 47 and 37%.

A Ponderosa Pine Tip Borer, Dioryctria cambiicola (Dyar)

A greatly reduced population of the ponderosa pine tip borer was evident in 1965. The only area where damage was noticeable was along the main highway between Oregon Jack Creek and Venables Valley turn-off. In 1964, 25 ponderosa pine in Venables Valley had from one to five tips infested. In 1965 the average was less than one per tree.

Lodgepole Terminal Weevil, Pissodes terminalis Hopping

Infested leaders of reproduction and pole-sized lodgepole pine were noted at the following localities: Mile 5 Coldwater Road, Horse Lake, Young Lake, 70 Mile House, Big Bar Lake, Jesmond Creek, Mile 104 Cariboo Highway, Creek Bend and Gustafsen Lake.

Adults were taken in standard beating samples from lodgepole pine at Rail Lake, 130 Mile Lake, Horn Lake, Gavin Lake Creek, Ogden Lake and Tin Cup Lake.

Collections of infested terminals were sent to Dr. S. G. Smith, Sault Ste. Marie Laboratory from Mile 104 Cariboo Highway and Mile 6 Fletcher Lake Road (Big Creek).

The infestation, in an old burn on the Fletcher Lake Road, declined and incidence of damaged leaders was about half the 32% observed in 1964. The population at Tatla Lake and Dean River also declined to the point where less than one per cent of the leaders were damaged.

Engelmann Spruce Weevil, *Pissodes engelmanni* Hopk.

Engelmann spruce with damaged leaders were noted at only one new locality in 1965. At Mile 16 on the Hendrix Creek Forest Development Road the weevil had infested leaders and the top lateral branches of a few immature spruce. The small infestation beside the road to Horsefly Bay, noted in 1964, was still active but damage was less than in 1964 when 10% of the 100 trees were infested. In 1965 about five per cent of the immature spruce had current damage.

Black Pine-leaf Scale, *Nuculaspis californica* (Colem.) and Pine Needle Needle Scale, *Phenacaspis pinifoliae* (Fitch)

Both black pine-leaf scale and pine needle scale were collected from ponderosa pine in the Lillooet area in 1965. Both species had killed a small percentage of the needles on large pine on the east side of the Fraser River.

Poplar-and-Willow Borer, *Sternochetus lapathi* (L.)

Clumps of infested willows were noted mainly in the southern portion of the West Kamloops District. Most of the infested stems were one inch dbh or less with maximum of three inches. Infested willow were observed at Oregon Jack Creek, Botanie Creek, Izman Creek, Twaal Creek, Bonaparte River and miles five and ten on the Texas Creek Road.

A Sawfly, *Xyela* sp.

Table 19 gives the results of a five year survey of ponderosa pine staminate flowers for damage caused by *Xyela* sp. There was a very poor flower crop on sample trees in 1965 and the percentage of flowers infested by *Xyela* sp. was much reduced.from previous years (Table 9). Three flower clusters from each cardinal direction on three trees were examined on plots established in 1961. In 1963 and 1964, 49 and 38% respectively of the flowers inspected were mined.

Table 19

Percentage Ponderosa Pine Flowers Infested by *Xyela* sp., West Kamloops District

Location	% flowers infested				
	1961	1962	1963	1964	1965
Venables Valley	11	5	20	9	0
Lytton	25	38	67	42	1
Lillooet	-	41	69	68	8
Lower Hat Creek	-	0	28	35	0

Alder Flea Beetle, Altica ambiens Lec.

Skeletonization of alder leaves was less and fewer adults were observed in areas where there had been severe damage in 1964. The only exceptions were at Seton Lake Canal and Texas Creek where populations and damage remained the same. In 1964 at the Canal 50% of the leaves on two bushes were skeletonized and at Mile 7 on the Texas Creek road 10 bushes were damaged.

Poplar Borer, Saperda calcarata Say

Ten mature aspen trees on the north shore of Deka Lake, 100 Mile District, were heavily infested by this cerambycid. A few infested trees were noted at the north end of Venables Valley, Ashcroft District.

A Tenthredinid Leaf Skeletonizer

Severe skeletonization of the leaves of reproduction black cottonwood was noted at Spences Bridge and Seton Lake Canal. Although only a few trees at each locality were involved a standard beating sample taken from trees at Seton Lake Canal yielded 225 small larvae.

Other Noteworthy Insects

Insect	Hosts	No. of collections	Remarks
Archips cerasivoranus (Fitch)	Choke-cherry	1	Ugly nest caterpillar; Single tent at Mile 9 Texas Creek Road.
Contarinia spp.	F	10	Douglas-fir needle miner; persistent low population in District.
Gonioctena americana Schaeff.	A	1	Light defoliation of aspens at Black Creek caused by the American aspen beetle.
Griselda radicana Wlshm.	Ba, F, Jc, Se	17	A budworm. Decrease in numbers and hosts.
Ips pini (Say)	Pl	0	Pine engraver. Infestation at Soda Creek collapsed.
Melanolophia imitata Wlk.	F, Se	10	Green-striped forest looper. Decrease.
Myeloborus boycei (Sw.)	Pl	0	No specimens of the pine twig borer collected in 1965.

Other Noteworthy Insects - continued

Insect	Hosts	No. of collections	Remarks
Neodiprion sp.	F	28	Conifer sawfly. Decrease.
Neodiprion sp.	Pl	13	Conifer sawfly. Decrease.
Neodiprion sp.	Py	7	Conifer sawfly. Decrease.
Neodiprion sp.	Se	7	Conifer sawfly. Decrease.
Pikonema alaskensis Roh.	Se	17	Yellow-headed spruce sawfly; decrease.
Schizura concinna (J. E. Smith)	Choke-cherry, domestic apple	5	Red-humped caterpillar. Light defoliation at Lytton and Lillooet.
Scolytus unispinosus Lec.	F	0	Douglas-fir engraver. Infestation north of Williams Lake collapsed in 1965.
Zeugophora sp.	A. Cot,	4	Leaf mining chrysomelids. Light damage at scattered areas of the District.

FOREST DISEASE CONDITIONS

Important Diseases

Bud Necrosis

Douglas-fir:

Heavy incidence of bud necrosis caused by Camarosporium sp. was found on a few immature Douglas-fir at Timothy Lake: one tree had 50% of its buds infected. A group of five trees at 111 Mile Creek and two Douglas-fir at Jim Creek also had their buds heavily damaged. Lighter infections were found east of Lac la Hache, Bull Mountain and Ogden Lake Creek.

Engelmann Spruce:

Jesmond Creek was the only location where a sample of infected spruce buds was taken. A single tree had 50% of its buds damaged.

White Pine Blister Rust

Damage to mature trees caused by Cronartium ribicola J. C. Fisch. ex Rab. near Botanie Lake was more evident in 1965 than in 1964. The foliage of approximately 100 white pine had started to fade and drop from branches killed by the disease, resulting in a thin unhealthy appearance of the tops of the infected trees.

One of the two new areas where trees infected with blister rust were found was at Duffey Lake where a stand of western white pine was severely damaged. In the other area both mature and immature whitebark pine at Heckman Pass had lost parts of their tops and branches to the disease.

Foliage Rust on Lodgepole Pine

Foliage rust caused by Coleosporium asterum (Diet.) Syd. did less damage to lodgepole pine in 1965 than in 1964. At both Ruth Lake and Big Lake where heavy damage occurred in 1964, the infection was reduced from 85% to 35%.

Reproduction lodgepole pine at the following areas was heavily infected with the rust: Rail Lake, Hendrix Creek, Black Creek, Quesnel Lake Road, Horsefly Bay Road, Gavin Lake Creek and Alexis Lake Road.

Die-back of Douglas-fir

This condition found at Black Creek and Beaver Valley in 1964 was also observed at the following localities in 1965: Hendrix Creek, Quesnel Lake Road, Crooked Lake, Sword Creek, Alexis Lake Road and Ogden Lake Creek. The most severe infection occurred on the Black Creek Road and the Alexis Creek Road where five of 10 trees had the top one foot of the stem and associated lateral branches damaged.

The dead portion was associated with a sunken canker-like depression immediately below the dead or dying portion of the top or branches. The causal agent or combination of agents have only been tentatively identified.

Needle Cast on Lodgepole Pine

Light infections of Elytroderma deformans (Weir) Darker were observed on lodgepole pine foliage at 111 Mile Creek, Black Creek, Moffat Creek and Watch Lake.

Winter Damage

During the winter of 1964-65 foliage of lodgepole pine between Clinton and 100 Mile was severely damaged by winter drying. The damage was first observed in April; by the end of August the damaged needles had dropped and except for slightly thin crowns the trees appeared normal.

Exotic Plantations

The exotic plantation plot XP 183 containing scots pine was examined twice in 1965. No damage caused by either insects or diseases was observed. In May the only damage noted was some winter injury from which the trees had recovered by the end of August.

Disease Progress Plots

Needle Cast on Ponderosa Pine

The two plots in the West Kamloops District used to study the progress of the needle cast disease Elytroderma deformans (Weir) Darker on ponderosa pine were examined on July 21, 1965. These plots were established in 1960 and only six pine have been killed by the disease, all since 1965. Table 20 shows the results of a six year study of these plots located at Lower Hat Creek and Clinton.

Table 20

Needle Cast Damage on Ponderosa Pine in Two Sample Plots, West Kamloops District 1960 - 1965

Infection class (% foliage infected)	No. of trees											
	Lower Hat Creek (30 trees)						Clinton (42 trees)					
	'60	'61	'62	'63	'64	'65	'60	'61	'62	'63	'64	'65*
0	3	1	1	1	14	11	0	0	3	6	6	3
10	10	10	11	11	2	3	4	4	4	3	4	3
20	8	12	8	3	1	3	7	7	4	3	5	5
30	1	1	3	4	0	2	4	3	4	3	2	4
40	3	3	2	2	3	1	4	5	6	4	1	2
50	3	2	1	3	4	3	1	1	2	1	3	1
60	0	0	1	1	1	1	6	5	2	3	0	4
70	1	1	1	0	0	0	7	9	4	4	0	4
80	1	0	1	2	1	1	4	4	8	6	8	2
90	0	0	0	2	2	2	4	2	2	3	6	5
100	0	0	1	0	0	1	1	2	3	2	3	3
No. of dead trees	0	0	0	1	2	2	0	0	0	4	4	5

*one tree logged in 1965

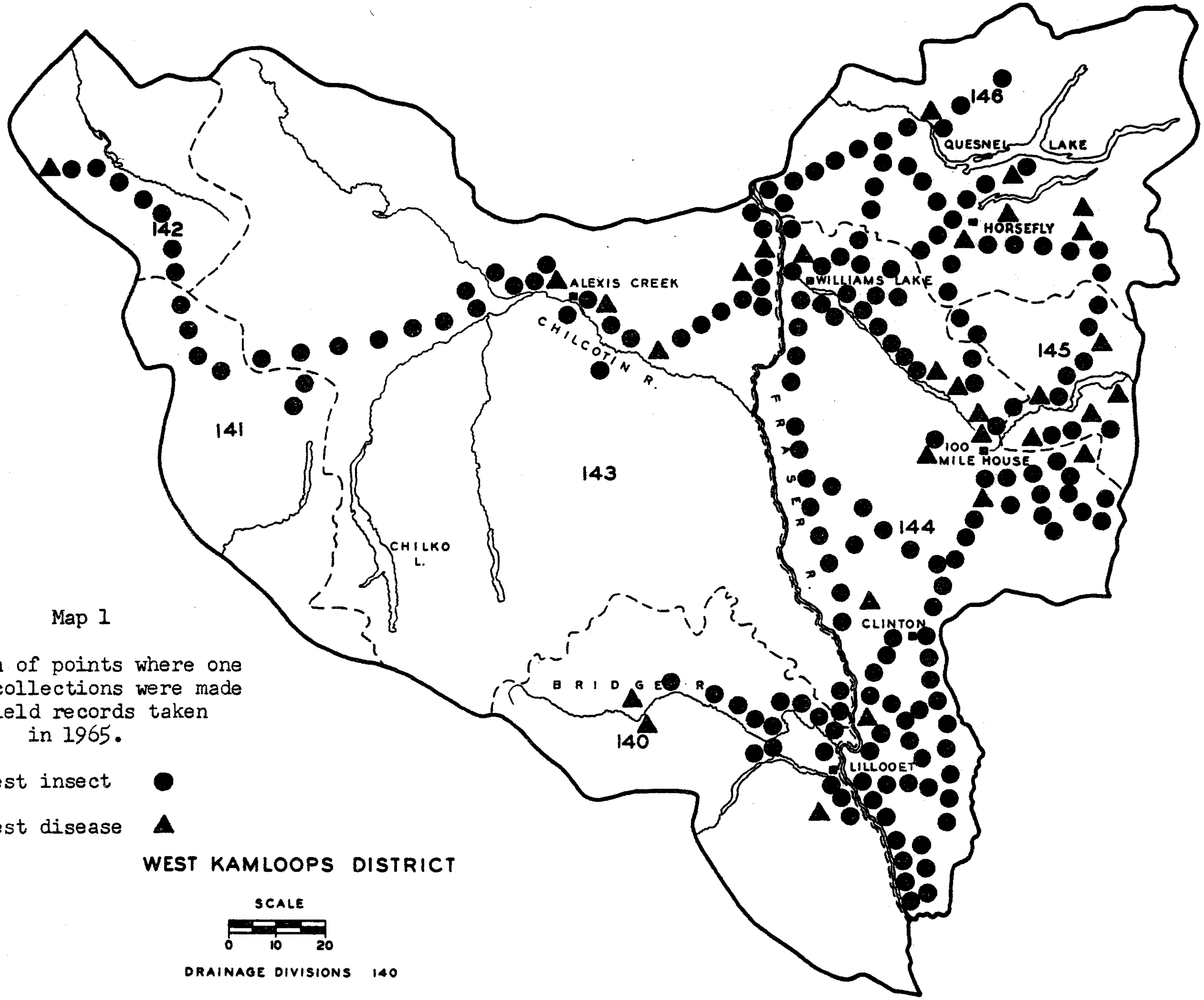
The infection at both plots remained moderate to high with the reduction in one tree being compensated by an increased infection of another.

Die-back on Douglas-fir

The study plot at Pavilion established in 1964 was examined on May 31, 1965. None of the Douglas-fir with top kill have died back any further and no infections possibly caused by Phomopsis sp. were observed.

Other Noteworthy Diseases

Host	Organism	Locality	Remarks
Fir, alpine	Armillaria mellea (Fr.) Kumm.	Canim Creek	A few small alpine fir killed.
	Melampsorella caryophyllacearum Schroet.	Quesnel Lake Road	One tree; heavy infection.
Pine, lodgepole	Atropellis piniphila (Weir) Lohm. Cash	Netherlands Road	Light infections; pole sized trees.
	Hendersonia pinicola Wehm.	100 Mile Moffat Cr. Zenzaco Cr. S. Fork Riske Cr.	Needle blight.
	Peridermium harknessii J. P. Moore	Ogden Lake	A few small trees infected.
	Scirrhia pini Funk & A. K. Parker	Rail Lake	Needle blight.
Maple, Douglas	Cucurbidothis pithyophila (Fr.) Petr.	Timothy Lake.	Canker disease; new record.
Pine, ponderosa	Armillaria mellea (Fr.) Kumm.	Mowson Pond	A few pole sized trees killed.
Pine, whitebark	Dasyscyphus pini (Brunch.) Hahn & Ayers	Heckman Pass	Canker disease.
Spruce, Engelmann	Chrysomyxa weirii Jacks	Lac la Hache Moffat Cr.	Needle rust.
	Fomes pini (Thore ex Fr.) Karst.	McKay Creek	Stem decay.



Map 1

Location of points where one or more collections were made and field records taken in 1965.

Forest insect ●

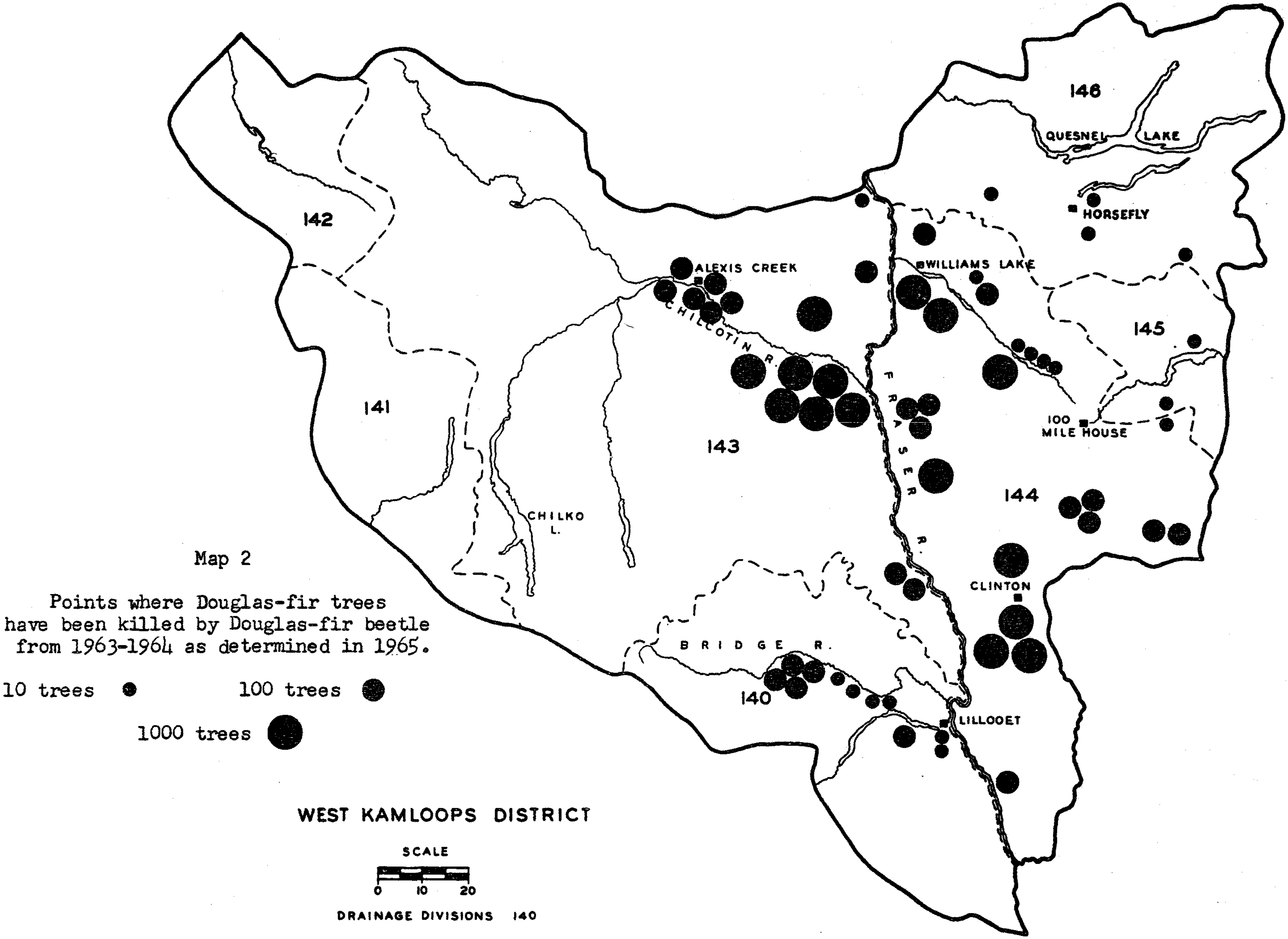
Forest disease ▲

WEST KAMLOOPS DISTRICT

SCALE

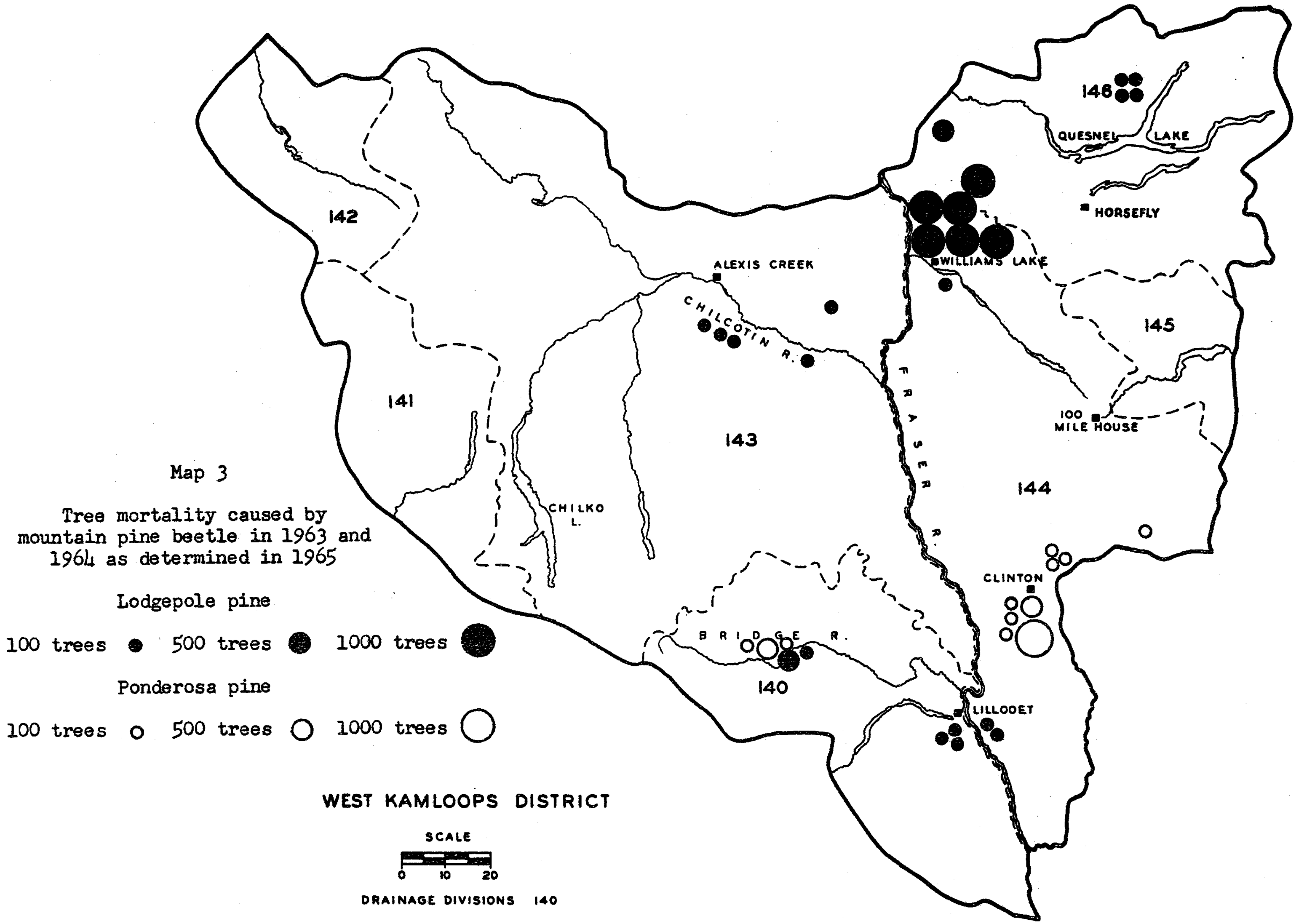
0 10 20

DRAINAGE DIVISIONS 140



Map 2

Points where Douglas-fir trees have been killed by Douglas-fir beetle from 1963-1964 as determined in 1965.



Map 3

Tree mortality caused by mountain pine beetle in 1963 and 1964 as determined in 1965

Lodgepole pine

100 trees 500 trees 1000 trees

Ponderosa pine

100 trees 500 trees 1000 trees

WEST KAMLOOPS DISTRICT

FOREST INSECT AND DISEASE SURVEY

BRITISH COLUMBIA

1965

NELSON FOREST DISTRICT

FOREST INSECT AND DISEASE SURVEY

NELSON FOREST DISTRICT

1965

D. W. Taylor

INTRODUCTION

There were no personnel changes in the Nelson Forest District in 1965. Research Technicians N. Geistlinger and D. W. Taylor were responsible for the survey in East and West Nelson districts, respectively, and E. V. Morris returned to the Central Nelson District.

During 1965 the mountain pine beetle remained the major pest in the Forest District, killing 13,000 pines in the East Nelson District and 4,800 and 200 in the Central and West Nelson districts, respectively. This was an increase in the East Nelson District but a decrease in Central and West Nelson districts over 1964.

Forest and western tent caterpillar populations collapsed in all three districts in 1965.

Populations of the Douglas-fir needle midge decreased in the East and West Nelson districts but increased in the Central Nelson District in 1965.

The larch sawfly, affecting a total of 358,800 acres of western larch, presented the major problem in the Forest District. However, no mortality was attributed directly to this insect in British Columbia in past infestations.

Another defoliator, the larch bud moth, was also active in the Forest District causing severe needle damage to high altitude larch on an estimated 165,000 acres. This was the first record of an infestation by this species in British Columbia.

Black-headed budworm populations erupted into major infestations in the Central and West Nelson districts. The total area defoliated amounted to 64,000 acres.

Spruce trees, windthrown in June 1964 at four locations in the East Nelson District, had moderate to high populations of spruce beetles in September 1965.

The number of white pine infected with blister rust increased during 1965 in the vicinity of Arrowhead, Trout Lake and the valley near Retallack.

The known distribution of red band disease, <u>Dothistroma pini</u> Hulbary was extended in the Central and West Nelson districts.

Larch needle cast occurred over an area from Anarchist Summit to Motherlode Creek (Greenwood).

FOREST INSECT AND DISEASE SURVEY

WEST NELSON DISTRICT

1965

FOREST INSECT AND DISEASE SURVEY

WEST NELSON DISTRICT

1965

D. W. Taylor

INTRODUCTION

The 1965 field survey began on May 17 and terminated with final studies on the larch sawfly in October. Within this period, 10 days were spent on spruce beetle survey work in the Prince George Forest District.

Totals of 299 insect and 29 disease collections were made. Thirty-three of 35 permanent sample points were visited. Collections from 10 common conifer hosts produced 76 species of insects in 1965 while in 1964 and 1963 there were 109 and 112 species, respectively.

Table 1 lists insect and tree disease collections by hosts and Map 1 gives the locations where one or more collections were made or field records taken during 1965.

Table 1

Collections by Hosts

West Nelson District, 1965

Coniferous hosts	Forest insects	Forest diseases	Broad-leaved hosts	Forest insects	Forest diseases
Cedar, western red	7	1	Alder spp.	6	1
Douglas-fir	61	5	Birch, western white	3	-
Fir, alpine	23	6	Aspen, trembling	5	-
Fir, grand	6	-	Cottonwood, black	2	1
Hemlock, western	21	1	Maple, Douglas	1	-
Juniper, common	-	1	Willow spp.	4	2
Juniper, Rocky Mtn.	1	-	Hazel	1	-
Larch, western	60	4	Miscellaneous	5	3
Pine, lodgepole	28	3			
Pine, ponderosa	25				
Pine, western white	5	-			
Spruce, Engelmann	35	1			
Totals	272	22		27	7
			GRAND TOTAL	299	29

FOREST INSECT CONDITIONS

Important Insects

Larch Sawfly, Pristiphora erichsonii (Htg.)

Larch sawfly became epidemic over large tracts of western larch in the West Nelson District in 1965. A brief history of occurrences (Ruppel, D. 1958. Ent. Soc. B. C. 55:32) is as follows: the first recorded infestation occurred in the Elko-Fernie area in 1930. This infestation then expanded up to 1935 as far west as Kitchener and from Fairmont Hot Springs to the Montana border. The insect then decreased in numbers but greatly increased in distribution, being found as far north and west as Slocan Lake, in 1937. Fluctuations of numbers and range occurred until 1942 when the sawfly population expanded to the western limit of its host in the Okanagan Valley. In 1943 almost all of the known western larch stands had been infested to a degree, but within the period 1944 to 1948 outbreaks declined until there were only scattered small infestations in the Lower Arrow Lake - Grand Forks valley systems. After 1948 larch sawfly larvae became rare in survey samples and remained so until 1965.

In the present infestation, defoliation was first noted on July 6 and continued until August 15, due to variations in elevation. Within that period larvae caused damage to larch trees from 2,500 feet in the valleys and up the mountain sides to an elevation of 5,500 feet, although infestations generally terminated at about 4,500 feet. The most severe defoliation occurred in nearly pure stands of larch.

Although the sawfly did not occur throughout the entire range of western larch, ground and air surveys showed that approximately 340,000 acres of this tree were attacked in the West Nelson District. The insect did not appear to prefer any particular slope, aspect, or valley system. Map 2 shows the approximate location of the various infestations.

District-wide sampling of larch trees in 1963 and 1964 yielded .13 and four larvae respectively, per positive sample. In 1965, samples from larch contained 50 larvae per positive collection.

By July 6 at Whatshan Lake, about 40% of the foliage on shoots produced prior to 1965 was defoliated. In stands containing at least 15% larch, 10 to 90% of the trees from sapling to mature size were damaged. Defoliation varied from 20 to 90% within any one area. Usually all the needles on a spur were consumed but, rarely, one or two needles remained. These were long compared with refoliation needles produced later in the season.

The number of curled branch tips resulting from sawfly oviposition were counted on five larch of varying size, each at one of five locations. Table 2 gives a description of the sampled trees, the number of curled tips found and the percentage of the total available current-year's tips damaged by oviposition. On the five trees, 36 tips were found to have been damaged in 1964 while 1,463 curled tips were found on 1965 growth.

Table 2

Larch Sawfly Curled Tips Formed in 1965
on Five Trees, West Nelson District

Locality	Dbh (ins.)	Height (ft.)	Crown class	No. of curled tips	Percentage 1965 tips affected
Paulson	6	60	C D	297	36.3
Salmo	6	45	D	127	16.3
Harrop	2	12	S	4	1.3
Nelson	8	66	I	879	65.3
Beaverdell	5	33	C D	156	9.3

Five current-year curled tips from each of seven points were examined for egg niches. The highest average number of egg niches per tip (53) was from a sample tree at Harrop, in a relatively lightly infested stand while the lowest was 29, from Beaverdell and Salmo, in moderate to heavily infested areas. The average number of egg niches for the 35 tips examined was 37.

Ten sample plots each consisting of 10 marked trees on which studies of defoliation, cocoon populations and parasitism are being carried out, were established in the Nelson Forest District.

A sequential sampling method developed at the Forest Entomology Laboratory in Winnipeg was used to determine the degree of infestation based on the numbers of curled tips. Heavy defoliation had occurred by the time the sequential sampling was done. Table 3 shows the level indicated by the sequential sampling method, related to defoliation as determined by ocular estimate.

Table 3

Degree of Infestation Using Sequential Sampling Technique
Compared with Ocular Estimates of
Defoliation, West Nelson District, October 1965

Locality	Level of infestation by sequential method	% defoliation (ocular estimates)
Whatshan	moderate	72
Fauquier	severe	78
Nelson	severe	78
Salmo	severe	50
Paulson	severe	62
Beaverdell	light	28

The two systems of rating the level of infestation compare favourably except on the plots at Whatshan and Salmo. These differences may have occurred because of the sporadic nature of the infestations resulting from groups of larch being separated by open areas or by other tree species.

Cocoon populations were studied using square-foot duff samples at six plots. At each plot, 10 square-foot samples were taken, one from beneath each of 10 marked trees. This material was sorted at the laboratory, and the cocoons separated into two categories: sound (unopened) and unsound (opened). Table 4 shows the number of sound and unsound cocoons in 10 square-foot samples from each of six localities.

Table 4

Number of Sound and Unsound Larch Sawfly Cocoons per 10 Square-foot Duff Samples at Each of Six Localities, West Nelson District, September - October, 1965

Locality	Number of cocoons	
	Sound	Unsound
Whatshan	903	353
Fauquier	486	73
Nelson	346	198
Salmo	312	360
Paulson	531	73
Beaverdell	179	21

Unsound cocoons were examined to determine the percentage of successful emergence, and mortality caused by various agencies. Some cocoons could not be classified because of deterioration. Table 5 shows results of this study. Figure I illustrates: 1. Normal emergence 2. Predation by mammals 3. Predation by elaterids 4. Parasitism by (upper) *Mesoleius tenthredinus* Morl. and (lower) *Tritneptis klugii* (Ratz.).

Table 5

Summary of Classification of Unsound Larch Sawfly Cocoons from 10 Square-foot Samples at Each of Six Localities, West Nelson District, September - October, 1965..

Locality	No. of unsound cocoons (10 sq. ft. samples)		% of classifiable unsound cocoons					
	Classifiable	Unclassifiable	Emerged	Mammal predation	*Mesoleius tenthredinus*	Elaterid predation	*Tritneptis Klugii*	Mould
Whatshan	302	51	23.6	62.2	2.0	7.3	4.6	0.3
Fauquier	73	0	38.3	17.8	4.1	21.9	17.8	0.0
Nelson	152	46	17.7	52.6	7.2	15.1	4.6	2.6
Salmo	299	61	19.7	66.5	1.6	7.0	4.3	0.6
Paulson	37	36	43.2	29.7	0.0	27.0	0.0	0.0
Beaverdell	19	2	68.4	15.7	0.0	10.5	5.2	0.0

To determine survival in the cocoon stage, 100 sound cocoons from each locality were opened, and the larvae dissected (Table 6).

Table 6

Results of Dissecting 100 Sound Cocoons from each of Six Sawfly Study Plots, West Nelson District

Locality	Healthy	Tritneptis	Mesoleius
Whatshan	94	0	6
Fauquier	80	9	11
Nelson	100	0	0
Salmo	77	9	14
Paulson	97	2	1
Beaverdell	94	0	6

Table 6 indicates that parasites (primarily Mesoleius tenthredinus Morl. in 1965) did not rate as major control factors after only one year of sawfly infestation.

In summary, larch sawfly populations, endemic for 17 years, reached the highest level in 1965 yet recorded in southern British Columbia. Analysis of data from six plots indicated that large populations may be expected in 1966. No tree mortality has been attributed to the larch sawfly in British Columbia to date but severe defoliation may reduce the growth of infested larch.

A Larch Bud Moth, Zeiraphera sp.

Defoliation attributed to this olethreutid was first observed on June 23 in the valleys of Buckworth and Boulais creeks south of the Creston Skyway. As the summer progressed defoliation was apparent over much of the District. Damage was rarely found below 4,000 feet elevation; it appeared to terminate at about 6,000 feet perhaps due to a lack of larch rather than altitude. The bud moth was associated only occasionally with the larch sawfly.

Prior to this year, infestations of this bud moth were rare in survey records in British Columbia. On numerous occasions, however, it had caused heavy defoliation in Montana and Idaho prior to 1955. In 1965, in the West Nelson District larch trees on approximately 155,000 acres were severely damaged. Larvae were not found during the larval period due to the inaccessibility of most of the infestations.

The foliage on 1965 twigs was untouched by the larvae but needle bundles on all older growth twigs were tied together in a neat cylindrical bundle, in which the larvae fed. The larvae fed from the tips of the needles downward and damaged one half to two thirds of the needles. Occasionally a few needles were undamaged except for some feeding along one edge which caused them to curl or twist. The early feeding caused large numbers of browned needle tips which gave the infested trees a reddish-tan colour when viewed from a distance. Later as the infested needle bundles opened and the damaged portions dropped the early-season reddish-tan changed to a somewhat translucent green. Defoliation occurred early in the season and the trees produced new foliage during the summer.

Branches and square-foot samples of bark were examined for eggs in the fall. Few eggs were found but indications are that eggs are laid on the underside of a grey-green leaf-like lichen common on the stem and branches of many conifers. Eggs were found occasionally under a bark scale or on an open branch surface.

A small population is expected in 1966. The infestations of this insect will probably be of short duration if they follow the pattern of those in the northwestern United States in recent years.

Black-headed Budworm, Acleris variana (Fern.)

The number of black-headed budworm taken in collections indicated there was a potentially dangerous population in the Stevens Creek Valley near the height of land between Stevens Creek and Garnet Creek (Central Nelson District). On July 15 defoliation was noted on western hemlock on about 50 acres in the Stevens Creek Valley. The stand was almost pure hemlock of all ages and 90% of the 1965 tips showed the typical browning and curling caused by this tortricid.

Collections of 100 or more larvae per three-tree sample were common in hemlock stands. A few hundred feet within a nearby hemlock-cedar stand the number of larvae per collection dropped to one or two. In August, an aerial survey showed that a total of 2,600 acres had been affected in the upper Whatshan Lake drainage.

Generally, the number of black-headed budworm collected throughout the District was small; however, they were higher than in 1964. The following will give a basis for future comparison:

Host	No. collections during larval period		% collections containing larvae		Av. no. larvae per positive sample	
	1964	1965	1964	1965	1964	1965
Hemlock	38	17	2	41	1	13

Areas in which hemlock was the dominant species are few and widely separated in the West Nelson District. Infestations of black-headed budworm occurred only in stands comprised mainly of western hemlock in Interior British Columbia in 1965.

Douglas-fir Beetle, Dendroctonus pseudotsugae Hopk.

Since 1961 there has been relatively little activity by this beetle in the West Nelson District, with the exception of Clement Creek.

The first attack occurred early in June, 1965 and throughout the remainder of the summer very little activity was seen.

Foliage Colour Change

Table 7 shows the colour change and needle loss of Douglas-fir trees attacked in 1963, near Carmi and Grand Forks. Although the last line of the table indicates four fading trees these trees actually had 50% green and 50% red needles.

Table 7

Foliage Color Change of Douglas-fir Trees Attacked in 1963 on Two Plots, West Nelson District

Location	Date of examination	No. of trees			% needle loss
		Green	Fading	Red	
Carmi	1963 (August)	5	0	0	0
	1965 (July)	0	0	5	20
Grand Forks	1963 (September)	40	0	0	0
	1965 (July)	0	0	11	100
		0	0	15	80
		0	0	10	60
		0	4	0	50

An aerial survey over the headwaters of Clement Creek west of Roderick Dhu lookout on August 9 revealed that an estimated 2,000 Douglas-fir trees had been killed by beetles from 1960 to 1964. The numbers of grey trees indicated that a majority of these were killed prior to 1963. Using a volume of 49.1 cubic feet per tree (used in these reports to summarize losses in 1961) the loss of timber was 98,260 cubic feet. In addition to this were 95 beetle-killed trees located in small patches throughout the range of Douglas-fir in the remainder of the District. This brought the total volume of beetle-killed Douglas-fir to approximately 103,000 cubic feet.

Mountain Pine Beetle, Dendroctonus ponderosae Hopk.

Only three small areas of damaged trees remained in 1965. There were about two acres of lodgepole pine infested by this beetle at Copperkettle Lake; south of this, near the junction of Copperkettle and Spindrift creeks an additional 100 red pines were noted. These are all that remain of an infestation which began in 1959 further north in the main Kettle River Valley.

In the Upper Whatshan Valley there were 100 infested white pine at Fife Creek and 50 at Red Fish Creek, near Balfour. The following summary shows the relationship between the colour patterns assumed by beetle-killed trees and the rate of needle loss of white and lodgepole pines attacked in 1963:

Location	Host	Date of examination	No. of trees			% needle
			Green	Fading	Red	loss
Worthington Creek	Pw	June 18	0	0	10	100
Kettle River	Pi	June 18	0	0	10	90

Red Turpentine Beetle, Dendroctonus valens Lec.

There were no signs of beetle activity in ponderosa pine in the infestation area on Mullins Hill near Beaverdell. East of Grand Forks a group of five ponderosa pines averaging 14 inches dbh were attacked. One tree was first attacked in 1963 and again in 1964. The remaining four were attacked in 1964. By June 3, 1965 the tree first attacked in 1963 was dead and one of the trees infested in 1964, with 17 attack holes on the lower bole, was also dead. The other three had 12, 13 and 8 holes respectively. The five trees appeared similar in all respects yet only three were able to "pitch out" the attacking beetles.

Spruce Beetle, Dendroctonus obesus (Mann.)

No spruce beetle activity was noted in standing timber in the West Nelson District in 1965. The only current area of concern, Upper Shields Creek, was isolated by road washout but no injury to spruces was observed from an aircraft on August 10. At Spion Kop Hill (Greenwood) and Murphy Creek, blowdown logs had a few galleries by the third week in June and later examinations revealed no additional beetle attacks.

Forest Tent Caterpillar, Malacosoma disstria Hbn.

A further decrease in forest tent caterpillar infestations occurred in 1965. Outbreaks recorded at Big Sheep, Pass and Stagleap creeks for the first time in 1964 subsided during the summer. Egg sampling in October showed that the infestations had totally collapsed.

Table 8 shows the trend of the infestations indicated by the total number of egg masses per three-tree sample during the years 1962 - 1965. The number of egg masses per three-tree sample varied slightly from locality to locality within a large infestation but the number of eggs contained in each mass was not indicative of the trend of the infestation.

An examination was made of the records of 18 plots established over the past five years in infestations at all stages of development. The only indication of fluctuations was seen in total numbers of current-year egg masses found per tree.

Table 8

Comparison of Results of Forest Tent Caterpillar Egg Mass Surveys, West Nelson District

Locality	Total no. egg masses from three-tree sample				Av. no. eggs per mass			
	1962	1963	1964	1965	1962	1963	1964	1965
Milkranch Creek	43	32	0	0	169	166	0	0
Warfield	144	39	1	0	194	184	225	0
Genelle	74	120	3	0	179	205	185	0
Harrop	-	57	2	0	-	155	129	0

Western Tent Caterpillar, Malacosoma pluviale (Dyar)

No infestations were found in 1965 and no larvae were collected at five points mentioned in the 1964 report. Webs were common only in the Grassie Creek - Erie Creek valleys.

Aspen Leaf Miner, Phyllocnistis populiella Cham.

Plot samples in 1964 indicated a moderate population in 1965. Table 9 shows there was a large increase in aspen leaf miner at the Grand Forks plot and a decrease at the other three; Table 10 shows an increase in cocoon mortality caused by parasitism at all plots, and an increase in mortality from miscellaneous causes at three.

Table 9

Percentage of Aspen Leaf Surfaces Mined and Adult Leaf Miners Produced per 100 Leaf Surfaces, West Nelson District

Locality	Percentage of leaf surfaces with mines				No. of adults produced per 100 leaf surfaces			
	1962	1963	1964	1965	1962	1963	1964	1965
Greenwood	19	66	19	17	9	35	6	3
Grand Forks	11	44	21	54	6	7	2	21
Phoenix	26	71	73	51	6	14	19	15
Crawford Cr.	9	25	31	13	6	10	18	3

Table 10

Mortality of Aspen Leaf Miners in Cocoons in 100-cocoon Samples, West Nelson District

Locality	Percentage mortality							
	Parasitism				Other causes			
	1962	1963	1964	1965	1962	1963	1964	1965
Greenwood	25	8	30	27	1	0	1	1
Grand Forks	12	15	38	29	1	5	0	7
Phoenix	32	7	21	19	1	0	0	4
Crawford Cr.	8	7	23	12	9	8	0	4

Spotless Fall Webworm, Hyphantria cunea (Drury)

There was a decline in the number of webs counted on three of the four check strips in the District. On the fourth, a 13-mile roadside strip near Grand Forks, there was an increase over the 1964 count but not over 1963 (Table 11). There was an increase in distribution of fall webworm in the West Nelson District in 1964 and the insect was found at the same points in 1965.

Table 11

Comparison of Spotless Fall Webworm Counts, Four Localities, West Nelson District

Locality	No. of miles	No. of webs	No. of webs per mile			
	1965	1965	1962	1963	1964	1965
Rock Creek - Westbridge	8	6	12	5	5	1
Grand Forks - Christina Lake	13	130	16	12	4	10
Christina - Cascade	4	54	27	20	29	14
Creston - Sanca	15	84	21	10	8	6

A notable feature along the strip from Creston to Sanca was that there was almost no webbing on some abandoned apple and cherry orchards previously infested but it was common on roadside alders, dogwood and chokecherry.

Pine Shoot Borer, Eucosma sonomana Kft.

1965

The survey of this shoot borer in 1965 concludes a four year study of its spread from an initial source, population fluctuations within the boundaries of the original infestation and the position in the crown most favoured by attacks.

On August 20, 1965 fifty ponderosa pines near Laurier were picked at random in the original 50 acre site chosen in 1961. There had been little if any increase in this area in five years. Of the 50 trees, 60% had tips damaged in 1965, almost double that of 1964 but less than 1963. The maximum number of tips affected on a single tree was eight, slightly lower than in 1964 and considerably below the 1963 and 1962 level of 17 and 13 respectively. There were approximately 10 times as many bored shoots in the upper third of the crown as in the mid-third and there was no damage to 1965 growth in the lower third of the crown.

Signs of this borer were much more difficult to find in 1965 but some slight damage was seen near Syringa Creek, West Grand Forks and Westbridge. It has never developed into a serious pest of ponderosa pine in the West Nelson District.

Ugly nest Caterpillar, *Archips cerasivoranus* (Fitch)

Unsightly damage by this tortricid continued in the Columbia River Valley below Trail and in the South Grand Forks area. Although infestations on chokecherry have never exceeded one-half acre, they have appeared persistently in these spots for five years. Occasional bushes were infested between Kuskanook and Creston.

Douglas-fir Needle Midges, *Contarinia* spp.

Damage by Douglas-fir needle midges occurred from Crawford Bay to La France Creek and from Destiny Bay to Twin Falls Creek. The total area of these two infestations is about 8,900 acres, and is less than half the size of infestations the previous two years. Some trees, varying in size from reproduction to overmature, had 83% of their 1965 needles infested. At Syringa Creek, on a study plot, 25 tips had 57% of 3,800 needles infested. The degree of infestation was sufficient to give a definite yellowish tinge to the hillsides. The area was about 1,000 acres in extent.

Western Hemlock Looper, *Lambdina fiscellaria lugubrosa* (Hulst)

There were fewer collections containing hemlock looper in 1965 than in 1964 on the preferred hosts. A summary of collections shows a decline in the percentage containing larvae and in the number of larvae per positive collection (Table 12).

Table 12

Summary of Western Hemlock Looper Collections,
West Nelson District

Host	No. collections during larval period			% collections containing larvae			Av. no. larvae per positive collection		
	1963	1964	1965	1963	1964	1965	1963	1964	1965
Alpine fir	19	15	22	5	0	0	1.0	-	-
Western red cedar	14	16	7	0	12	0	-	-	-
Douglas-fir	59	63	43	13	23	9	3.4	1.2	1.3
Grand fir	3	7	5	0	14	0	-	7.0	-
Western hemlock	28	33	18	11	27	5	1.0	1.4	2.0

Table 12 continued

Host	No. collections during larval period			% collections containing larvae			Av. no. larvae per positive collection		
	1963	1964	1965	1963	1964	1965	1963	1964	1965
Western larch	24	30	46	25	33	9	3.1	1.5	1.0
Lodgepole pine	21	32	25	5	6	0	1.0	1.0	-
Engelmann spruce	23	43	32	13	18	0	1.0	3.3	-

Western Balsam Bark Beetle, Dryocoetes confusus Swaine

Aerial surveys in 1965 indicated that the old infestations in sub-alpine forests around Big White Mountain and at the headwaters of Bruer and Coalgoat creeks were still active but had declined since 1955. Ground examination revealed a similar situation in the Upper Summit Creek Valley near Bridal Lake. The only new areas recorded in 1965, were seen about 10 miles north of Gable Mountain in the upper elevations of the Midway Range.

Western Winter Moth, Erannis vancouverensis Hulst

The three acre infestation of western winter moth in the upper Trail Creek Valley subsided in 1965, but two miles down the valley larvae defoliated 500 acres of alder, maple, trembling aspen and red osier dogwood trees and shrubs. Defoliation ranged from light to severe; 70% of the leaves were consumed on the lower half of the crowns of two large black cottonwood trees. The upper crowns had comparatively little damage. The centre of this infestation was located exactly where the outbreak of Malacosoma disstria Hbn. beban in 1961.

Engraver Beetles, Ips sp.

Engraver beetles had laid eggs for the 1965 broods in ponderosa pine logs at four places within the District by the second week in June. The largest population occurred in debris resulting from a 1964 fall logging operation near Westbridge. In August a number of ponderosa pine long-butts had four to six beetle holes per square foot in the bark with well developed stages under the bark. No evidence of attack was found on standing timber nearby.

Lace Bugs, Corythucha sp.

Lace bugs damaged the leaves of willow bushes over approximately 2,000 acres north of Grand Forks, near Syringa Creek, in the McRae Creek Valley and near Sanca. This tingid is a late defoliator and by August 26 severe discoloration of willows was evident.

Other Noteworthy Insect

Insect	Host	No. of collections	Remarks
Choristoneura fumiferana (Clem.)	L, F, Bg, Se	9	Spruce budworm; frequent, Wallace Creek
Chrysomela semota Br.	Cot	0	Cottonwood leaf beetle; 5 years on same bushes.
Coleophora laricella Hbn.	L	0	Larch Casebearer, nearest known infestation 40 miles south of Canada-U.S. border.
Dioryctria cambiicola Dyar	Py		Western pine moth; on 3% of regen. ponderosa, Grand Forks.
Hemichroa crocea Fourc.	Dt	0	Alder sawfly; no repetition of 1964 population.
Neophasia menapia F. and F.	Pw, Py	0	Pine butterfly; no larvae collected but four adults seen at scattered points.
Orgyia pseudotsugata (McD.)	F	0	Douglas-fir tussock moth; no damage near Danville (see 1964 report).
Stilpnotia salicis (L.)	A	0	Satin moth; Bridesville, two acres mortality from 1964 feeding.
Vespamima sequoiae (Hy. Edw.)	Pl	0	Pitch moth; Motherlode Creek Rd., continuing at Eholt (1961).

FOREST DISEASE CONDITIONS

Important Diseases

Larch Needle Cast

Infection by Hypodermella laricis Tub. was confined to the southern portion of the District in 1965. It appeared most frequently in western larch-Douglas-fir stands, above 3,000 feet elevation, from Anarchist Mountain to Phoenix Mountain, a distance of about 25 miles.

Douglas-fir Needle Blight

Four Douglas-fir seedlings infected by Rhabdocline pseudotsugae Syd.

were observed near Deer Park in 1965, in a stand composed of 90% Douglas-fir. In the Ingram Creek Valley, 12 fir saplings had dropped a high percentage of their 1964 needles. The shed needles on the duff had the same symptoms as those on the infected seedlings near Deer Park.

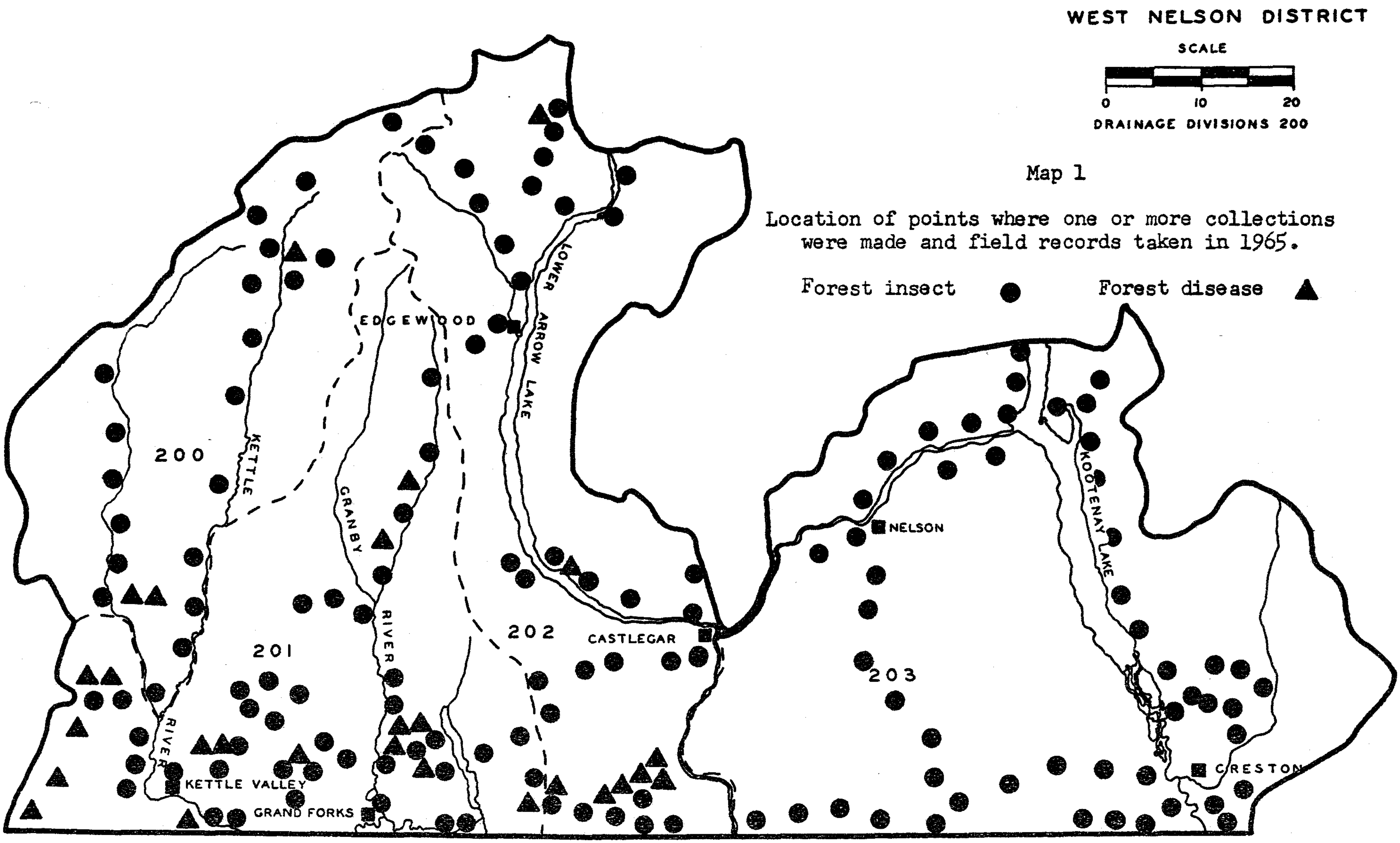
Top Dieback on Western Larch

In 1965, over 300 western larch trees with yellow tops were counted along the south slope of upper Blueberry Creek. They had not been damaged by rodents. Further ground and aerial surveys showed several hundred larch with discoloured tops from the foot of Old Baldy Mountain to Conkle Lake.

Two pathological collections, removed from yellow-topped trees at Conkle Lake and Camp McKinney were determined at the Victoria Pathology Laboratory to be _Cytospora_ sp., possibly the imperfect state of _Valsa kunzei_ Fr.

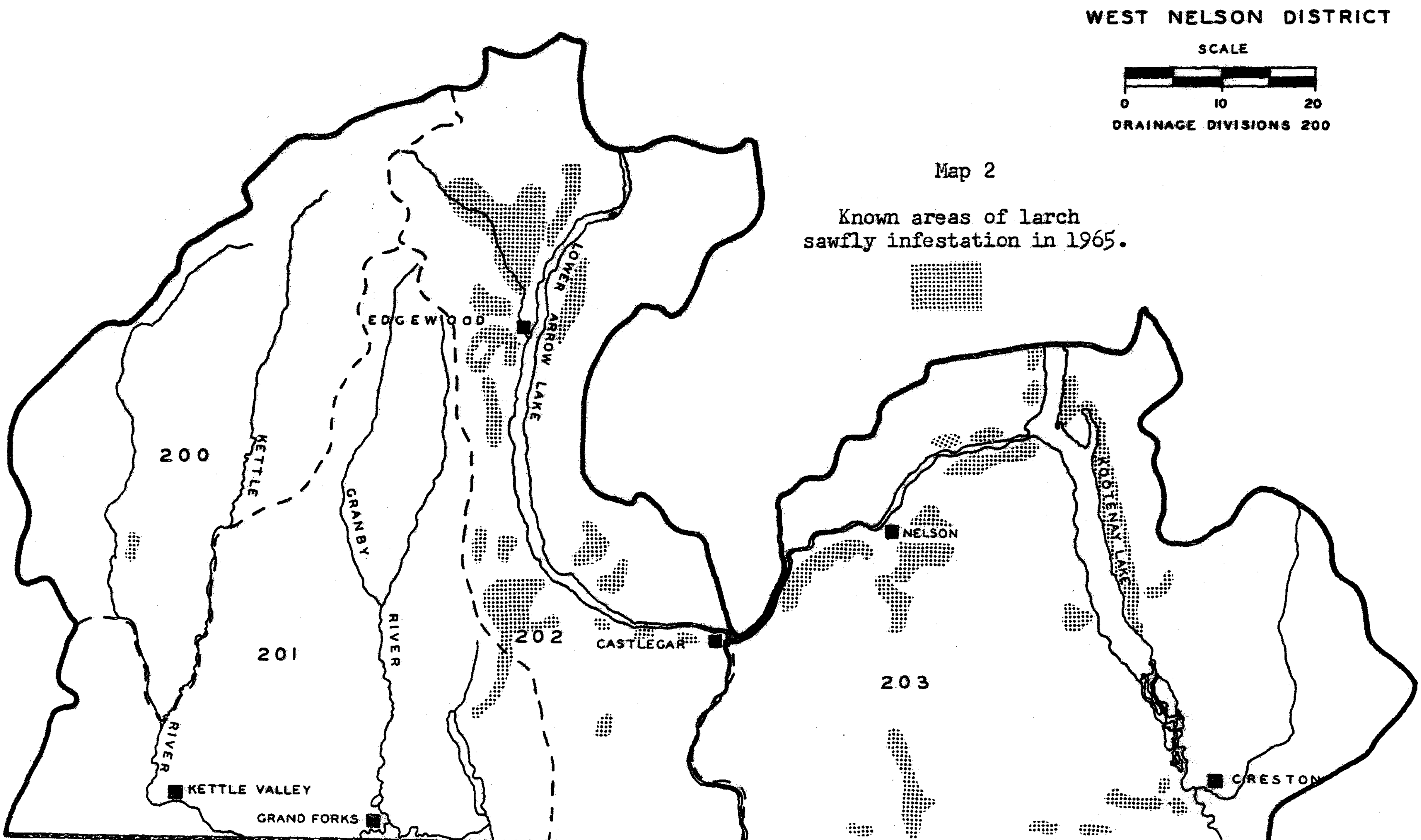
Other Noteworthy Diseases

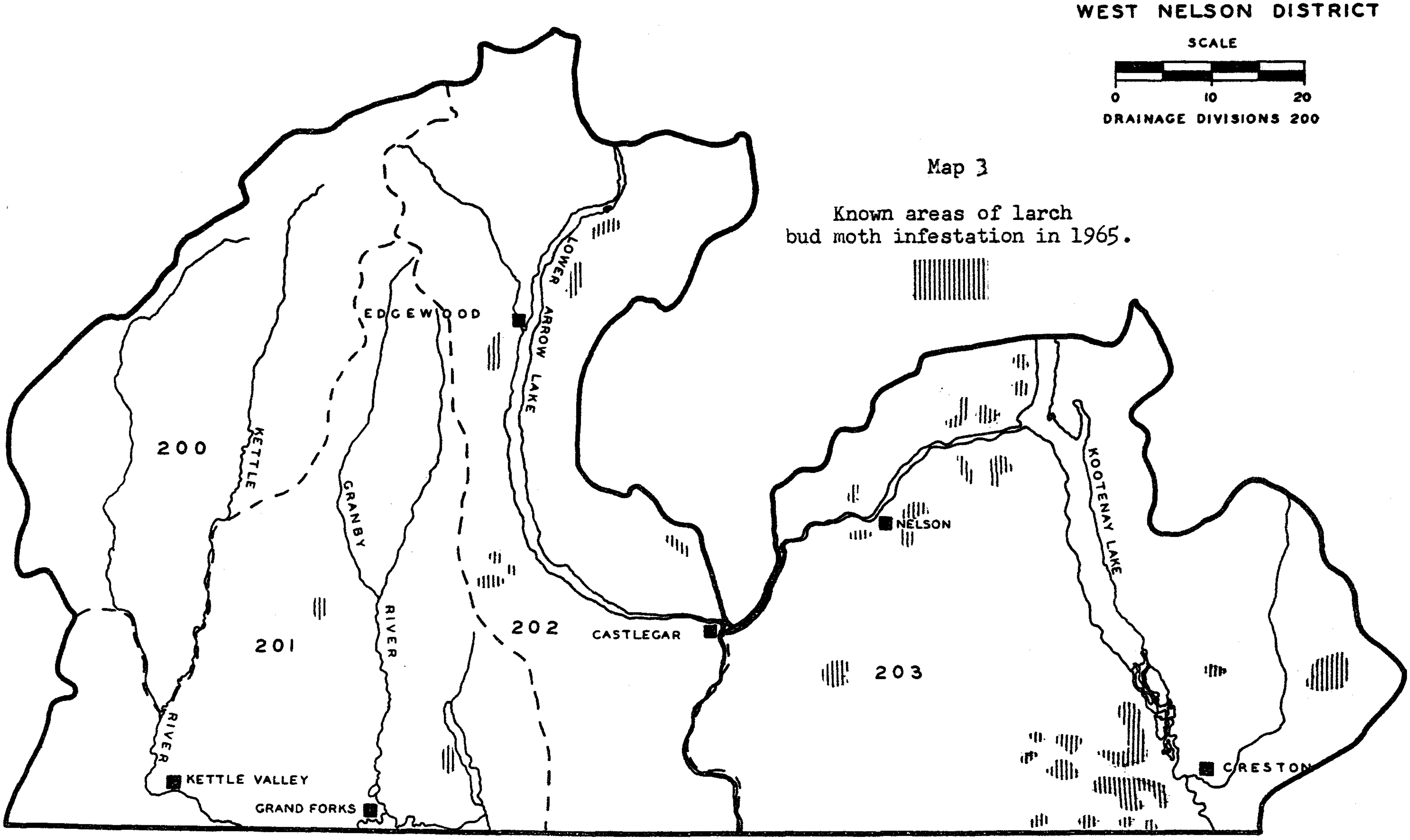
Host	Organism	Locality	Remarks
Alpine fir	Flagging	Goat Peak Road, Sand Creek	Fifty seedlings in one-quarter acre.
Columbian hawthorn	_Gymnosporangium tremelloides_ Hartig	Pend d'Orielle	Fifth year on same bushes.
Mountain ash	_Gymnosporangium bethelii_ Kern	Santa Rosa Summit	At 5,200 feet elevation, frequent.
Douglas-fir	? _Phacidium abietis_ (Dearn.) Reid & Cain	Xenia Lake Goat Peak Rd.	Host unusual in West Nelson.

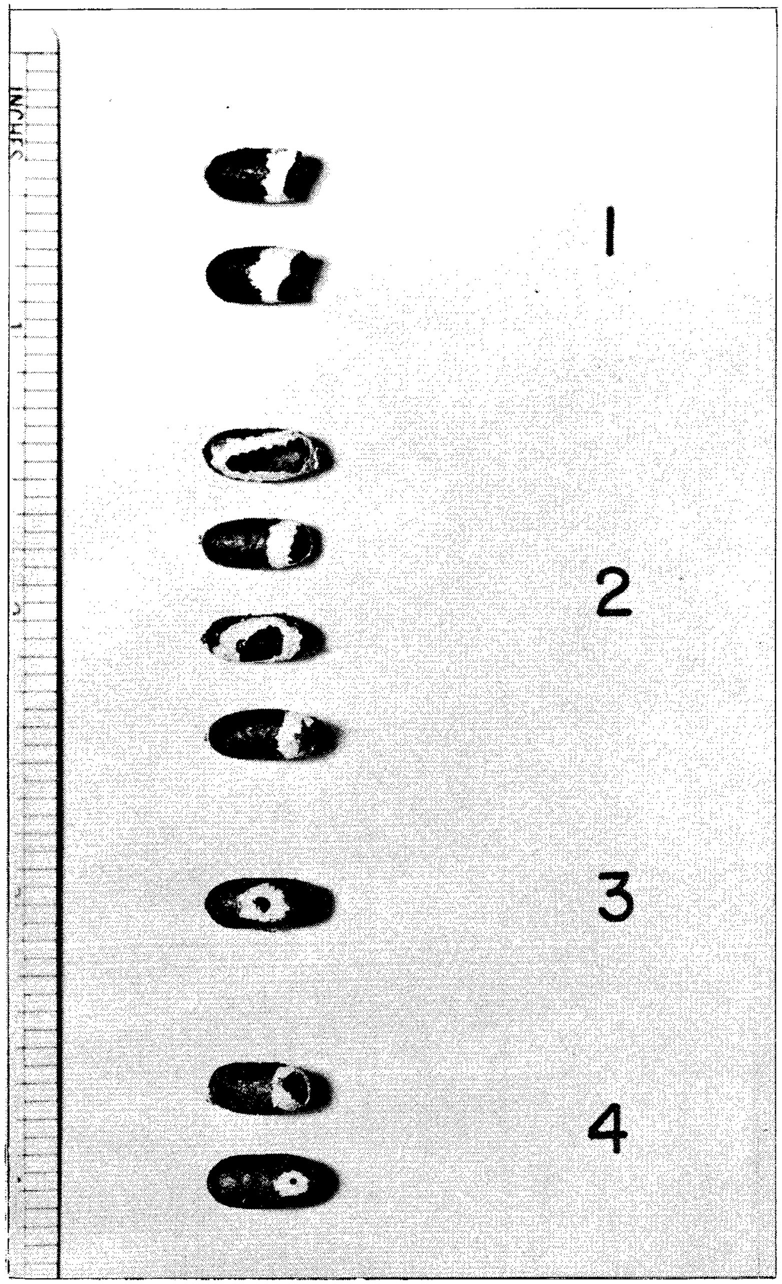


Map 1

Location of points where one or more collections were made and field records taken in 1965.


WEST NELSON DISTRICT
SCALE
0
10
20
DRAINAGE DIVISIONS 200
Map 2
Known areas of larch sawfly infestation in 1965.
200
201
202
203
KETTLE
RIVER
GRANBY
RIVER
LOWER ARROW LAKE
KOOTENAY LAKE
EDGEWOOD
CASTLEGAR
NELSON
KETTLE VALLEY
GRAND FORKS
CRESTON


WEST NELSON DISTRICT
SCALE
0 10 20
DRAINAGE DIVISIONS 200
Map 3
Known areas of larch
bud moth infestation in 1965.
EDGEWOOD
LOWER ARROW LAKE
200
KETTLE
GRANBY
201
RIVER
202
CASTLEGAR
NELSON
203
KOOTENAY LAKE
RIVER
KETTLE VALLEY
GRAND FORKS
CRESTON


1
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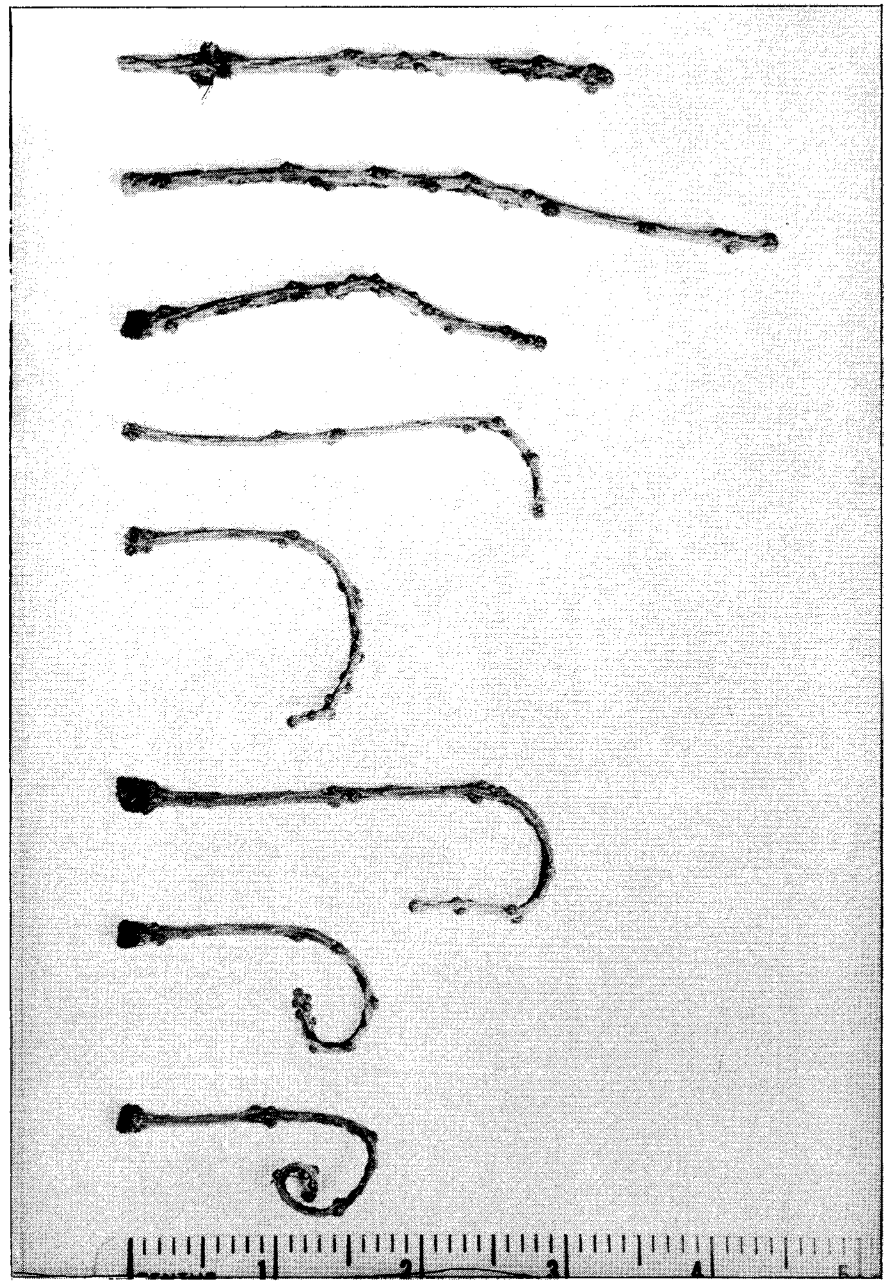


Fig. I - Variety in "crook" formation of western larch branch tips resulting from oviposition by larch sawfly, West Nelson District, October, 1965.

J. Holms.

Fig. II. 1. Normal larch sawfly emergence .
2. Mammal damage. 3. Elaterid damage.
4. Emergence holes of <u>Mesoleius tenthredinis</u> Morley (upper) and <u>Tritneptis klugii</u> (Ratz.) (lower), West Nelson District, October 1965.

J. Holms.

FOREST INSECT AND DISEASE SURVEY

CENTRAL NELSON DISTRICT

1965

FOREST INSECT AND DISEASE SURVEY

CENTRAL NELSON DISTRICT

1965

E. V. Morris

INTRODUCTION

Field work commenced in the Central Nelson District on May 3 and continued until October 20. Six weeks of this time were spent on the black-headed budworm and larch sawfly surveys in the Nelson Forest District. Totals of 382 forest insect and 27 forest disease collections were made throughout the District by Forest Insect and Disease Survey and British Columbia Forest Service personnel during the field season. The 45 permanent sampling points established in the District were sampled from one to four times.

Three species of defoliating insects increased to epidemic levels in the District during the 1965 field season: black-headed budworm caused light to moderate defoliation of western hemlock throughout much of the range of this tree species; larch sawfly and larch budmoth increased to epidemic levels and caused noticeable defoliation of western larch in the southern portion of the District. There was a sharp decline in the number of beetle-killed western white pine trees. Twenty hours flying time by fixed wing aircraft were used in aerial surveys of these infestations.

Table 1 shows the forest insect and tree disease collections by host. Map 1 shows the distribution of collections and field records taken.

Table 1

Collections by Hosts

Central Nelson District, 1965

Coniferous hosts	Forest insects	Forest diseases	Broad-leaved hosts	Forest insects	Forest diseases
Cedar, western red	36	3	Alder spp.	5	1
Douglas-fir	74	4	Aspen, trembling	5	1
Fir, alpine	15	2	Birch, western white	5	4
Hemlock, western	116	3	Cottonwood, black	1	-
Larch, western	30	-	Maple, Douglas	2	1
Pine, lodgepole	22	2	Miscellaneous	15	4
Pine, ponderosa	7	-			
Pine, western white	26	-			
Spruce, Engelmann	21	2			
Yew, western	2	-			
Total	349	16		33	11
			GRAND TOTAL	382	27

FOREST INSECT CONDITIONS

Important Insects

Black-headed Budworm, *Acleris variana* (Fern.)

Black-headed budworm larval populations increased to infestation levels in the mature and overmature hemlock-cedar forests in the northern part of the Central Nelson District. Noticeable discoloration of hemlock foliage was visible during aerial surveys late in July. The largest infestations occurred in the Upper Arrow Lake watershed from Nakusp to Beaton, along the Columbia River from Arrowhead to Boat Encampment, along the Rogers Pass Highway in Glacier National Park, and in the Jordan River Valley. Smaller infestations occurred along Trout Lake, Wilson Lake, and in the Keen Creek Valley. Approximately 100 square miles of discoloration was mapped (Map 3). Most of the infestations were between 2,500 and 4,500 foot elevation. Western hemlock was the only tree species which suffered noticeable defoliation.

The heaviest areas of defoliation occurred in the Wilson Lake, Stevens Creek, North Low Pass and Keen Creek areas. Up to 60% of the 1965 growth was defoliated with some feeding on older foliage in the upper crowns. The average defoliation on the 25 plots established throughout the infestation was 28% on new growth and 6% on the older foliage. Random three-tree beating samples taken throughout the range of western hemlock showed a sharp increase in the number of larvae compared with 1964 beating collections. The highest number of budworm larvae was taken at Stevens Creek where 368 larvae were collected in a single sample. At Keen Creek and Wilson Lake, 245 and 244 larvae respectively, were taken in three-tree beating samples. The incidence of black-headed budworm larvae in three-tree beating collections taken in the larval period between July 7 and August 12 from western hemlock for 1963 to 1965 was as follows:

Number of samples taken during larval period			% samples containing larvae			Average number of larvae per sample		
1963	1964	1965	1963	1964	1965	1963	1964	1965
45	56	48	29	36	68	2.6	3.8	42.2

Mass collections of black-headed budworm larvae were taken at several localities for parasitism studies. Table 2 shows the number of larvae collected, percentage pupation, larvae and pupa parasitism and percentage adult emergence. The highest percentage of parasitism occurred at Keen Creek in the Kaslo Ranger District where 55% of the larvae were killed by parasites. The highest number of pupae parasitized was at Low Pass where 22% were killed.

Table 2

Mass Rearing of Black-headed Budworm,
Central Nelson District, 1965

Locality	Date	No. larvae collected	% pupation	% parasitism Larvae	% parasitism Pupae	% adult emergence
Kuskanax Cr.	11-VIII-65	36	61	24	27	33
Low Pass	10-VIII-65	26	92	4	45	27
Wilson Lake	3-VIII-65	181	50	13	3	28
Mi. 26 Rogers Pass	2-VIII-65	95	61	18	4	28
Stevens Cr.	30-VII -65	213	43	18	2	22
Keen Cr.	23-VII -65	76	39	55	0	29

A survey was conducted in September and October to determine the amount of defoliation that had occurred in 1965 and to sample egg populations as a basis for predicting the population trend in 1966. Twenty-five plots were established in the District: at each plot, 10 trees were selected at random and an estimate was made of the percentage defoliation of the current year's growth and of the total foliage. Egg counts were made on five 10-inch branch tips selected at random from each of three dominant or co-dominant trees. Table 3 gives current and total defoliation, average number of eggs per branch sample, and predicted defoliation for 1966 at 25 localities in the Central Nelson District.

Table 3

Results of Black-headed Budworm Defoliation and Egg Surveys,
Central Nelson District, October 1965

Locality	% defoliation Current	% defoliation Total	Av. no. of eggs per branch sample	Predicted 1966 defoliation
Stevens Creek	34	8	16.4	heavy
Vipond Road	30	7	0.7	light
Mile 10 Kuskanax Cr.	26	7.	11.9	medium
Mile 5 Wilson L.	42	10	7.0	light
Mile 2 Wilson L.	33	9	26.6	heavy
Mile 6 Keen Cr.	36	10	7.7	light
Mile 4 Keen Creek	45	11	10.5	medium
Low Pass	35	7	8.7	medium
North Low Pass	59	18	6.0	light
Caribou Pass	16	3	4.5	light
Mile 8 Halfway R.	22	4	11.4	medium
Mile 5 Halfway R.	24	4	12.6	medium
Jordan R.	14	3	6.4	light
Kirkup Cr.	24	6	9.0	medium
Sale Cr.	26	6	8.3	medium
Keystone Rd.	30	8	6.0	light

Table 3 - continued

Locality	% defoliation		Av. no. of eggs per branch sample	Predicted 1966 defoliation
	Current	Total		
Mile 4 Goldstream L/O	34	9	8.0	medium
(Br. 4) Goldstream L/O	26	5	3.6	light
Begbie Rd.	33	7	10.8	medium
Begbie Cr.	13	3	4.0	light
Rogers Pass Hwy.	9	2	1.8	light
Cougar Cr.	19	5	7.4	light
Victor Rd.	30	5	1.9	light
Galena Bay	11	3	4.2	light
Beaton Junction	33	8	9.8	medium

Investigations of black-headed budworm outbreaks on the Coast of British Columbia indicated that from one to seven eggs per 10-inch branch sample may be expected to produce light defoliation the following year; eight to 15 produces medium, and 16 or more eggs per sample, heavy defoliation. Egg counts were based on the average of 15 branch samples taken at each plot. On this basis, egg surveys suggested that there may be a moderate to heavy population in 1966 in the Upper Arrow Lake area and a light to moderate population along the Columbia River Valley from Arrowhead to Boat Encampment.

Mountain Pine Beetle, Dendroctonus ponderosae Hopk.

Aerial and ground surveys in the Central Nelson District in 1965 showed a substantial decrease in the number of red-topped white pine trees. A total of 4,800 red-topped white pine trees were counted in 1965; this represented a decrease of approximately 10,000 trees from the 1964 counts. The most noticeable decrease occurred along the west shore of Upper Arrow Lake from West Demars to Arrowhead, along the east shore from Shoreholm to Beaton and along the Mosquito Creek drainage from Arrow Park to Mosquito Lake. There was a slight increase in red-tops along Trout Lake, from Beaton to Trout Lake, north of Revelstoke along the Columbia River to Boat Encampment and along the Canoe River. Most of the tree mortality was attributed to mountain pine beetle attack in 1964 since trees attacked previously had lost up to 100% of their foliage by June 1965 and would not have been included in the 1965 counts in most areas. Table 4 gives the number of red-topped white pine killed in 1964 as determined in 1965 by aerial and ground surveys. An average tree volume of 42 cubic feet was used to calculate the volume of timber killed at each locality. This figure was produced by taking measurements of beetle-killed white pine at several localities throughout the Central Nelson District and from two strip cruises at Low Pass and Fosthall Creek where a total of 80 chains one chain wide were run.

Table 4

Number of Trees and Volume Killed by Mountain Pine Beetle in Central Nelson District, 1964 as Determined by Aerial and Ground Surveys in 1965

Locality	No. of trees killed	Volume (cu. ft.)
West shore Upper Arrow Lake (West Demars to Arrowhead)	815	34,230
East shore Upper Arrow Lake (Shoreholm to Beaton)	235	9,870
Mosquito Creek Drainage (Arrow Park to Mosquito L.)	270	11,340
Upper Fosthall Creek (South Fork)	35	1,470
Halfway River	85	3,570
Beaton to Trout Lake	400	16,800
Trout Lake	500	21,000
Fish River	100	4,200
Arrowhead to Revelstoke (Columbia River)	400	16,800
Big Bend (Revelstoke to Boat Encampment)	500	21,000
Canoe River	650	27,300
Enterprise Creek (Slocan Lake)	300	12,600
Wilson Creek (Slocan Lake)	200	8,400
Slocan Lake	30	1,260
Kootenay Lake	35	1,470
Duncan Lake	75	3,150
Lardeau River	100	4,200
Wilson Lake	60	2,520
Total	4,790	201,180

Five new colour change plots were established in the District in 1965. These, along with three plots established in 1964, were used to make observations on foliage colour change and needle loss on beetle-killed white pine to determine the optimum time to carry out aerial surveys. The three plots of 1963 beetle-killed white pine had lost up to 100% of their needles by June 1965 and would not have been included in the red-top counts for 1964 beetle-killed white pine in most areas where aerial surveys were done. The colour change plots established in 1965 on 1964 beetle-killed trees were put in at five localities throughout the beetle infestation: Mosquito Creek, Low Pass and Galena Bay, all in the Upper Arrow Lake watershed, and at Trout Lake and Wilson Creek in the Slocan Lake area. Table 5 shows foliage colour change and needle loss of western white pine trees attacked in 1963 and Table 6 shows the same data for trees attacked in 1964.

Table 5

Colour Change of Western White Pines Attacked in 1963, Central Nelson District, 1965

Locality	No. of trees			% needle loss
	Green	Fading	Red	
Mosquito Creek Road				
June 1964	0	18	15	45
July 1964	0	6	27	65
Aug. 1964	0	0	33	80
Sept. 1964	0	0	33	85
June 1965	0	0	0	100
Low Pass				
June 1964	0	15	5	20
July 1964	0	4	16	45
Aug. 1964	0	0	20	60
Sept. 1964	0	0	20	65
June 1965	0	0	2	98
Galena Bay Road				
June 1964	0	17	7	45
July 1964	0	12	12	50
Aug. 1964	0	0	24	50
Sept. 1964	0	0	24	55
June 1965	0	0	4	95

Table 6

Colour Change of Western White Pines Attacked in 1964, Central Nelson District, 1965

Locality	No. of trees			% needle loss
	Green	Fading	Red	
Mosquito Creek Road				
June	4	12	4	10
July	0	0	20	45
August	0	0	20	50
September	0	0	20	60
Low Pass				
June	2		6	10

Table 6 - continued

Locality	No. of trees Green	Fading	Red	% needle loss
July	0	0	15	38
August	0	0	15	48
September	0	0	15	50
Galena Bay				
June	0	0	12	8
July	0	0	12	40
August	0	0	12	45
September	0	0	12	52
Trout Lake				
June	0	3	2	6
July	0	0	5	48
August	0	0	5	51
September	0	0	5	60
Wilson Creek				
June	3	7	2	10
July	0	0	12	35
August	0	0	12	55
September	0	0	12	60

Trees on the colour change plots retained their needles for only one year after being killed by mountain pine beetle. Further colour change plots will have to be established to determine if this is the case every year.

Larch Sawfly, Pristiphora erichsonii (Htg.)

Western larch stands throughout the southern half of the Central Nelson District suffered light to severe defoliation by larch sawfly in 1965. The last larch sawfly outbreak in the District occurred in the 1940's in the Upper Arrow Lake between Whatshan and Needles; defoliation was evident up to 1947.

Moderate to heavy defoliation in 1965 occurred along the Slocan River Valley from Slocan City to Passmore. Small pockets of light to moderate defoliation occurred along the Upper Arrow Lake from West Demars north to Arrowhead, the northern limit for western larch in the District. Light defoliation occurred along the Kaslo River Valley from New Denver to Kaslo and on the west side of Kootenay Lake from Ainsworth to Lardeau. Small patches of light defoliation were also noted along Slocan Lake and along the main highway from New Denver to Nakusp. Approximately 10,000 acres were mapped from aircraft (Map 4). The following compares the incidence of larch sawfly larvae in three-tree beating collections from western larch for 1963 to 1965 taken in the larval period between June 15 to August 15:

Number of samples taken during larval period			% samples containing larvae			Average number of larvae per sample		
1963	1964	1965	1963	1964	1965	1963	1964	1965
8	13	25	0	10	48	0	1	41.8

The largest numbers of larvae were collected at Perry Siding where one sample contained 200 larvae and at Passmore where 150 larvae were collected. The heaviest defoliation occurred in these two areas.

Several mass collections of larch sawfly larvae were examined at the Vernon Laboratory for larval parasitism. No larval parasites were reared from these collections but large numbers of larvae died in the field from unknown causes, possibly from starvation or as a result of high temperatures after they fell from the tree.

In October, a survey was made for defoliation estimates, sequential sampling for degree of infestation, and cocoon sampling for predicting the 1966 population level. Plots were established at three localities in the Central Nelson District: at West Demars in the Upper Arrow Lake watershed and at Passmore and Perry Siding in the Slocan River Valley. An average of 70% defoliation occurred at the West Demars plot, 75% defoliation at Perry Siding and 64% at the Passmore plot. Sequential sampling based on the number of 1965 curled larch tips at these plots showed the degree of infestation as severe. Cocoon sampling was carried out at these plots to determine the population trend for 1966. Ten dominant and co-dominant western larch trees were selected at each plot and a one-square-foot duff sample was removed from beneath each of the ten sample trees. These duff samples were taken back to the Vernon Laboratory where the cocoons were removed and classified as sound and unsound; totals are as follows:

Locality	No. of cocoons	
	Sound	Unsound
West Demars	261	125
Perry Siding	604	313
Passmore	515	312

The unsound cocoons were examined and classified as emerged, destroyed by mammals or Elateridae, parasitized by *Mesoleius tenthredinus* Morley or *Tritneptis klugii* (Ratz.), or unclassifiable.

Locality	No. of cocoons in 10 sq. ft. samples		% of classifiable cocoons				
	Classi-fiable	Unclassi-fiable	Emerged	Mammal preda-tion	Elaterid preda-tion	*Meso-leius*	*Trit-neptis*
West Demars	368	18	10	16	1	2	1
Perry Siding	710	207	6	4	2	1	3
Passmore	647	180	3	10	3	1	3

One hundred sound cocoons from each plot were opened and the larvae dissected to determine percentage parasitism.

Locality	Healthy	*Tritneptis*	*Mesoleius*	Diptera
West Demars	64	0	36	0
Perry Siding	100	0	0	0
Passmore	93	4	2	1

Larch Budmoth, *Zeiraphera* sp.

High elevation larch stands in the Slocan Lake, Slocan River Valley, Koch Creek, Kaslo River Valley, and the Fosthall Creek areas were heavily infested by this budmoth. Approximately 15,000 acres of discolored larch stands were mapped from aircraft. Most infestations were above 4,000 feet in elevation in over-mature and pole-size larch stands.

Examination of several stands in the week of July 12-16 revealed that the budmoth larvae had already pupated. Three live pupae and some empty pupal cases were found in the duff at Springer Creek in the Slocan Lake district on July 22 in a heavy *Zeiraphera* infestatio at about 4,500 foot elevation.

Egg counts were made in September in two infestations to determine the population level for 1966. Several representative larch trees were felled at the Springer Creek and Idaho Mountain plots and the foliage, branches, and main stem thoroughly examined for eggs. Only a few 1965 eggs and a few old egg cases were found. It was concluded that the infestations have collapsed, that the moths went to new areas to lay their eggs, or that they laid their eggs in places that were not sampled. It is most probable that the infestations collapsed, as information from German and American publications indicated that infestations of this or related species are usually of short duration (one to three years).

Examination of the stands in August and September showed no visible damage to the larch trees. In most areas the trees had refoliated and very little evidence of defoliation could be found.

There are no previous records of Zeiraphera outbreaks in the District, although occasional budmoth larvae have been collected from western larch over the past few years.

Douglas-fir Beetle, Dendroctonus pseudotsugae Hopk.

Populations of the Douglas-fir beetle remained at a low level in 1965. Only one pocket of 25 red-topped Douglas-fir trees was observed during aerial and ground surveys in 1965. These red-tops were on the northeast shore of Trout Lake.

Spruce Beetle, Dendroctonus obesus (Mann.)

As in the past year, the spruce beetle remained at a low population level during 1965. Aerial and ground surveys over parts of the District did not reveal a single infested Engelmann spruce tree.

Western Balsam Bark Beetle, Dryocoetes confusus Sw.

Aerial surveys in the District in 1965 showed a decline in the number of red-topped alpine fir trees. Numerous areas of old dead trees were noted in the Upper Arrow Lake watershed and in the Slocan Lake watershed. Red-topped alpine fir were noted along Pingston Creek and the Fish River where several hundred red-tops were counted on high elevation spruce-balsam stands. Both these areas are in the Upper Arrow Lake watershed. In the remaining areas where aerial surveys were carried out very few red-tops were noted.

Sawyer Beetles, Monochamus spp.

No appreciable damage by wood borers to log decks was recorded in 1965. Beetle-killed white pine at several localities in the Upper Arrow Lake area were lightly infested by wood borers but no other damage was noted in the District.

A Plantation Weevil, Steremnius carinatus Boh.

Douglas-fir seedlings were examined for weevil damage at Celgar's Box Lake nursery but no damage to seedlings was found. Poison bait traps set out in this area in 1964 attracted large numbers of these weevils.

Strawberry Root Weevil, Brachyrhinus ovatus (L.)

The previous year's infestation of this root weevil on Douglas-fir seedlings at Celgar's Box Lake nursery subsided in 1965. Only a few seedlings were damaged in 1965. Control measures had been carried out in 1964.

A Weevil in Western Red Cedar, Hexarthrum sp.

This weevil was commonly found in cull shake bolt material along the Big Bend Highway at several shake cutting operations. No appreciable damage to cut shakes was found.

Poplar-and-Willow Borer, Sternochetus lapathi (L.)

This borer infested roadside willow and black cottonwood throughout the Central Nelson District. Some of the heavier infestations occurred at Summit Lake, Enterprise Creek, Blaylock and Wilson creek. No trembling aspen were found infested.

An Ambrosia Beetle, Trypodendron sp.

There were no reports of ambrosia beetles causing appreciable damage to log decks in 1965. Logging slash in a spruce-alpine fir stand at the 5,000 foot level in the Shannon Creek area on Slocan Lake was heavily infested by ambrosia beetles. Light attacks occurred in spruce-alpine fir logging slash at Airy Creek in the Passmore area. No damage to merchantable timber occurred at these two areas.

Western Hemlock Looper, Lambdina f. lugubrosa (Hulst)

Hemlock looper larval populations decreased in 1965. The highest numbers of larvae were collected at Gordon Rapids along the Big Bend Highway where seven larvae were taken from western red cedar and six larvae from hemlock. The highest number of larvae collected from Engelmann spruce was four at Armstrong Lake; only one larva was collected from Douglas-fir, that being at Mile 8 Galena Bay Road. Table 7 shows the collections of hemlock looper for 1964 and 1965 from four coniferous hosts. The larval period was from May 29 to August 15.

Table 7

Summary of Western Hemlock Looper Collections, Central Nelson District

Host	No. of samples taken during larval period		% samples containing larvae		Av. no. of larvae per sample	
	1964	1965	1964	1965	1964	1965
Western hemlock	88	82	36	32	2.3	2.0
Engelmann spruce	26	19	12	31	2.3	1.6
Western red cedar	61	31	38	10	5.3	4.3
Douglas-fir	60	62	5	2	2.3	1.0

False Hemlock Looper, Nepytia freemani Munroe

The occurrence of false hemlock looper larvae in beating collections from Douglas-fir and western hemlock remained at a low level in 1965. These two tree species were the preferred host. Twenty-five per cent of the Douglas-fir collections contained larvae with an average of 1.4 per positive sample. The hemlock collections had an average of two larvae per positive sample but only five per cent of the collections contained larvae. The largest number of larvae in a single Douglas-fir collection was three at Lemon Creek and the largest number from hemlock was four at Halfway River.

Spruce Budworm, Choristoneura fumiferana (Clem.)

Spruce budworm larval populations remained at a low level in 1965. The highest number of larvae were collected from hemlock at Silverton Creek where four were taken in a three-tree beating sample. Western hemlock and Douglas-fir were the preferred hosts.

The following gives a comparison of 1964 and 1965 spruce budworm collections taken between June 1 and July 31 from western hemlock and Douglas-fir in Central Nelson District.

Host	Number of samples taken during larval period		% samples containing larvae		Av. number of larvae per sample	
	1964	1965	1964	1965	1964	1965
Douglas-fir	44	55	14	18	1.7	1.6
Western hemlock	71	56	6	17	1.2	1.5

A Hemlock Sawfly, Neodiprion sp.

Hemlock sawfly larvae were commonly found in three-tree beating samples from western hemlock. The percentage of collections containing sawfly was 33% with the average number of larvae per positive sample 10.5. Both these figures represent a decrease from the 1964 level. In 1965 the highest number of sawfly larvae was collected at Box Lake where 35 were taken.

Aspen Leaf Miner, Phyllocnistis populiella Cham.

Aspen leaf miner infestations on trembling aspen throughout the District continued in 1965. There was an increase in the number of infested leaf surfaces at the five sample plots. The largest increase occurred at the McKay Creek plot where there was an increase of 33% in the number of infested leaf surfaces. There also was an increase in the number of adults produced per leaf surface. The McKay Creek plot had the largest increase, 73%.

Table 8 compares the percentage of leaf surfaces mined and the number of adults produced per 100 leaf surfaces for 1964 and 1965 at five locations. Table 9 gives the percentage of cocoon mortality at these plots for 1964 and 1965.

Table 8

Comparison of Aspen Leaf Surfaces Mined and Number of Adults Produced per 100 Leaf Surfaces at Five Plots, Central Nelson District, 1964 and 1965

Locality	Percentage of leaf surfaces with mines		No. of adults produced per 100 leaf surfaces	
	1964	1965	1964	1965
Revelstoke	76	72	43	43
McKay Creek	41	64	14	52
Summit Lake	*	69	*	49
New Denver	67	67	44	42
Winlaw	55	69	15	22

* Not sampled; heavy tent caterpillar defoliation.

Table 9

Mortality of Aspen Leaf Miner in 100-Cocoon Samples at Five Locations, Central Nelson District, 1964 and 1965

Locality	Percentage mortality			
	Parasitism		Other causes	
	1964	1965	1964	1965
Revelstoke	33	20	7	13
McKay Creek	33	12	10	20
Summit Lake	*	8	*	17
New Denver	21	13	4	11
Winlaw	36	24	11	15

* Not sampled; heavy tent caterpillar defoliation.

Western Tent Caterpillar, *Malacosoma pluviale* Dyar

Tent caterpillar infestations that have persisted in the Central Nelson District for the past four years in the Summit Lake and Slocan River Valley completely collapsed in 1965. Examination of these areas revealed only occasional tents and no visible defoliation caused by this insect. Occasional tents were noted throughout the southern portion of the District on roadside deciduous trees and shrubs. The main factors suspected of causing the collapse of the infestations are a virus disease and climatic conditions in 1964.

Forest Tent Caterpillar, Malacosoma disstria Hbn.

Forest tent caterpillar infestations in the Summit Lake area and along the Slocan River Valley, where heavy defoliation occurred in 1964 on trembling aspen and black cottonwood, completely collapsed in 1965. Examination of the areas infested in 1964 revealed only occasional larvae feeding.

The three egg sample plots were examined in October. Only two egg masses were found at Summit Lake plot and the other two plots in the Slocan Valley produced negative results.

Weevils in Western White Pine, Pissodes spp.

Weevils infesting roadside white pine reproduction were common throughout the Central Nelson District. Some of the areas of heavy infestation were in the Galena Bay area, along the Big Bend Highway, along the Kaslo-New Denver Highway and in the Aylwin Creek area. Several collections of infested white pine root collars were sent to the Sault Ste. Marie Laboratory for identification.

Pine Butterfly, Neophasia menapia Feld.

Pine butterfly larvae were collected at two localities in 1965. Six larvae were collected at Lemon Creek in a ponderosa pine collection and one larva from lodgepole pine at Riondel. Adults were noted in flight along the Galena Bay Road in August.

A Leaf Blotch Miner, Lyonetia saliciella Busck

This blotch miner was commonly found infesting white birch, willow and alder trees. Some of the heavier infestations occurred at Blaylock in the Kaslo River Valley, in the Trout Lake area and along the highway from New Denver to Kaslo. These infestations have persisted for several years. Numerous spot infestations were noted from aerial surveys.

Spotless Fall Webworm, Hyphantria cunea Drury

Populations of this webworm remained at a low level in 1965. Occasional tents were noted in the southern areas of the District.

Douglas-fir Needle Midges, Contarinia spp.

Needle midge damage to Douglas-fir reproduction was common throughout the range of this tree in the Central Nelson District. The heavier infestations were at McKay Creek in the Revelstoke area and along the

Slocan Valley from New Denver to Thrums. Five localities were examined for the degree of infestation on current year's Douglas-fir needles. The plots were established in chronic midge infestations and five trees tagged at each plot. Five terminal twigs were examined from each tree and the percentage of current year's needles infested recorded. Table 10 gives the percentage of current year's needles infested by Douglas-fir needle midges, at five localities,

Table 10

Results of Examination of Douglas-fir Needles for Midge Damage at Five Plots, Central Nelson District, 1965

Locality	Percentage of current year's needles infested
Thrums	37
Lemon Creek	30
Gwillum Creek	44
Vallican	68
Little Slocan River	43

Trays were dug into the ground under each of the five sample trees at Thrums. These trays will be removed in the spring for Douglas-fir needle miner adult population studies at the Vernon Laboratory.

Green Spruce Looper, Semiothisa granitata complex

Larvae were less common in beating collections from hemlock and Douglas-fir in 1965 compared with 1964 samples. Twenty-six per cent of the Douglas-fir collections contained larvae with an average of 1.2 larvae per collection; corresponding figures for western hemlock were 13 and 1.5.

Satin Moth, Stilpnotia salicis Linn.

The small infestation of satin moth on trembling aspen and black cottonwood trees at Summit Lake collapsed in 1965. This infestation was found in 1964 and is an eastern record for satin moth. Only a few larvae could be found. A virus disease in 1964 is the suspected cause of the collapse.

Gray Forest Looper, Caripeta divisita Wlk.

This insect remained at a low population level in 1965. Western hemlock collections at Glacier Creek contained no gray forest loopers whereas in 1964 they averaged 65 larvae per three-tree beating sample.

Lace Bugs, Corythucha sp.

The leaves of roadside willows were damaged by this lace bug. Damage was first noted in late June and early July. This is the first time this damage has been noted in the Central Nelson District.

Other Noteworthy Insects

Insect	Host	No. of collections	Remarks
Adelges tsugae (Annand)	H	1	Hemlock aphids; not found in 1964; one collection Keen Cr. 1965.
Anoplonyx laricivorus Ross	L	15	Western larch sawfly; average of 4.5 larvae per positive sample; 12 larvae taken at Kaslo.
A. *occidens* R.M.	L	2	Two-lined larch sawfly; down from 1964 beating samples.
Ectropis crepuscularia Schiff.	H	5	Saddle back looper; small increase over the 1964 collections.
Hypagyrtis piniata Pack.	H, F	4	A looper; slight decrease from 1964.
Melanolophia imitata Wlk.	H, F, C	9	Green striped forest looper; down from the 1964 collection.
Nematocampa filamentaria Gn.	H, F	4	Filament bearer; 50% decrease from 1964.
Orgyia a. badia (Hy. Edw.)	H, Se	3	Rusty tussock moth; sharp decline from 1964.
Parorgyia grisefacta Dyar	H, F	2	A tussock moth; only found on hemlock in 1964.
Protoboarmia p. indicataria Wlk.	H, F, Pl, D, Se	19	Dotted line looper; common in 1965; no. of collections same as 1964.

FOREST DISEASE CONDITIONS

Important Diseases

Larch Needle Cast

Larch needle cast caused by Hypodermella laricis Tub. on western larch completely disappeared in areas that were infected in 1964 in the Kaslo and Lardeau districts. Spot infections were noted at Mosquito Lake in the Upper Arrow Lake watershed. No other infections were noted in the Central Nelson District. Areas of larch needle cast along the Kaslo River in 1964 were infested with larch sawfly and larch budmoth in 1965.

White Pine Blister Rust

Infections of Cronartium ribicola J. C. Fisch. ex Rab. on western white pine remains one of the most serious and widespread diseases in the Central Nelson District. Heavy infection of white pine occurred at several localities. Three of the largest areas were found along the Kaslo River from Retallack to Kaslo, north of Lardeau at Gold Ridge, and at the south end of Trout Lake. Several hundred acres were infected at each locality. Aerial surveys in the Upper Arrow Lake watershed revealed numerous areas of white pine blister rust infection. This disease appears to be increasing throughout the range of white pine in the District.

Dwarf Mistletoe on Western Larch

Dwarf Mistletoe Arceuthobium campylopodum Engelm. f. laricis (Piper) Gill, was commonly found throughout the range of western larch in the District. Two areas of heavy infection occurred at Wee Sandy Creek in the Slocan Lake area and along the Wilson Creek Road from Mile 8 to Beaver Lake.

Browning of Alpine Fir Needles

Heavy browning of the current year's needles of alpine fir possibly caused by Delphinella balsameae (Waterm.) E. Mueller was recorded at a number of localities. Some of the heavier infections occurred along Kane, Keen and Enterprise creeks. This disease was also noted to a lesser degree at various other localities where alpine fir trees occurred.

Brown Felt Blight

Infections of Herpotrichia nigra Hartig on alpine fir was commonly found along the Idaho Mountain Road and in the Idaho Mountain Basin. Light infections were also noted along Keen Creek in Kokanee Provincial Park on alpine fir.

Porcupine Damage

Porcupines, Erithizon dorsatum nigrescens Allen, feeding on the bark and cambium layer of lodgepole pine, white pine and to a lesser degree, alpine fir have caused considerable damage. Some of the heavier feeding occurred along the valley from New Denver to Kaslo on white pine and lodgepole pine. The high elevation lodgepole pine stands in the Slocan Lake area also suffered damage. Occasional alpine fir trees along the Idaho Mountain Lookout Road and along the trail to Fishermaiden Lake had evidence of porcupine feeding. Generally throughout the District porcupine damage increased in 1965.

Shoestring Root Rot

Shoestring root rot caused by Armillaria mellea (Fr.) Kummer was again commonly found in 1965, on dead roadside Douglas-fir and white pine saplings.

Exotic Plantations

Three of the four exotic plantations in the District were examined in November. The plantation at Mosquito Landing was flooded out several years ago causing 100% mortality. The Low Pass plantation was not accessible and was not examined. Table 11 gives the results of the examination of three exotic plantations.

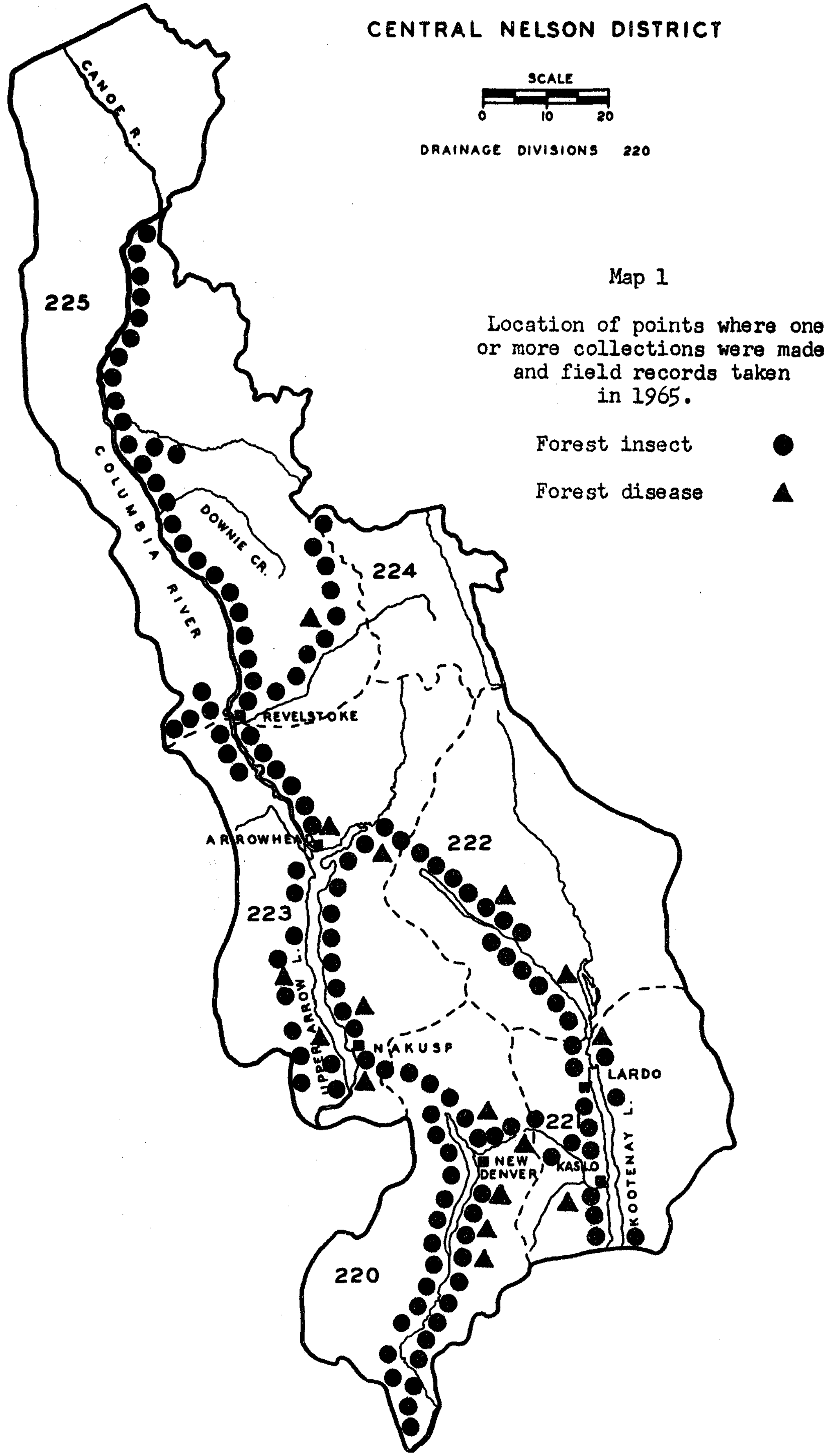
Table 11

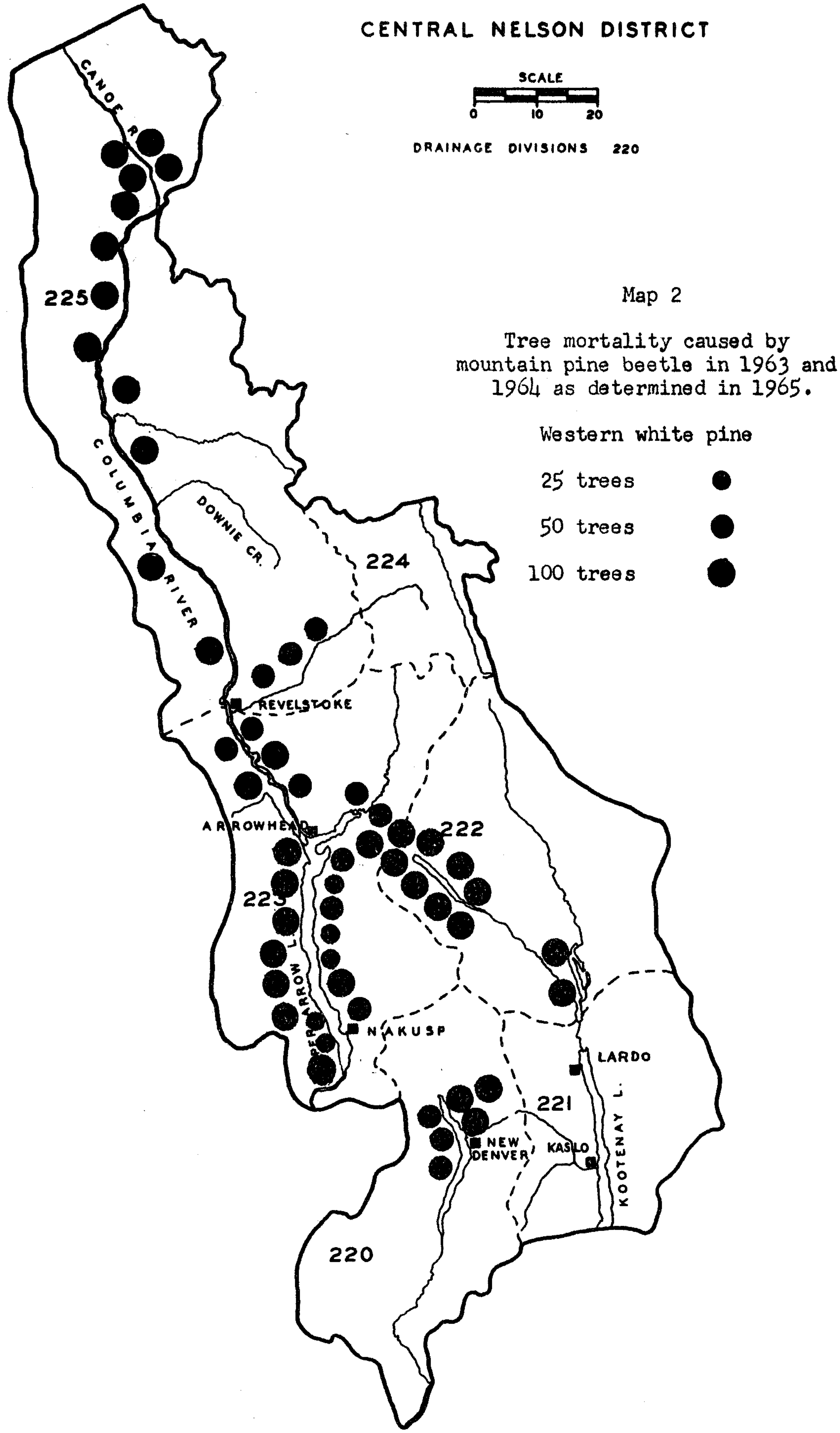
Summary of Disease Collections on Exotic Plantations, 1965

Plantation no.	Location	Species	Remarks
XP 167	Marble Head	Hybrid Populus spp.	Plantation neglected, numerous trees with broken tops. Trees damaged by livestock. Undamaged trees doing well.
XP 168	Mosquito Landing	Hybrid Populus spp.	100% mortality caused by flooding.
XP 216	Mosquito Cr.	Sitka spruce	Heavy underbush at this plantation; trees doing well that are growing out in open spots.
XP 217	Low Pass Camp	Sitka spruce	Not examined in 1965; road washed out several miles from plantation.
XP 218	Plante Cr.	Sitka spruce	From 6 to 8 inches new growth in 1965.

OTHER NOTEWORTHY DISEASES

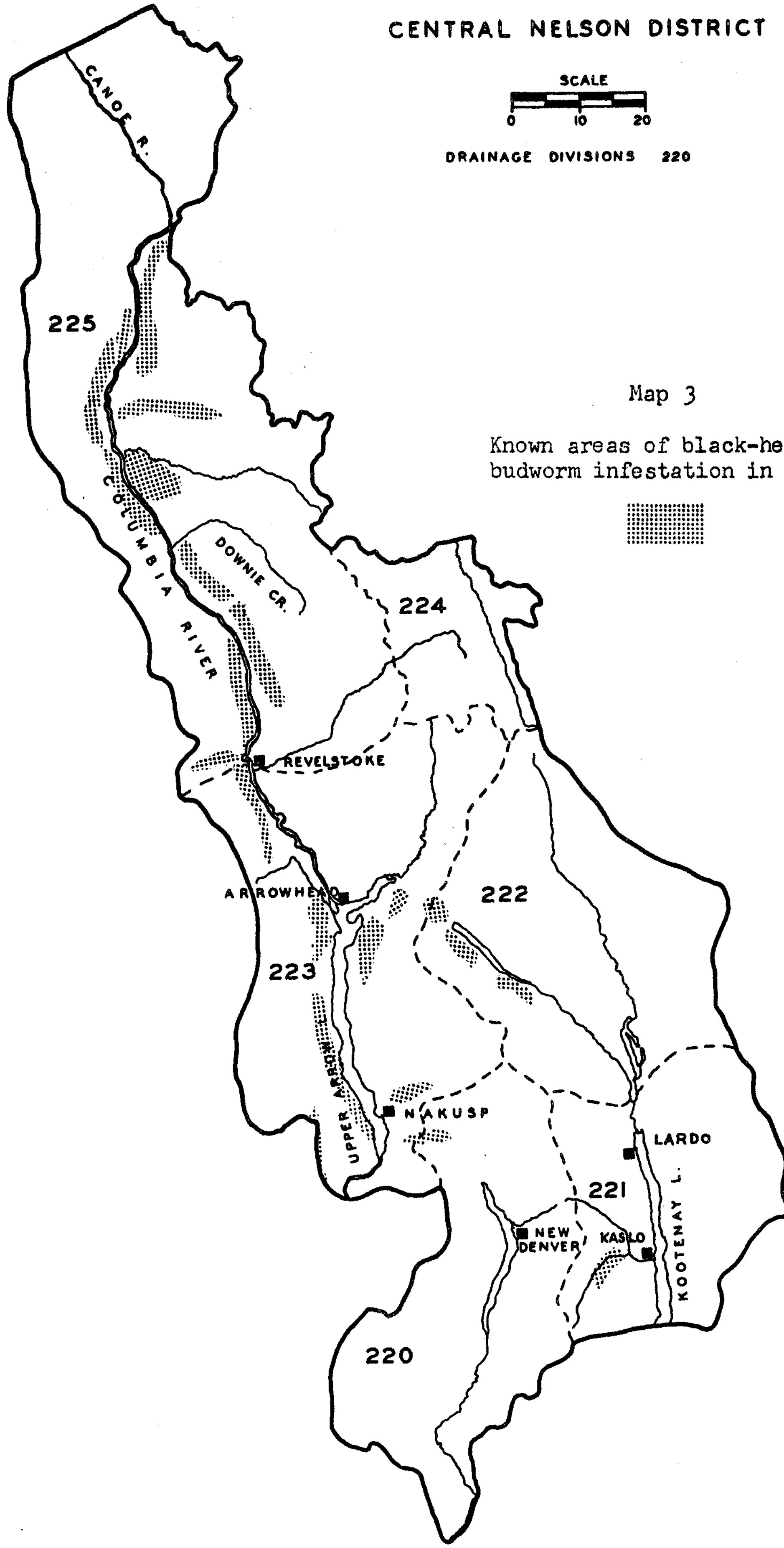
Host	Organism	Locality	Remarks
Alder, Sitka	Didymosphaeria oregonensis Goodd.	Slocan Lake	Canker on alder; new host record.
Cedar, western red	Didymascella thujina (Durand) Maire	Retallack	Cedar leaf blight, common throughout District.
Douglas-fir	Phomopsis sp.	Arrowhead	Tip blight.
Fir, alpine	Delphinella balsameae (Waterm.) E. Mueller	Gerrard	Needle blight; new record.
	Pucciniastrum epilobii Otth	Retallack	Common in most areas where this tree species is found.
Hemlock, western	Epipolaeum tsugae (Dearn.) Shoem.	Low Pass	Sooty mould found throughout range of this tree.
	Pucciniastrum vaccinii (Wint.) Joerst.	Meadow Creek	Needle rust; not common in this area.
Pine, lodgepole	Scirrhia pini Funk & A.K. Parker	Kaslo	Brown spot needle blight.
	Arceuthobium americanum Nutt. ex Engelm.	Slocan Lake	Mistletoe not common in this area.
	Dothistroma pini Hulbary var. linearis Thyr & C.G. Shaw	Retallack	Red band disease, new host record.
Pine, whitebark	Neopeckia coulteri (Pk.) Sacc.	Idaho Mt.	Brown felt blight along Idaho Mt. trail.
Spruce, Engelmann	Chrysomyxa weirii Jacks.	Silverton	Needle rust common in this area.


CENTRAL NELSON DISTRICT
SCALE
0 10 20
DRAINAGE DIVISIONS 220
Map 1
Location of points where one or more collections were made and field records taken in 1965.
Forest insect
Forest disease
CANOE R.
225
COLUMBIA RIVER
DOWNIE CR.
224
REVELSTOKE
ARROWHEAD
222
223
UPPER ARROW L.
NAKUSP
LARDO
NEW DENVER
KASLO
KOOTENAY L.
220



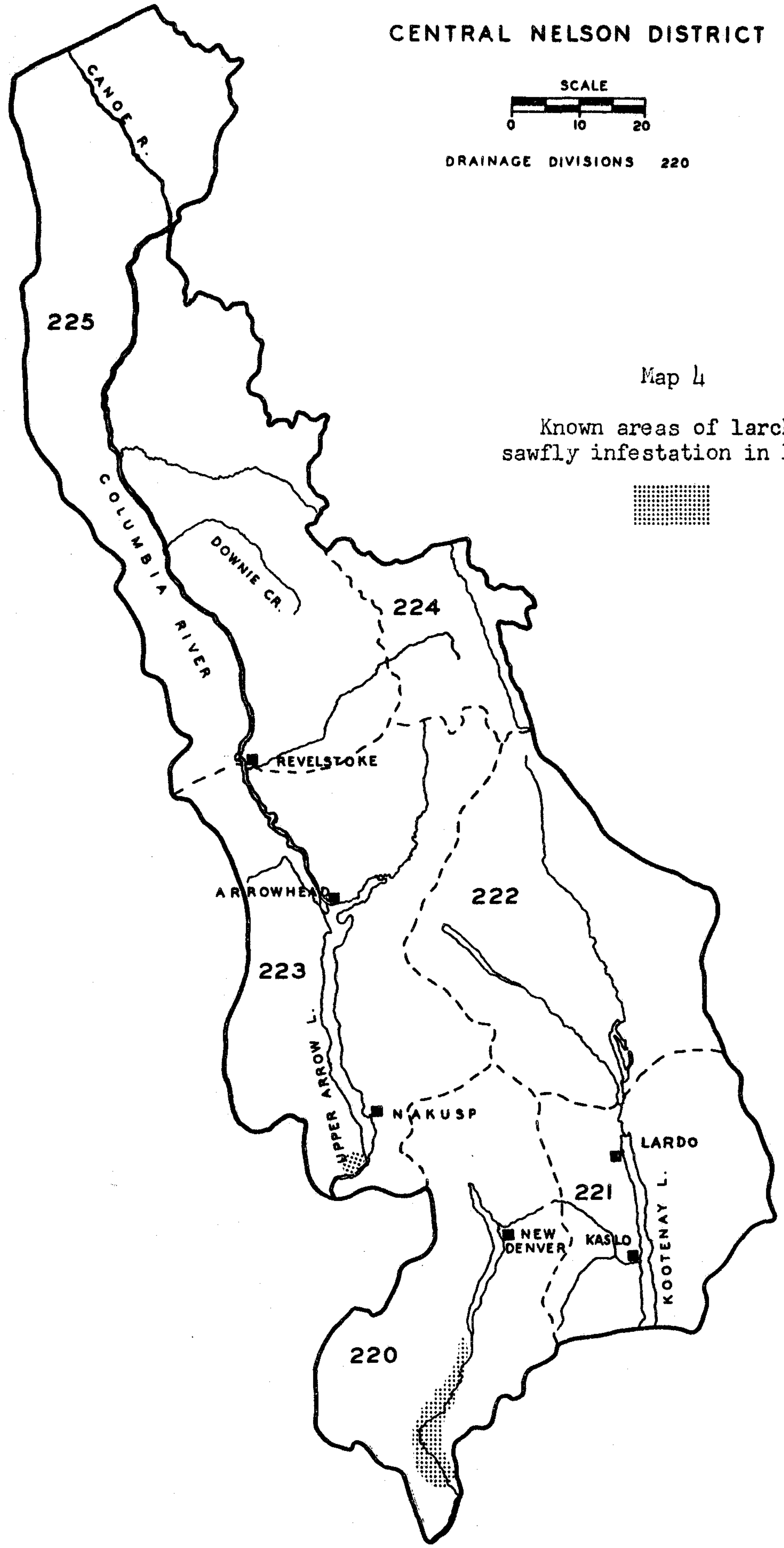
Map 2

Tree mortality caused by mountain pine beetle in 1963 and 1964 as determined in 1965.



Map 3

Known areas of black-headed budworm infestation in 1965.



Map 4

Known areas of larch
sawfly infestation in 1965.

FOREST INSECT AND DISEASE SURVEY

EAST NELSON DISTRICT

1965

N. J. Geistlinger

INTRODUCTION

The 1965 field season in the East Nelson District began on May 31 and ended on October 1. During this period one week was spent on Douglas-fir beetle strips in the Cariboo and three weeks on appraisal surveys in the West Nelson and Prince George districts.

More extensive aerial surveys were conducted than in the past because of infestations of larch sawfly, a larch bud moth and black-headed budworm. A total of 22 hours flying time was used, 19 of which were contracted by the Department of Forestry and three provided through the courtesy of the British Columbia Forest Service.

Totals of 371 forest insect and 37 forest disease collections were taken in the District. Table 1 lists the collections by hosts and Map 1 shows locations where one or more collections were made or field records taken in 1965.

Table 1

Collections by Hosts

East Nelson District, 1965

Coniferous hosts	Forest insects	Forest diseases	Broad-leaved hosts	Forest insects	Forest diseases
Cedar, western red	18	-	Alder spp.	4	1
Douglas-fir	119	6	Aspen, trembling	8	1
Fir, alpine	33	2	Birch spp.	4	1
Hemlock, western	27	2	Hazel	-	1
Juniper, common	2	-	Willow spp.	-	1
Juniper, Rocky Mtn.	14	-	Miscellaneous	1	8
Larch, western	34	1			
European	-	1			
Pine, lodgepole	48	5			
ponderosa	13	1			
Scots	-	1			
western white	2	1			
whitebark	-	1			
Spruce, Engelmann	44	3			
Total	354	24		17	13
			GRAND TOTAL	371	37

FOREST INSECT CONDITIONS

Important Insects

Mountain Pine Beetle, Dendroctonus ponderosae Hopk.

The mountain pine beetle continued its depredations in lodgepole pine stands in the District. Aerial surveys revealed an overall increase in the number of red-topped lodgepole and western white pines in 1965. The most significant increase in the number of dead trees was noted in the infestation along Coyote Creek. Numbers of red-topped lodgepole pines decreased from 1964 in the Waitabit Creek and Bush River infestations, although substantial losses still occurred in these areas.

Table 2 shows the number of red-topped pine trees counted or estimated during aerial surveys in 1963-65. Map 2 shows locations and numbers of pines killed by mountain pine beetle as determined by aerial surveys in 1965.

Table 2

Estimated Number of Lodgepole and Western White Pine Killed by Mountain Pine Beetle as Determined from Aerial Surveys 1963-1965, East Nelson District

Locality	Host	Number of red-tops		
		1963	1964	1965
Bush River	Pl, Pw	1,500	2,100	1,700
Redgrave	Pl	750	1,250	2,000
Waitabit Creek	Pl	625	2,250	2,000
Parson	Pl	35	25	10
Horsethief Creek	Pl	100	125	165
Dutch Creek	Pl	125	375	155
Findlay Creek	Pl	400	225	120
Elk Creek	Pl	500	800	1,200
Coyote Creek	Pl	550	900	3,500
Kootenay River-White R.	Pl	75	300	1,120
Forster Creek	Pl	-	225	150
Steamboat Mt.	Pl	-	50	25
Kinbasket Lake	Pw	-	-	400
Palliser R.	Pl	-		250
Cross River	Pl	-		200
Blackwater Lake	Pw	-		15
Total		4,660	8,625	13,010

The two foliage colour change plots in mountain pine beetle infestations on Steamboat Mountain near Edgewater were examined on July

28. Trees attacked two years prior to examination had lost almost their full complement of foliage and those attacked three years previously had lost all their foliage (Table 3).

Table 3

Foliage Loss of Lodgepole Pine Trees Attacked by Mountain Pine Beetle, East Nelson District

Time of attack	Examination date 1964	Examination date 1965	Estimated percentage needle loss
Aug. 1962	June 19		78
	July 9		87
	Aug. 18		93
		July 28	100
Aug. 1963	June 19		0
	July 9		13
	Aug. 18		33
		July 28	98

Spruce Beetle, *Dendroctonus obesus* (Mann.)

Examinations of Engelmann spruce windthrown in the Fernie Ranger District in June 1964 were conducted late in September 1965 to determine the extent of infestation by spruce beetles. In areas where salvage operations were completed, stumps, long butts and other slash were examined. At seven locations where downed trees were not salvaged or where there were long logs at landings, bark samples were removed from these hosts.

In unsalvaged blowdown, square-foot bark samples were removed partly from the side and partly from the underside at the lower, mid and upper bole levels of 10 trees. In areas which had been salvage logged, a square-foot sample was taken from stumps and one or two samples from butts, depending on the length. Trees ranged from 12 to 38 inches dbh, stumps from 14 to 38 inches diameter, and long butts from 16 to 30 inches diameter and 10 to 25 feet long. Bark samples were also removed from 20 high stumps in the Upper Coal Creek area which was logged in the winter of 1963-64.

Table 4 shows the results of bark sampling of whole trees at seven points and Table 5 contains data gathered from bark sampling of stumps and long butts at seven locations.

Table 4

Average Number of Living Spruce Beetle Adults, Larvae and Pupae per Square Foot at Three Bole Heights on Windthrown Spruce Trees, Fernie Ranger District, September, 1965

Location	Average number per square foot								
	Upper bole			Mid bole			Lower bole		
	Adults	Larvae	Pupae	Adults	Larvae	Pupae	Adults	Larvae	Pupae
Coal Cr.	11.7	0	0	5.9	0	0	8.9	0	0
Harvey Pass	1.5	15.3	0.3	4.1	19.4	0.1	5.7	33.6	0.2
Harvey Cr.	2.3	12.1	6.6	16.0	7.8	0	15.1	7.0	0
Howell Cr.	0	0	0	0	0	0	0.1	3.6	0
Roche Cr.	0	0	0	0	0	0	0	0	0
Line Cr.	0	0	0	0	0	0	0	0	0
Harmer Cr.	0	0	0	0	0	0	0	0	0

Table 5

Average Number of Living Spruce Beetle Adults, Larvae and Pupae per Square Foot on Stumps and Butts, Fernie Ranger District, September, 1965

Location	Host type	No. of sq. ft. examined	Av. no. per sq. ft.		
			Adults	Larvae	Pupae
Upper Coal Cr.	stumps	20	7.8	0.2	0.4
Harvey Pass	stumps	10	0.1	3.3	0
Howell Creek	stumps	10	0.3	1.3	2.0
Roche Creek	stumps	10	0	0	0
Sage Cr.	stumps	10	0	0	0
	butts	10	4.5	0	0
Lodgepole Cr.	stumps	10	0.3	5.2	0
	butts	13	3.2	17.5	6.8
Harmer Cr.	stumps	20	0	0	0
	butts	10	0	0	0

Large populations of beetles were found in spruce windfall at Harvey Pass and along Harvey and Coal Creeks where seven, 10 and nine trees respectively were infested. Beetles were in all stages of development except along Coal Creek where only adults were present. Maxima of 83 adults and 47 pupae per square foot were found in trees along Harvey Creek and 123 larvae at Harvey Pass. Eggs were observed in one gallery at Harvey Pass on September 29. A light beetle population was found along Howell Creek but no attack was noted along Roche, Line or Harmer creeks.

There were light to moderate beetle populations in stumps remaining after completion of salvage operations at Harvey Pass and along Howell and Lodgepole creeks. Late in September 1965, an examination of 20 stumps cut in the winter of 1963-64 in the Upper Coal Creek area, revealed that 12 were infested with a maximum of 41 adults per square foot. Moderate to dense populations of beetles were found in long butts along Lodgepole Creek. Butts examined at other points did not contain a significant number of beetle progeny.

Potentially dangerous population levels of spruce beetle exist in windthrown trees and logging slash at Harvey Pass, along Coal, Harvey and Lodgepole creeks and in high stumps in the Upper Coal Creek area. Although there may be some attack on living mature and overmature spruce trees in stands adjacent to areas where beetles were abundant, in all probability the 1966 attack will be directed mainly towards windfalls and logging slash. Although the bulk of the windthrown timber has been salvaged, there is a great quantity of slash which may remain in favourable condition for infestation in 1966 as it was noted that only slight desiccation of the cambial layer had occurred in a period of more than one year.

The various stages of development of the spruce beetle present late in September indicated that the majority of the population requires two years to reach maturity but that a portion does mature in one year. The 1965 beetle flight in the Harvey Pass area, over 5,000 feet elevation, occurred late in June and early in July. When windfalls in this area were examined on July 8, 1965, the 1964 beetle broods were mainly in the pupal stage with a small portion in the late larval stage. The 1965 broods were in the egg and early larval stages and many adults had just begun to excavate galleries.

No infestation of standing Engelmann spruce trees by this beetle was noted in the District in 1965.

Douglas-fir Beetle, Dendroctonus pseudotsugae Hopk.

The number of red-topped Douglas-fir trees observed during aerial reconnaissance increased significantly in 1965 (Table 6). The most notable increase occurred in mature stands in the Gold and Caven creek areas southeast of Cranbrook. In 1964 only scattered groups of up to five trees were observed while in 1965 one particular block alone was estimated to contain 400 red-tops. An abundance of logging slash was probably partly responsible for the beetle build-up in this area.

An increase in the number of red-topped Douglas-fir trees was also noted in the Whiteswan Lake-White River areas. No other noteworthy numbers of red-topped Douglas fir were observed.

As ground examinations showed that many trees infested in 1964 had lost much of their foliage by mid-June 1965, many trees would not have been counted during aerial surveys. Seven Douglas-fir trees attacked in 1965 were marked for foliage colour change observations.

Table 6

Estimated Number of Douglas-fir Trees Killed by Douglas-fir Beetle Observed During Aerial Surveys in 1964 and 1965

Locality	Number of red-tops	
	1964	1965
Windermere Lake	75	30
White Swan Lake-White River	400	765
Gold Creek-Caven Creek	-	770
Kootenay River	150	115
Elkp-Roosville	75	40
Wigwam River	250	-
Total	950	1,720

Douglas-fir Needle Midges, Contarinia spp.

A general decrease in the percentage of Douglas-fir needles infested by midges was noted in the District again in 1965. The only area where infestation was readily visible was in a Christmas tree stand near Edgewater.

Four permanent sampling plots were established for comparison of midge infestation from year to year. Samples consisted of five current tips taken at breast height from each of five trees at each plot. Three of these plots will also be used to determine midge emergence from soil samples each year. Table 7 shows percentage infestation of current needles at the four localities.

Table 7

Douglas-fir Needles Infested by Contarinia spp., East Nelson District, 1965

Locality	Percentage infestation	
	Range	Average
Canal Flats	0.3 - 1.9	0.7
Invermere	0 - 4.9	1.6
Edgewater	11.1 - 36.6	21.8
Brisco	0 - 2.3	0.8

Early in September, a screen-bottomed tray, nine by eight inches and four inches deep was placed in the ground under each of five trees at the Invermere, Edgewater and Brisco plots to collect larvae dropping from the needles. In the spring of 1966 when the ground has thawed, these trays will be gathered and placed in incubators to force midge emergence. Blocks of soil removed in the spring from beneath heavily infested trees failed to produce sufficient numbers of midges on which population predictions could be based. It is expected the tray method will give a more accurate assessment of populations.

A small scale control experiment was again conducted by the British Columbia Forest Service in a Christmas tree cutting area near Edgewater. Approximately 0.75 acres were treated with thiodan emulsion at the rate of one quart (2 lb. technical thiodan per gallon) of emulsion per 100 gallons of water. Spraying was done on June 1 when midges were in flight and ovipositing. Samples consisting of five tips at breast height from each of 10 trees in both the treated area and a nearby untreated area were taken early in September to determine the effectiveness of the insecticide. The following table shows the percentage of needles infested on the sprayed and unsprayed trees.

Treatment	Range	Average
Thiodan emulsion	0 - 1.9	0.5
Check	5.9 - 50.0	21.0

Early in September a band at the base of 20 regeneration Douglas-fir trees was treated with Cygon applied with a brush. Samples will be taken from these trees in 1966 to determine whether or not the systemic qualities of this insecticide will effect control of *Contarinia* midges.

Larch Sawfly, *Pristiphora erichsonii* Htg.

The larch sawfly reached epidemic proportions in several localities in the southern portion of the East Nelson District in 1965. A total of approximately 8,800 acres of mainly pole-sized larch stands was defoliated.. The largest single infestation covered an area of approximately 1,500 acres south of Fernie. The last severe infestations of larch sawfly began at Grave Creek, north of Fernie, in 1930 and spread throughout the range of western larch in the District. By 1945 all infestations in the District had subsided and only very light populations were found.

Defoliation in all current outbreaks was moderate to severe and readily discernible from the air. Defoliation in a 100-tree plot along Sunrise Creek ranged from 10 to 90% with an average of about 70%. Late in September there was no evidence of refoliation on the denuded trees.

Random beatings of western larch in 1963 and 1964 did not indicate any significant increase in population of the larch sawfly. The percentage of samples taken between June 14 and August 8 containing larvae and the average number of larvae per sample increased in 1965 as shown in the following table:

Number of samples taken during larval period			% samples containing larvae			Average number of larvae per sample		
1963	1964	1965	1963	1964	1965	1963	1964	1965
8	17	20	12	17	25	4.0	4.6	13.4

Late in September, sampling was conducted in the only readily accessible infestation in the District, along Sunrise Creek, east of Moyie Lake. Sequential sampling indicated the infestation was in the severe category.

Square foot soil samples were taken from beneath each of 10 randomly selected trees and all cocoons, both old and new, were separated from the earth. The average number of cocoons per square foot containing living larvae was 39.4. The following table shows the results of examination of 103 unsound cocoons:

Emerged	Predation by		*Mesoleius* parasitism	Mouldy
	Mammals	Elateridae		
22	27	5	6	43

Dissection of 10 living larvae from each of the 10 samples showed that 94 were healthy, five were parasitized by *Mesoleius tenthredinis* Morley, and one parasitized by *Tritneptis klugii* (Ratz.).

Larch sawfly infestations will probably increase in size in 1966 as 1965 egg crooks were observed in areas where there was no noticeable defoliation in 1965.

A Larch Bud Moth, *Zeiraphera* sp.

Damage to western larch caused by this insect was first observed in the District near Canuck Creek in mid-July. By this time the only evidence of insects other than defoliation was one dead larva found in a needle bundle. In all, approximately 7,000 acres of larch stands from the 4,000 foot level to the upper elevation limit of the host were affected. All infestations were in mature or pole-sized stands.

Damage, when viewed from the air, resembled that caused by *Hypodermella laricis* Tub., a needle cast disease. On close examination it was noted that the insects fed inside tubes formed of the needle bundles. The characteristic yellowish-brown colour of infested trees was produced when the bundles broke and the partially eaten portions of the needles became exposed. After the dead tips of the needles had dropped, later in the season, the only indication of infestation was a thinning of the foliage.

As a satisfactory sampling method for determining overwintering populations was not developed in 1965, no data was obtained on the trend of infestations.

A Spruce Tip Moth, Zeiraphera fortunana Kft.

A significant decrease in the percentage of Engelmann spruce tips infested by this insect was noted in the Whiteswan Lake-White River area in 1965. Damaged buds were also observed in the Bull River and Elk River drainages on understory spruce trees. Larvae were taken in random Engelmann spruce beating samples throughout the District.

Table 8 shows the data gathered from five 18-inch branch samples taken from each of three understory Engelmann spruce trees at four locations in the Whiteswan Lake-White River area.

Table 8

Percentage of Engelmann Spruce Tips Damaged by Zeiraphera fortunana Kft., East Nelson District

Locality	Range		Average	
	1964	1965	1964	1965
Inlet Creek	0 - 21	1 - 4	8	2
Elk Creek	13 - 35	4 - 8	22	5
Rock Creek	18 - 21	0 - 14	20	5
Whiteswan Lake	15 - 28	3 - 8	23	6

Aspen Leaf Miner, Phyllocnistis populiella Cham.

Populations of the leaf miner were generally moderate to severe throughout the District in 1965. Little fluctuation in the percentage of leaf surfaces mined was observed at the St. Mary Lake and Findlay Creek plots in 1965. The percentage of leaf surfaces mined increased appreciably at the Nicholson plot, although the number of adults produced per 100 leaf surfaces decreased. Significant decreases in both the percentage of leaf surfaces mined and the number of adults produced were observed at the Moyie Lake plot (Table 9). Mortality in the cocoon stage due to parasitism and other causes increased at St. Mary Lake and Nicholson and decreased at the Findlay Creek plot (Table 10). The plot established near Dutch Creek in 1962 was removed during right-of-way clearing, necessitating the establishment of a new plot in the same area.

Table 9

Percentage of Aspen Leaf Surfaces Mined and Average Number of Adult Aspen Leaf Miners Produced per 100 Leaf Surfaces at Five Localities, East Nelson District.

Locality	Percentage of leaf surfaces infested			Av. no. of adults produced per 100 leaf surfaces		
	1963	1964	1965	1963	1964	1965
St. Mary Lake	81	82	89	41	55	56
Moyie Lake	67	57	36	52	43	24
Findlay Creek	27	45	38	110	13	11
Dutch Creek	-	-	78	-	-	11
Nicholson	20	48	62	13	20	15

Table 10

Aspen Leaf Miner Mortality in 100-Cocoon Samples at Five Plots in the East Nelson District

Locality	Percentage mortality in the cocoon stage					
	Parasitism			Other causes		
	1963	1964	1965	1963	1964	1965
St. Mary Lake	17	9	13	18	9	13
Moyie Lake	9	7	11	5	11	8
Findlay Creek	19	23	17	13	11	9
Dutch Creek	-	-	34	-	-	18
Nicholson	6	23	38	2	13	15

Western Hemlock Looper, Lambdina fiscellaria lugubrosa (Hulst)

A noteworthy decrease in the percentage of samples from five coniferous hosts containing hemlock looper larvae occurred in 1965 (Table 11).

The maximum number of larvae in a single sample was 20, taken from western hemlock near Rogers. Random three-tree beatings of western red cedar produced a maximum of 17 larvae, alpine fir, two larvae, and Engelmann spruce, three larvae. Generally, only one to three larvae were found in collections taken from other hosts.

Table 11

Summary of Western Hemlock Looper Collections Taken Between June 9 and August 8 from Five Coniferous Hosts, East Nelson District

Host	No. of samples taken during larval period			% samples containing larvae			Average number of larvae per sample		
	1963	1964	1965	1963	1964	1965	1963	1964	1965
Douglas-fir	69	65	94	13	25	5	1.7	1.8	1.4
Western hemlock	18	22	26	56	64	54	3.2	5.4	5.4
Western red cedar	10	13	17	50	62	47	4.4	5.1	5.3
Engelmann spruce	33	39	40	33	49	3	3.2	2.6	3.0
Alpine fir	23	32	30	26	56	23	8.0	4.2	1.1

False Hemlock Looper, Nepytia freemani Munroe

A general decrease in populations of this looper in the District was noted in 1965. Although the percentage of Douglas-fir collections containing loopers increased from 15% in 1964 to 25% in 1965, the number of larvae decreased from eight per sample in 1964 to four in 1965. The maximum number of larvae in a collection in 1965 was 18, taken in a three-tree beating near Dry Gulch Campsite, south of Radium Junction. In 1964 a single sample along the Toby Creek Road yielded 41 larvae. Larvae were more commonly collected in the Invermere Ranger District than in any other area.

Black-headed Budworm, Acleris variana (Fern.)

Population density of the black-headed budworm remained at a low level in mature and overmature hemlock stands in the District in 1965. Light defoliation of current hemlock foliage was noted near Rogers during the first week of August. A three-tree hemlock sample at this locality on August 2 yielded 31 larvae, the maximum taken in a collection in 1965. Aerial surveys of the Columbia River watershed from Donald Station to Boat Encampment late in August failed to reveal any defoliation. Larvae were commonly found in Engelmann spruce beatings in the White River area.

The following table gives a summary of the occurrence of black-headed budworm in collections taken between June 18 and August 6 from three coniferous hosts.

Host	No. of samples taken during larval period			% samples containing larvae			Average number of larvae per sample		
	1963	1964	1965	1963	1964	1965	1963	1964	1965
Engelmann spruce	29	31	37	35	23	14	1.5	2.6	3.2
Alpine fir	19	26	30	0	35	10	-	3.0	1.0
Western hemlock	17	15	26	12	47	19	2.0	3.7	7.6

Engelmann Spruce Weevil, *Pissodes engelmanni* Hopk.

Examination of the plot along the Corbin Road was conducted on September 28. It appeared that the weevil population in this area was waning as there was a decrease in the number of trees attacked. Table 12 shows the data gathered from examination of 100 open-growing Engelmann spruce trees. Variation in the number of uninfested trees arises from the fact that trees are not tagged, but are chosen randomly each year.

Table 12

Healthy and Attacked Engelmann Spruce Trees, Corbin Road, East Nelson District

Year	Percentage of trees		
	Current attack	Old attack	Uninfested
1962	64	11	25
1963	50	28	22
1964	55	27	18
1965	38	23	39

Forest Tent Caterpillar, *Malacosoma disstria* Hbn.

A total collapse of tent caterpillar infestations in trembling aspen and black cottonwood stands in the Columbia Valley occurred in 1965.

No defoliation was observed west of the Columbia River between Brisco and Radium Junction where very light populations existed in 1964. Egg sampling was discontinued at all plots in 1965.

Tree mortality plots at Nicholson and Donald Station were examined late in August. All 10 trees at both Nicholson plots were apparently healthy, and at the Donald Station plot one of 10 trees was dead; the remaining nine appeared to be healthy. Most trees in all three plots had dead branches in the lower crown which is typical of trembling aspen in these areas.

Spruce Budworm, Choristoneura fumiferana (Clem.)

Spruce budworm larvae were very scarce in beating samples in 1965. The infestation which built up in a lodgepole pine stand in the Yahk River area in 1964 collapsed. When this area was surveyed on July 16, 1965 no defoliation was evident and a three-tree sample of lodgepole pine yielded only five larvae.

Beating samples from other portions of the District produced a maximum of three larvae per collection. This was found in a Douglas-fir sample near Dutch Creek.

A Woolly Aphid on Larch, Adelges oregonensis Annand

Populations of this aphid were commonly found infesting foliage of western larch in the southern portion of the District in 1965. Most severe infestations of regeneration and pole-sized trees were observed along Tanglefoot Creek, Gold Creek Road, near Wardner and in the Flathead Valley near the International Boundary. In some cases the trees were almost snowy white.

A Midge in Ponderosa Pine Tips, Retinodiplosis sp.

Damage to open growing regeneration and pole-sized ponderosa pine trees was moderate to severe near Skookumchuck Station. Up to 75% of the lateral tips of some trees were infested. Light attack was also observed in ponderosa pine stands near Waldo.

A Leaf Blotch Miner, Lyonetia saliciella Busck

Only a very light infestation of white birch, willow and alder by the blotch miner was evident along the Big Bend Highway from Donald Station to Kinbasket Lake. Damage was not readily discernible from the air as in past years.

Western Balsam Bark Beetle, Dryocoetes confusus Sw.

An increase in the number of alpine fir trees killed by this beetle was noted in 1965. Largest infestations were observed in alpine country northeast of Kinbasket Lake and in the area of the headwaters of Bull River (Table 13).

Table 13

Locations and Estimated Numbers of Alpine Fir Trees Killed by Western Balsam Bark Beetle, East Nelson District, 1965

Locality	Estimated number of red-tops
Kinbasket Lake	750
Upper Bull River	500
Linklater Creek	250
Bighorn Creek	370
Cabin Creek	300
Yahk River	200
Lamb Creek	150
Total	2,520

Poplar-and-willow Borer, Sternochetus lapathi (L.)

Infested willow clumps were again common throughout the southern portion of the District in 1965. Most severe attack was observed along Findlay Creek Road. Willows along the Yahk River and Moyie River roads suffered moderate infestation by the weevil.

Other Noteworthy Insects

Insect	Host	No. of collections	Remarks
Altica sp.	Bi	-	Light population along Frances Cr. Rd.
Dichelonyx sp.	F	-	Common in small numbers. No defoliation visible along Joseph Cr. Rd.
Griselda radicana Wlshm.	H, Ba, Se, F	13	Increase; maximum of 3 larvae per collection.

Other Noteworthy Insects - Continued

Insect	Host	No. of collections	Remarks
Ips sp. prob. *amiskwiensis* G. Hopp.	Se	-	Moderate to heavy infestations in windfalls in Fernie Ranger District.
Malacosoma pluviale Dyar	Antelope bush	-	Very light populations.
Monochamus sp.	Se	-	Light populations in windfalls.
Neodiprion spp.	H, Pl, Se, F	7	Decrease from 1964; maximum of 25 larvae per sample.
Pikonema alaskensis Roh.	Se	2	Decrease.
P. dimmockii Cress.	Se	4	Decrease.
Pissodes alascensis Hopk.	Se	-	Found in windfalls; not numerous.
Pleroneura borealis Felt	Ba	-	Light populations in tips along Inlet Cr.
Semiothisa granitata complex	F	2	Very scarce.
Tetropium sp.	Se	-	Small numbers in windfalls.
Vespamima sequoiae (Hy. Edw.)	Pl, Py	-	Common throughout range of hosts.

FOREST DISEASE CONDITIONS

Important Diseases

Ink Spot of Aspen

Moderate to severe infection of trembling aspen foliage by *Ciborinia whetzelii* (Seaver) Seaver occurred in the Yahk and Elk valleys. Light infections were observed in the southern Flathead Valley. Leaves which were infected in 1964 and overwintered at the Wasa Ranger cabin failed to produce fructifications in 1965.

Fume Injury

Plant life in the vicinity of Kimberley suffered apparent fume injury from emissions from the iron and fertilizer plants in this community. Browning foliage has existed for several years, but became more noticeable in 1965. Many species of both broad-leaved and coniferous plants exhibited damage symptoms with most severe browning of foliage noted on ponderosa and lodgepole pines and western larch. The approximate total area of damage was 3,700 acres extending from Kimberley to Marysville and to the slopes of North Star Hill west of Kimberley.

Phomopsis Canker of Douglas-fir

Infection of regeneration and pole-sized Douglas-fir trees by Phomopsis pseudotsugae Wils. was observed at Premier Lake and near Baynes Lake. Dead and dying lateral branches were quite common in both areas early in June.

Douglas-fir Needle Rust

Moderate to severe infection of Douglas-fir foliage by Melampsora medusae Thüm. was common on regeneration and pole-sized trees west of Lake Windermere. On some trees up to 100% of the current needles were infected and needle drop was noted on many trees at the end of July.

Spruce Needle Rust

Engelmann spruce trees along the North Fork of the White River were lightly to moderately infected by Chrysomyxa ledicola Lagh. Severe infection was observed on spruce trees along the Nicholson-Donald Road, west of the Columbia River. In many instances infections were so severe as to give the tree an orange hue.

Pine Needle Cast

Infection of lodgepole pine by Elytroderma deformans (Weir) Darker was moderate to severe in the Whitetail Lake area in 1965. Light infection was observed on lodgepole and ponderosa pines in the vicinity of Kimberley and Marysville.

Larch Dieback

Numerous regeneration larch trees near Dewar Creek along the west fork of St. Mary River have been infected with a dieback-causing fungus. Most small larches in this area have multiple leaders and dead branches, indicating the disease has been present for some time. The causal fungus has been determined as a species of Godronia.

Bud Necrosis of Douglas-fir and Engelmann Spruce

Douglas-fir understory at the north end of Whiteswan Lake was moderately infected with an unknown bud-killing pathogen. Fructifications were also commonly found on Engelmann spruce understory in the White River area. The perfect state of the causal fungus was collected from Engelmann spruce on October 1.

Porcupine Damage

Porcupines again killed lodgepole pine trees in the Lodgepole Creek, Bull River and St. Mary River watersheds. Some damage was also observed in the Yahk River drainage.

Douglas-fir Dieback

The three plots established to record progress of Douglas-fir dieback were examined early in September. There was little recent mortality of terminals, laterals or whole trees. The following table shows the data gathered from plot examinations in 1964 and 1965.

Location	Year	No. of trees examined	Healthy	No. with dead laterals	No. with dead terminals	Dead
Premier	1964	91	53	33	10	3
L. Rd.	1965	91	47	34	9	5
Canal	1964	98	83	7	2	4
Flats	1965	98	81	8	5	4
Inver-	1964	93	63	30	1	1
mere	1965	93	61	31	1	2

Exotic Plantations

The three exotic plantations in the District were examined late in August. Dead or partially dead trees were found at two plots. The following table gives a summary of the condition of trees in the plantations.

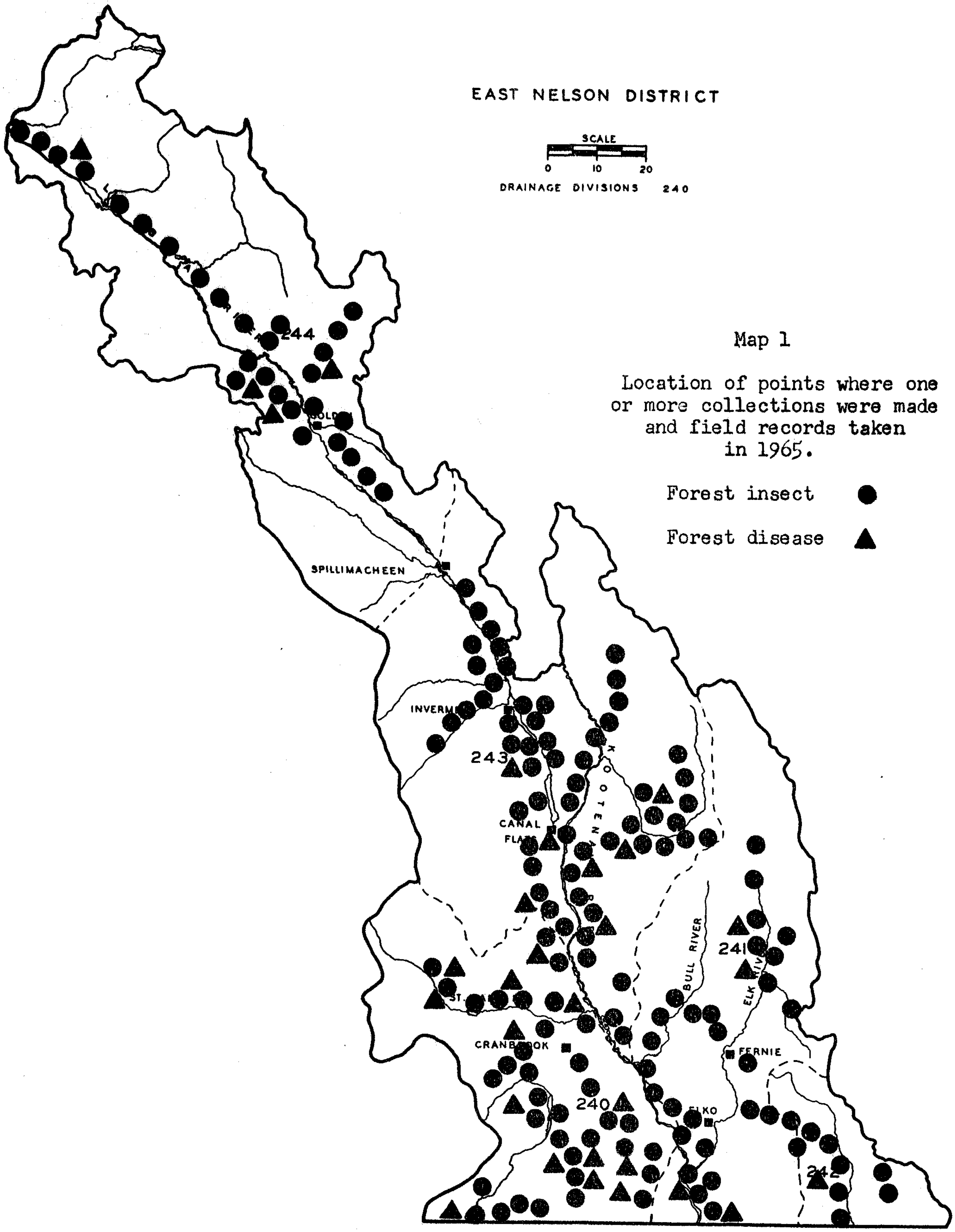
XP number	Location	Exotic species	Remarks
143	Yahk River	*Pinus sylvestris*	Myxomycetes fruiting on stems and branches of two trees, one of which was dead. Up to 10 inches of current height growth on most healthy trees.

Exotic Plantations - continued

XP number	Location	Exotic species	Remarks
149	Moyie River	Larix decidua	Many trees have again suffered browsing damage. Up to 10 inches of current height growth on many trees.
171	Findlay Cr.	Larix decidua	Dieback of main stem caused by Sclerophoma sp. found on three trees. Up to 12 inches of current height growth on healthy trees. Some browsing damage. Plantation becoming suppressed by heavy shrub growth.

Other Noteworthy Diseases

Host	Organism	Locality	Remarks
Aster	Coleosporium asterum (Diet.)	Sparwood	Lodgepole pine needle rust.
Buckthorn	Puccinia coronata Cda.	Flathead Valley	Leaf rust.
Lodgepole pine	Hendersonia pinicola Wehm.	Gold Creek	Needle disease; common in this area.
Western hemlock	Melampsora epitea Thüm. f. sp. tsugae Ziller	Donald-Nicholson Road	Needle rust.
Western larch	Hypodermella laricis Tub.	Skookumchuck Cr.	Needle cast; light infections.

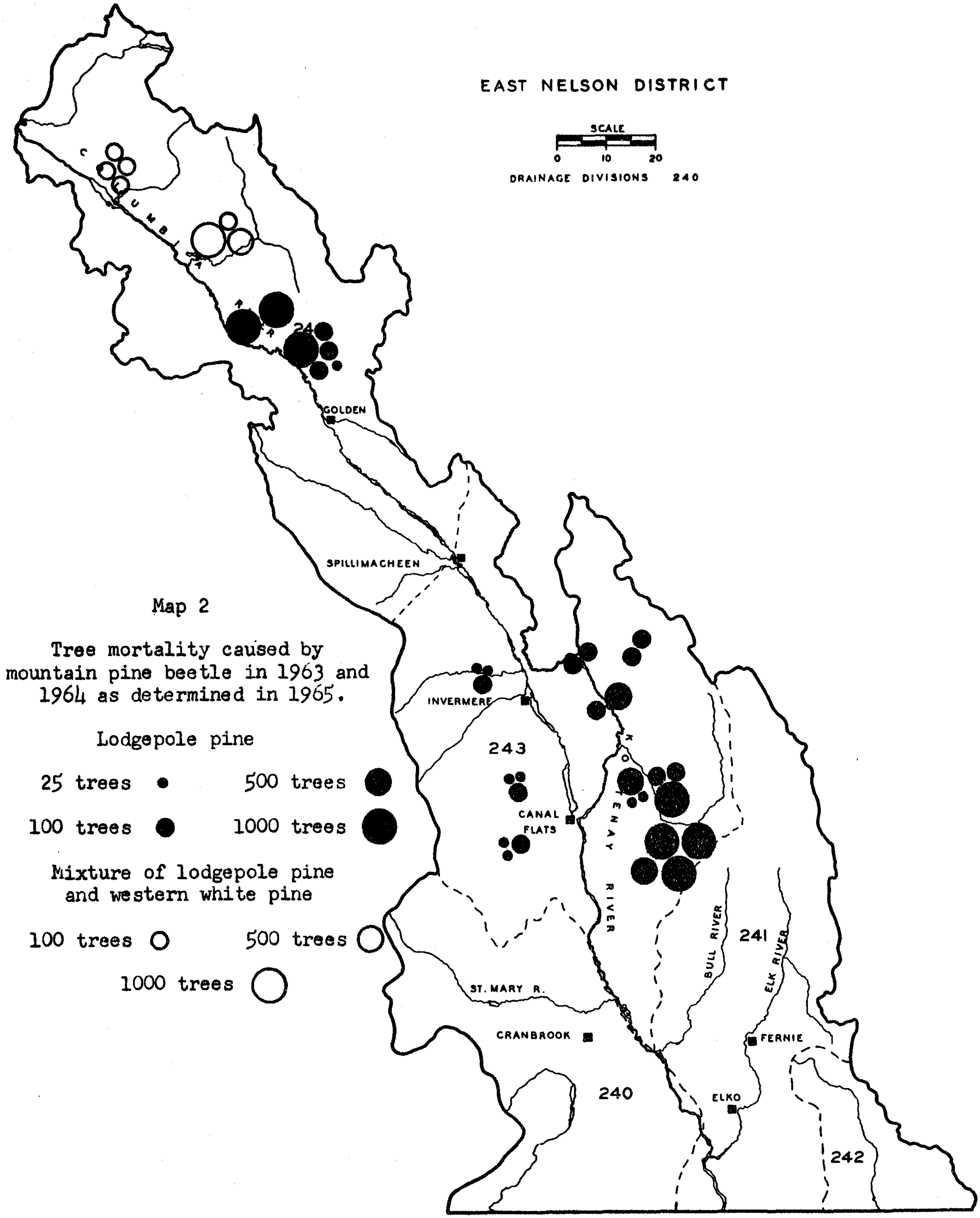


Map 1

Location of points where one or more collections were made and field records taken in 1965.

Forest insect ●

Forest disease ▲



Map 2

Tree mortality caused by mountain pine beetle in 1963 and 1964 as determined in 1965.

FOREST INSECT AND DISEASE SURVEY

BRITISH COLUMBIA

1965

PRINCE GEORGE FOREST DISTRICT

and

YUKON TERRITORY

FOREST INSECT AND DISEASE SURVEY

PRINCE GEORGE FOREST DISTRICT

AND

YUKON TERRITORY

1965

C. B. Cottrell

INTRODUCTION

Forest Research Technicians assigned to the Prince George and Yukon districts in 1965 were: R. O. Wood, Yukon and North Prince George; J. C. Holms, West Prince George; and C. B. Cottrell, South Prince George. A new member of the Forest Insect and Disease Survey, D. F. Doidge, spent six weeks in the West and South Prince George districts. Ten technicians and three members of the B. C. Forest Service appraised the spruce beetle outbreak for three weeks in September.

Bark beetles remained the most serious pests west of the Rocky Mountains although their populations were much reduced by climatic conditions in the winter of 1964-65. The spruce beetle attacked an estimated 11 million cubic feet of spruce in 1964 but surveys indicated that most of the beetles in the 1965 flights entered windfalls. Counts made in 1965 of red-topped lodgepole pine near Kuzkwa River and Bivouac Creek were higher than the year before but examinations made on the ground indicated a high mountain pine beetle brood mortality and very little fresh attack. The number of trees killed by Douglas-fir beetles in the Stuart Lake and Narcosli Creek areas remained at a low level.

East of the Rocky Mountains, the one-year-cycle spruce budworm continued to cause severe defoliation of white spruce in the Liard, Fort Nelson, Muskwa and Prophet valleys. Tree mortality was light but the infestation is expected to continue in 1966. West of the Rockies, the two-year-cycle spruce budworm remained at a low level.

Defoliation caused by the larch sawfly was generally light to moderate along the Hart and Alaska highways. Tent caterpillar infestations near Taylor and McBride collapsed. Aspen leaf miner populations in Yukon Territory and Prince George Forest District declined and damage was light.

STATUS OF THE SPRUCE BEETLE

PRINCE GEORGE FOREST DISTRICT

1965

C. B. Cottrell, J. C. Holms and D. A. Ross

Introduction

In 1964, surveys in the Prince George Forest District indicated that 433 million cubic feet of white spruce, Picea glauca (moench) Voss, on 550 thousand acres had been killed or attacked up to and including 1963 by the spruce beetle, Dendroctonus obesus (Mann.) (Cottrell et al 1964).[1] In 1965 the aerial and ground surveys again were carried out by personnel of the British Columbia Forest Service and Canada Department of Forestry to ascertain the extent of the epidemic and to determine the amount of tree mortality. Observations begun in 1963 on the beetle's life history were continued in 1965 to obtain a basis for predicting the trend of the outbreak.

Methods

Spruce beetle mortality in the winter of 1964-65 was assessed in May, 1965 at four locations: Kerry Lake, Aleza Lake, Wells and Kenny Lake. A square foot bark sample was taken from the base of 65 standing spruce trees, and from three areas on the bole of 24 downed spruce, at 5, 20 and 35 feet from the base of the tree.

Known areas of 1964 beetle-attack were observed from the air and on the ground from early June to late July to determine the progress of foliage discoloration, on which the timing of aerial mapping was based.

Spruce beetle infestations in the Prince George Forest District were mapped in 16 hours flying time between August 11 and 17, 1965. All major old infestations were systematically examined from the air; in addition some outlying infestations were observed on routine patrol flights with the B. C. Forest Service.

Intensity of attack was recorded as: light, up to 5% of the stems killed; medium, 6 to 30%; and heavy, over 30%. Mapping was usually done at heights less than 1,000 feet above tree level. All aerial recording was done on two mile to the inch interim forest cover series maps. Later, acreages were calculated with aid of a dot grid.

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[1] C. B. Cottrell, J. C. Holms and D. A. Ross. 1965. Spruce Beetle Report, Prince George Forest District, 1964. Can. Dept. For., For. Ent. Lab., Vernon. Inform. Rep. 6 pp.

Some of the ground strips established in 1963 and 1964 and still un-logged were re-surveyed in September 1965. New survey strips were established in recently attacked areas bringing the total to 26 strips. Each strip was one chain wide and from 50 to 100 chains long. Center lines were painted on all strips and in each of six permanent strips individual trees were marked to show year of attack. Twenty hours of helicopter time were used to ferry survey personnel into inaccessible areas.

Data recorded on ground strips were: diameter of healthy and attacked trees eight inches dbh and over, year of attack, severity of attack, and diameters of new and old windfalls and their infestation status. Diameters and heights were determined for 20 trees on each strip to obtain data for calculating timber volumes. The "Standard Cubic-foot Volume Table for Interior Spruce Species (All Ages)", British Columbia Forest Surveys and Inventory Division, 1962, was used.

Ground strips were located in areas rated from the air as light and medium attack. The average volume per acre of spruce attacked in 1964, calculated from the ground strips, was applied to the areas of corresponding severity class mapped from the air.

The life cycle of the spruce beetle was investigated further at eight locations in the District: Tudyah Lake, McLeod Lake, Kerry Lake, Merton Lake, Aleza Lake, Pitoney Lake, Kenny Lake, and near Wells. Late in May, two healthy mature spruce trees were felled at each plot. Two four-foot bolts were cut from each tree and left lying on the ground. Late in September, the numbers of larvae, pupae and adults were recorded from a two-foot section of each bolt.

Results and Discussion

Aerial surveys in 1965 indicated that spruce beetle attacks in 1964 occurred on an estimated 48,300 acres (Map 1), including heavy attacks for 540 acres, medium attacks for 17,000 acres, and light attacks for 30,760 acres, (Table 1). Much of this area had been attacked earlier in the epidemic. Of the 48,300 acres it was estimated that only an additional 5,000 acres of spruce were freshly infested bringing the total acreage of beetle-killed or currently infested trees to 555,000 by the end of 1964. Most 1964 beetle-killed trees were at high elevations (3,000' to 5,000') bordering areas where trees had been killed in 1963.

Extensive areas of 1964 medium attack containing pockets of heavy attack were: 1,160 acres near Isadore and Hodda creeks in the Parsnip Sustained Yield Unit; 5,840 acres between Wansa and Pitoney lakes in the Willow Sustained Yield Unit, and 980 acres between Genevieve and Yardley lakes in the Naver Sustained Yield Unit.

Notable areas of medium attack were: 2,180 acres southeast of Firth Lake in the Crooked River Sustained Yield Unit; 960 acres on Seebach Creek, 1,080 acres on Otter Creek and 560 acres along the McGregor River in the Monkman Sustained Yield Unit; 720 acres west of Ahbau Lake in the

Naver Sustained Yield Unit, and 520 acres along Tregillus Creek in the Cottonwood Sustained Yield Unit.

Beetle attacks were light along the Upper Fraser and Bowron rivers where vast numbers of spruce were attacked in 1961 and 1962.

The intensity of beetle attack in the Prince George Forest District is shown in Table 2. The 11 million cubic feet of white spruce eight inches dbh and over beetle-attacked in 1964 (Table 3) was much less than the amount attacked in previous years (Table 4). The total volume of beetle-attacked white spruce in the current epidemic was estimated to be 444 million cubic feet. Estimated acreages and volumes attacked in 1964 are presented by Sustained Yield Unit and Tree Farm License areas (Table 5).

Due in part to a cold, wet summer in 1964, very few broods could complete their life cycle by the following year. Adults that developed in 1965 from eggs laid in 1964 will not attack until 1966. The 1965 beetle flight probably was composed mostly of adults from the 1963 broods. The majority of the broods begun in 1963 overwintered twice and were much reduced in numbers during the winter of 1964-65 (Table 6).

Less than half of the ground strips contained 1965-attacked trees and in all cases the attack was light. The area involved in the 1965 attack cannot be estimated until the foliage of attacked trees discolors in 1966. However, the ground strips indicated that the majority of beetles of the 1964 and 1965 flights entered windfalls and other downed material rather than standing trees. Therefore the 1965 attack on trees probably was less than that in 1964 with the possible exception of some remote high elevation areas where deep snow coverings afforded protection to overwintering beetles. There was a smaller number of windfalls per acre in 1965 than in 1964 or 1963, but a high percentage of the windfall were infested (Table 7).

Most of the 1965 broods in log sections in eight life cycle plots (Table 8), and in wind-felled trees on ground strips entered the winter of 1965-66 in the larval stage. These larvae should become adults in the summer of 1966, overwinter and attack in 1967. A small population of 1965 parent adults may attack in 1966.

Summary

The spruce beetle infestation in the Prince George Forest District declined sharply in 1964. Aerial and ground surveys showed that the 10,866,000 cubic feet of white spruce represented only 2.4% of the total loss since 1961. The attacked trees occurred on 48,300 acres, mainly at high elevations. The total volume of spruce killed in the past four or five years was estimated at 444 million cubic feet on 555 thousand acres.

The 1965 attack appeared to be light in standing trees due to slow development of the 1964 broods and to heavy brood mortality in the winter of 1964-65. Most of the beetles in the 1965 flight appeared to have entered wind-felled trees. Although the quantity of windfall is not great, a high percentage were infested.

The 1966 attack is also expected to be light since only a small percentage of the 1965 broods attained adulthood in 1965; the 1966 beetle flight will mainly comprise adults from the 1964 broods.

Acknowledgements

The co-operation of members of the B. C. Forest Service is gratefully acknowledged. Most of the 40 hours flying time for aerial mapping and ferrying survey personnel into inaccessible areas were provided by the Prince George Forest District. The Victoria office of the B. C. Forest Service Management Division provided three men for three weeks to assist Department of Forestry Forest Research Technicians in the ground survey.

Table 1

Estimated Acreage of White Spruce Stands Attacked by Spruce Beetle in 1964, Prince George Forest District, as Mapped from Air, August 1965

Location	Heavy	Medium	Light 1/	Total
Parsnip S.Y.U.	200	2,120	3,140	5,460
Carp S.Y.U.	-	200	400	600
Crooked S.Y.U.	-	2,200	5,980	8,180
Upper Fraser River				
T.F.L. 28	-	440	80	520
T.F.L. 29	-	100	480	580
T.F.L. 30	-	-	240	240
T.F.L. 31	-	-	120	120
T.F.L. 34	-	960	220	1,180
Pr. Geo.-Aleza S.S.A.		-	280	280
Monkman S.Y.U.		1,840	5,000	6,840
Longworth S.Y.U.		-	1,580	1,580
Robson S.Y.U.	-	-	200	200
Purden S.Y.U.	-	-	1,960	1,960
Willow S.Y.U.	220	5,640	3,800	9,660
Naver S.Y.U.	120	2,780	2,880	5,780
Big Valley S.Y.U.		640	3,300	3,940
Bowron S.Y.U.		-	140	140
Cottonwood S.Y.U.	-	80	800	880
T.F.L. 5	-	-	160	160
Totals	540	17,000	30,760	48,300

1/ Intensity of attack: light, up to 5% of the stems killed; medium, 6 to 30%; and heavy, over 30%.

Table 2

Summary of Ground Survey Data on Beetle-attacked Spruce 8 in. DBH and Over, Prince George Forest District, September 1965

Location of strip	No. acres	No. trees	Total volume (cu. ft.)	% volume attacked	% trees attacked 1965	1964	1961-63
McLeod L.	8	457	35,624	10.0	0	0.8	3.8
Weedon Cr.	9	482	42,213	13.9	0.2	1.3	8.6
Firth L.	5	185	21,169	42.6	0	12.7	18.3
" "	6	381	29,372	22.2	1.8	6.1	5.5
" "	6	129	14,417	17.3	0	0.6	12.8
Kerry L.	8	553	41,296	9.3	0	0.4	7.5
Angusmac Cr.	8	339	30,425	10.7	0	2.6	7.7
Davie L.	8	374	29,458	11.8	0	0.5	8.9
Merton L.	6	425	32,364	14.1	0.2	1.8	13.3
Barney Cr.	8	591	60,013	4.9	0	0.5	2.6
McGregor R.	6	275	23,850	28.5	0.3	8.1	6.2
" "	7	277	23,569	15.0	3.8	2.5	6.6
Woodall Cr.	6	290	20,469	2.2	0	1.0	1.0
Hansard	8	185	22,869	5.6	0	0	3.6
"	9	408	39,414	10.9	0	0	8.7
Aleza L.	6	309	34,488	24.9	0	2.2	13.3
" "	8	526	46,151	27.5	0	1.4	18.4
Wansa L.	8	475	49,481	8.0	0.2	0.6	3.2
" "	6	438	26,364	16.5	0.4	5.7	4.9
Pitoney L.	8	537	66,586	31.7	0	1.3	27.7
" "	8	685	57,938	13.7	0	0.8	9.7
" "	10	650	76,936	14.7	0	1.1	8.0
Naver Cr.	8	566	54,676	12.4	0.5	4.1	2.9
Tregillus Cr.	8	482	25,918	3.8	0	0.2	3.0
" "	8	415	44,773	11.1	1.4	2.7	1.4
Wingdam	8	652	42,246	20.9	0.1	1.5	10.4

Table 3

Acreages and Volume of Spruce Trees 8 in. DBH and Over
Attacked by Spruce Beetle in 1964, Prince George Forest District, 1965

Infestation rating	Acreage attacked	Av. volume attacked per acre (cu. ft.)	Total volume attacked (MCF)
Heavy	540	est. 1,500	810
Medium	17,000	445	7,565
Light	30,760	81	2,491
Totals	48,300		10,866

Table 4

Estimated Volume of Spruce 8 in. DBH and Over Attacked by
Spruce Beetle in the Current Epidemic, Prince George Forest District

Year	Volume of beetle-attacked timber (MCF)
1964	10,866
1963	53,170
1962	306,087
1961 2/	73,942
Total	444,065

2/ May include trees attacked in 1959 and 1960.

Table 5

Estimated Acreage and Volume of Trees 8 in. DBH and Over Attacked by Spruce Beetle in 1964, Prince George Forest District, 1965

Location	No. acres	Est. volume attacked (cu. ft.)
Parsnip S.Y.U.	5,460	1,497,740
Carp S.Y.U.	600	121,400
Crooked S.Y.U.	8,180	1,463,380
Upper Fraser River		
T.F.L. 28	520	202,280
T.F.L. 29	580	83,380
T.F.L. 30	240	19,440
T.F.L. 31	120	9,720
T.F.L. 34	1,180	445,020
Prince George-Aleza S.S.A.	280	22,680
Monkman S.Y.U.	6,840	1,223,800
Longworth S.Y.U.	1,580	127,980
Robson S.Y.U.	200	16,200
Purden S.Y.U.	1,960	158,760
Willow S.Y.U.	9,660	3,147,600
Naver S.Y.U.	5,780	1,650,380
Big Valley S.Y.U.	3,940	552,100
Bowron S.Y.U.	140	11,340
Cottonwood S.Y.U.	880	100,400
T.F.L. 5	160	12,960
Totals	48,300	10,866,560

Table 6

Average Number of Living and Dead Spruce Beetles per Square Foot in Standing and Downed Spruce at: (a) Kerry Lake; (b) Aleza Lake; (c) Wells, and (d) Kenny Lake, May 1965

(a) Kerry Lake

Year of attack	Condition of trees	No. of samples	Av. no. per sq. ft.			
			Adults		Larvae	
			Living	Dead	Living	Dead
1964	standing	4	0	0	18.3	0.5
1964	downed	7	1.7	2.3	20.1	26.1
1963	standing	7	0.7	6.7	0	0
1963	downed	6	0	1.0	0	0

(b) Aleza Lake

1964	standing	14	0.5	0.8	2.8	0.3
1964	downed	12	2.9	1.4	14.1	7.6
1963	standing	25	0	0	0	0
1963	downed	15	8.7	4.5	0	0

(c) Wells

1963	standing	2	21.0	5.5	0	0
1963	downed	4	20.0	2.7	0.8	1.3

(d) Kenny Lake

1964	standing	8	0.8	0.4	6.1	0.6
1964	downed	16	0.7	0.9	10.8	2.5
1963	standing	5	0.6	0.6	0	0.6
1963	downed	5	14.6	2.4	0.6	0

Table 7

Number of New Windfall 8 in. DBH and Over and Percentage Infested in Ground Survey Strips, 1965, 1964 and 1963, Prince George Forest District

Year	No. acres	No. new windfall		% new windfall infested	No. new windfall per acre	
		Infested	Not infested		Infested	Not infested
1965	194	51	21	71	0.26	0.11
1964	307	131	116	53	0.43	0.38
1963	383	154	35	82	0.40	0.09

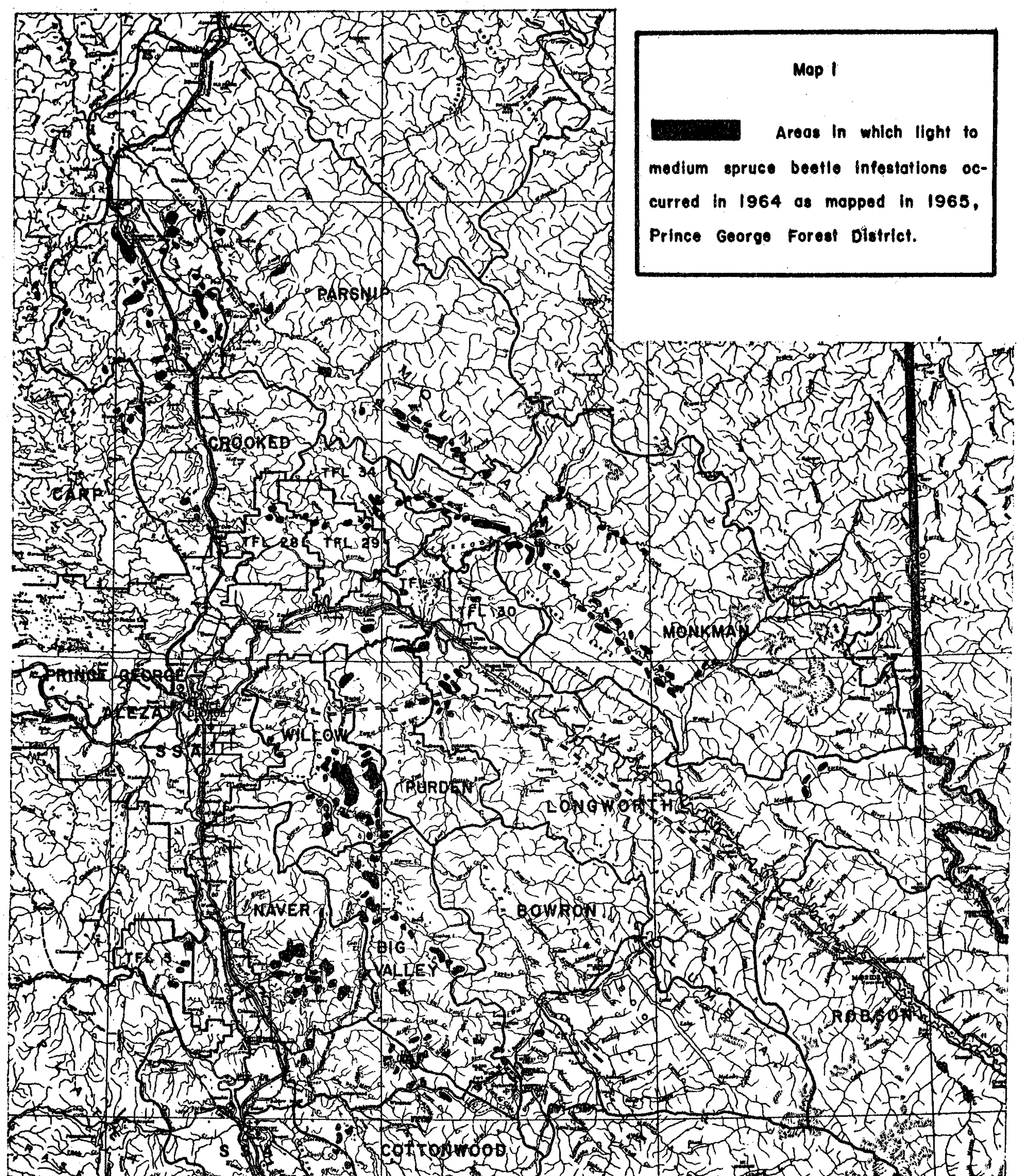
Table 8

Average Number of Living Spruce Beetles per Square Foot in Log Sections Cut in May 1965 and Examined in September 1965, Prince George Forest District

Location	Elevation (ft.)	No. per sq. ft.			
		Larvae	Pupae	Teneral adults	Parent adults
Tudyah L.	2300	12.1	0.9	0.5	2.7
McLeod L.	3000	57.4	2.7	0.3	2.2
Kerry L.	2300	13.7	6.6	2.5	2.2
Merton L.	2800	23.0	0.5	0.1	1.4
Aleza L.	2100	0.5	0.1	1.6	0.5
Pinoney L.	3100	50.0	1.9	-	2.3
Wells	4000	65.5	-	-	2.6
Kenny L.	2900	17.0	0.5	-	1.1

Map I

Areas in which light to medium spruce beetle infestations occurred in 1964 as mapped in 1965, Prince George Forest District.



FOREST INSECT AND DISEASE SURVEY

SOUTH PRINCE GEORGE DISTRICT

1965

FOREST INSECT AND DISEASE SURVEY

SOUTH PRINCE GEORGE DISTRICT

1965

C. B. Cottrell

INTRODUCTION

Field work in the South Prince George District began on May 10 and ended on October 6. Twenty-eight hours flying time was used to map bark beetle infestations and to ferry ground survey crews into inaccessible areas. Of the total, 19 hours were supplied by the British Columbia Forest Service. In September, 10 Forest Research Technicians and three B. C. Forest Service people cruised beetle-killed spruce for three weeks.

During the field season, 291 insect and 10 forest disease collections were made. Table 1 lists the collections by hosts and Map 1 shows locations where collections and field records were taken in 1965.

Table 1

Collections by Hosts

South Prince George District - 1965

Coniferous hosts	Forest insects	Forest diseases	Broad-leaved hosts	Forest insects	Forest diseases
Douglas-fir	31	6	Alder, mountain	1	-
Fir, alpine	77	2	Aspen, trembling	28	-
Hemlock, western	18	-	Birch, western white	2	-
Juniper, Rocky Mtn.	2	-	Cottonwood, black	2	-
Pine, lodgepole	27	2	Maple, Douglas	1	-
Spruce, white	95	-	Willow spp.	3	-
Miscellaneous	5	-			
Totals	255	10		37	-
			GRAND TOTAL	292	10

FOREST INSECT CONDITIONS

Important Insects

Spruce Beetle, Dendroctonus obesus (Mann.)

See Spruce Beetle Report following introduction to Prince George Forest District Report.

Douglas-fir Beetle, *Dendroctonus pseudotsugae* Hopk.

The number of Douglas-fir trees killed by beetles remained at a low level in the South Prince George District. Most of the estimated 1,240 dead trees were in the Narcosli and Tingley creek areas. Table 2 shows the number of dead Douglas-fir estimated from the air.

Table 2

Douglas-fir Trees Killed by the Douglas-fir Beetle in the Period 1962 to 1964 as Determined in 1965, South Prince George District

Location	No. of dead trees	Av. vol. per tree	Est. vol. of timber (cu. ft.)
Averil Creek	25	100	2,500
Barney Creek	35	100	3,500
Saunders	60	100	6,000
Whites Landing	25	100	2,500
Marvin Creek	30	100	3,000
Ruric Creek	25	86	2,150
Narcosli Creek	480	100	48,000
Australian Creek	130	86	11,180
Twan Creek	20	76	1,520
Cuisson Creek	100	86	8,600
Tingley Creek	310	76	23,560
Totals	1,240		112,510

Mountain Pine Beetle, *Dendroctonus ponderosae* Hopk.

Approximately 1,000 lodgepole pine were killed by beetles in the vicinity of Cuisson Lake. No freshly killed pine were noted in the Narcosli Creek Valley where numerous small infestations have occurred in the past five years.

Western Balsam Bark Beetle, *Dryocoetes confusus* Sw.

There were an estimated 6,000 red-topped alpine fir along the tributaries of the Upper Fraser River in the vicinity of McBride. The following estimates were made from the air: Morkill River, 1,000 trees; Laselle Creek, 700; Fleet Creek, 400; East Twin Creek, 400; McKale Creek, 300; Holmes River, 1,000; Castle Creek, 200; Rausch River, 800; Small Creek, 200; Canoe River, 500; and Tonquin Creek, 500.

Two-year-cycle Spruce Budworm, Choristoneura fumiferana (Clem.)

There was a further decrease in spruce budworm populations in 1965. The number of larvae per square foot of alpine fir foliage and the number of infested tips on ten overstory trees for five permanent plots is shown for three non-flight years in Table 3. Defoliation on 100 understory trees at each plot averaged less than two per cent of the current foliage. Defoliation is expected to be negligible in the flight year 1966.

Table 3

Number of Two-year-cycle Spruce Budworm Larvae per Square Foot of Alpine Fir Foliage and % Tips Infested, 1961, 1963 and 1965, South Prince George District

Location	No. larvae per sq. ft.			% tips infested		
	1961	1963	1965	1961	1963	1965
George Mountain	2.0	6.2	1.2	6	57	10
Strathnaver	12.5	1.6	0.2	43	14	1
Hay Lake	22.0	0.7	0.5	44	5	6
Genevieve Lake	29.5	2.7	0.4	49	12	3
Barkerville	18.5	7.9	0.1	35	26	1

Western Hemlock Looper, Lambdina fiscellaria lugubrosa (Hulst)

The buildup of larval populations in the Upper Fraser region collapsed in the winter of 1964-65. In the vicinity of Hansard, where white spruce collections contained up to 158 larvae in 1964, a few collections contained only single larvae in 1965. Although there was a large moth flight in September 1964, egg sampling indicated that few eggs were laid. Table 4 shows a summary of collections containing larvae from 1963 to 1965.

Table 4

Summary of Western Hemlock Looper Collections, South Prince George District, 1963 to 1965

Host	No. of samples taken during larval period			% samples containing larvae			Av. no. of larvae per sample		
	1963	1964	1965	1963	1964	1965	1963	1964	1965
White spruce	42	91	84	10	45	5	4.5	14.9	1.0
Alpine fir	35	65	62	9	49	15	1.3	11.5	1.4
Western hemlock	4	13	18	75	62	28	1.3	4.6	3.0
Douglas-fir	20	40	27	5	13	0	1.0	1.2	-

Black-headed Budworm, *Acleris variana* (Fern.)

Larvae were commonly collected from white spruce, alpine fir and western hemlock in the Upper Fraser region from Shelley to Sinclair Mills. Although the number of black-headed budworm did not reach dangerous proportions, it was one of the few insects to show a population increase in 1965. A summary of collections on four coniferous hosts is given in Table 5.

Table 5

Summary of Black-headed Budworm Collections, South Prince George District, 1963 to 1965

Host	No. samples taken during larval period			% samples containing larvae			Av. no. larvae per sample		
	1963	1964	1965	1963	1964	1965	1963	1964	1965
White spruce	34	82	65	9	24	23	1.0	2.7	2.9
Alpine fir	28	61	46	0	16	24	-	1.3	1.5
Western hemlock	4	11	9	0	18	33	-	2.5	1.3
Douglas-fir	19	37	19	0	8	0	-	1.0	-

Forest Tent Caterpillar, *Malacosoma disstria* Hbn.

The infestation near McBride which was first reported in 1957 collapsed in 1965. No defoliation was noted during the summer and only one egg mass was collected from 21 aspen trees sampled in October.

Western Tent Caterpillar, *Malacosoma pluviale* (Dyar) var.?

The small infestations on scrub birch near Newlands and Aleza Lake subsided.

Aspen Leaf Miner, *Phyllocnistis populiella* Cham.

Aspen leaf miner populations decreased to a very low level throughout the District in 1965. Only one to two adult leaf miners were produced per 1,000 leaf surfaces (Table 6) because many larvae and pupae were parasitized or otherwise destroyed (Table 7).

Table 6

Aspen Leaf Surfaces Mined and Number of Adults Produced per 100-leaf Surfaces, South Prince George District

Location	% leaf surfaces with mines		No. adults produced per 100 Leaf surfaces	
	1964	1965	1964	1965
Prince George	10	1.4	2.7	0
Cale Creek	13	1.9	5.5	0.1
Stone Creek	6	1.2	1.6	0.2
Woodpecker	10	6.4	5.3	0.1
Hixon	20	1.3	8.0	0.1

Table 7

Mortality of Aspen Leaf Miner in 100-cocoon Samples, South Prince George District

Location	Percentage mortality			
	Parasitism		Other causes	
	1964	1965	1964	1965
Prince George	31	40	4	60
Cale Creek	17	12	16	40
Stone Creek	36	27	8	10
Woodpecker	9	12	5	28
Hixon	10	44	1	26

A Sawfly on Western Hemlock, Neodiprion sp.

Three-tree-beating samples from western hemlock averaged 71 Neodiprion larvae near Sinclair Mills. The highest number in one collection was 140. No defoliation was noticeable.

An Engraver Beetle on White Spruce, Ips perturbatus (Eich.)

A very large population of engraver beetles overwintered in 1964-65 in logging slash and in standing trees weakened by bark beetle attacks. Engraver beetle broods appeared healthy in the spring of 1965 and apparently did not suffer the same mortality as overwintering bark beetle broods. Engraver beetles attacked and killed the upper crowns of many spruce trees which had been lightly attacked but not killed by the spruce beetle the previous year.

An Ambrosia Beetle, prob. *Trypodendron lineatum* (Oliv.)

Decked white spruce logs were lightly to moderately attacked in the vicinity of Hansard and Sinclair Mills. There were moderate to heavy attacks on spruce near Valemount.

Engelmann Spruce Weevil, *Pissodes engelmanni* Hopk.

By August 1965, 39 of 179 immature white spruce in a sample plot near Wansa Lake had been attacked by weevils. This is four more than in 1964, 12 more than in 1963 and 18 more than in 1962.

Other Noteworthy Insects

Insect	Host	No. of collections	Remarks
Ectropis crepuscularia Schiff.	Ba, Sw	4	Decrease; common in 1964.
Epirrita autumnata Harr.	Ba	1	Scarce; common in 1964.
Monochamus oregonensis Lec.	Sw	2	Unusually scarce since 1962.
Pikonema alaskensis Roh.	Sw	14	Decrease; common in 1964.
P. dimmockii Cress.	Sw	24	Decrease; common in 1964.
Pissodes schwarzi Hopk.	Pwb	1	Collected at Red Pass, distribution record.
Pristiphora erichsonii Htg.	Siberian larch	1	Host isolated from native larches.
Tetropium sp.	Sw	1	Light damage at Valemount in sawlogs.
Zeiraphera fortunana Kft.	Sw, Ba	31	Common but caused little damage.

FOREST DISEASE CONDITIONS

Important Diseases

A Dieback of Douglas-fir

A stem canker and dieback of Douglas-fir caused by _Dermea_ sp. was common on both sides of the Fraser River from Macalister to Quesnel. Usually trees up to 10 feet in height were affected but west of Marguerite, the tops of 80-foot trees were killed.

Climatic Injury to Western Hemlock

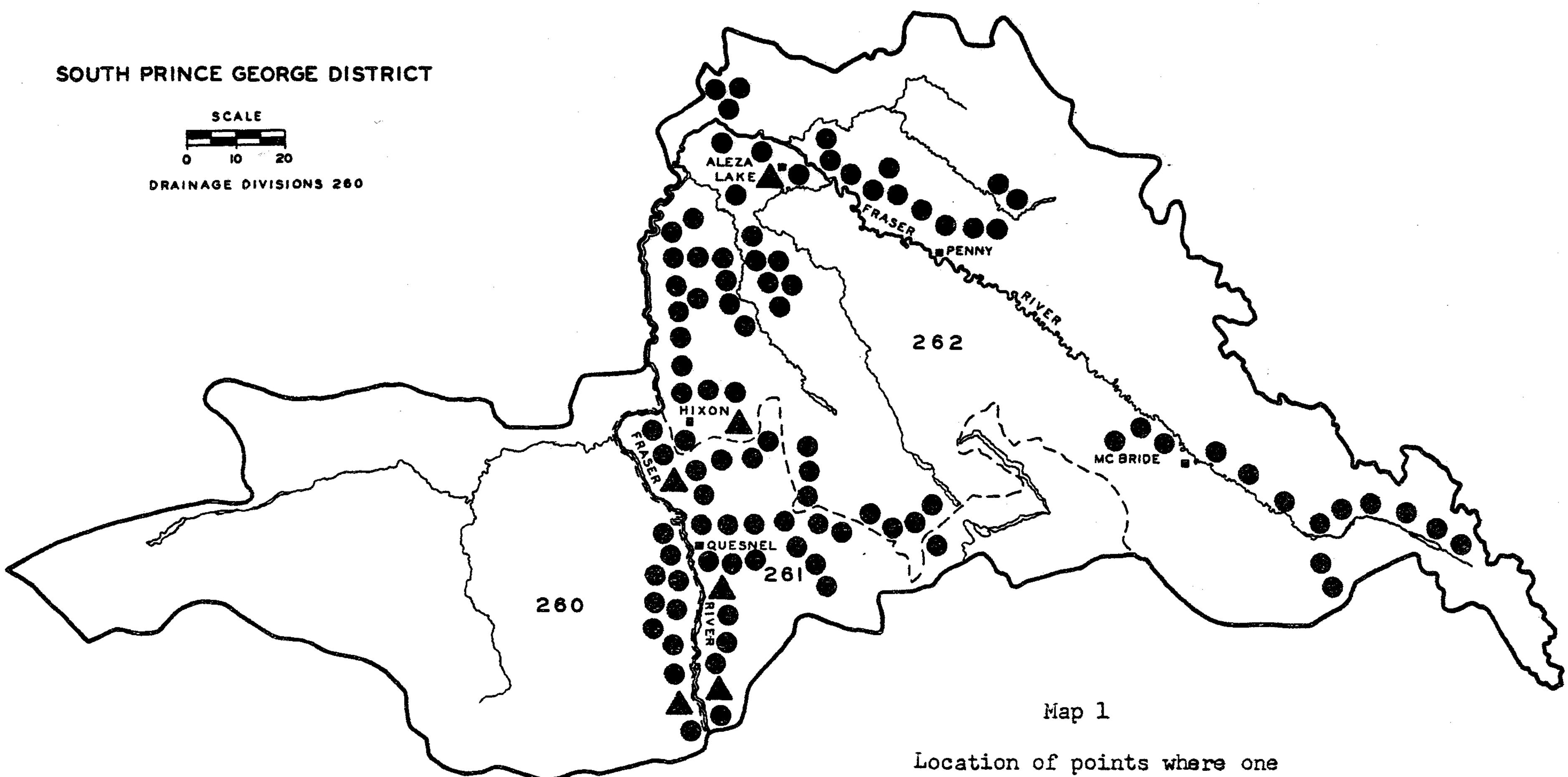
Vast numbers of immature hemlocks were severely damaged during the winter of 1964-65 west of the Bowron River near Willow Creek. Many trees had lost from 50 to 100% of their foliage by mid-summer of 1965.

Possible Climatic Injury to Lodgepole Pine

The inner crown foliage was discolored in most immature lodgepole pine in the valley bottoms of the Quesnel River from Quesnel to Beavermouth and Fraser River from Macalister to Hixon. The foliage grown prior to 1964 was brown, while the 1964 growth was slightly discolored and dry. The 1965 growth did not appear to be affected.

Exotic Plantations

Plantation no.	Location	Tree species	Remarks
XP-50	Aleza Lake Exp. Station	Scots pine	Trees healthy, good growth.
XP-117	Prince George Exp. Station	Mixed conifers	Two scots pine dead, light needle cast on remainder. Winter injury to common juniper.
XP-118	Prince George Exp. Station	Mixed hardwoods	Trees healthy.



Map 1

Location of points where one or more collections were made and field records taken in 1965.

Forest insect ●

Forest disease ▲

FOREST INSECT AND DISEASE SURVEY

WEST PRINCE GEORGE DISTRICT

1965

FOREST INSECT AND DISEASE SURVEY

WEST PRINCE GEORGE DISTRICT

1965

J. C. Holms

INTRODUCTION

The 1965 field season in the West Prince George District began on May 12 and continued until September 24. Totals of 458 forest insect and 120 forest disease samples were collected in the District by Forest Entomology and Pathology personnel and co-operators during the field season. An additional 22 permanent sampling stations were established, bringing the total number to 72. These stations were sampled from one to three times during the season.

Spruce beetle continued to be the most important pest for the third consecutive year. Six weeks of the field season were spent assisting with the spruce beetle survey in the Prince George Forest District. Twenty-one hours helicopter and fixed wing aircraft, flying time provided by British Columbia Forest Service were used for surveying spruce, mountain pine and Douglas-fir beetles and western balsam bark beetle-Ceratocystis damage in the District.

Table 1 shows the forest insect and tree disease collections by host; Map 1 shows the distribution of the collections and field records.

Table 1

Collections by Hosts

West Prince George District - 1965

Coniferous hosts	Forest insects	Forest diseases	Broad-leaved hosts	Forest insects	Forest diseases
Douglas-fir	36	18	Alder, mountain	5	0
Fir, alpine	81	10	Alder, Sitka	1	2
Pine, lodgepole	59	8	Alder spp.	0	2
Spruce, black	27	0	Ash, Sitka mountain	0	1
Spruce, white	195	61	Aspen, trembling	26	6
Larch, eastern	5	0	Birch, dwarf	5	3
			Birch, western white	10	3
			Cottonwood, black	2	0
			Dogwood, red osier	2	0
			Maple, Douglas	1	0
			Poplar sp.	0	1
			Willow	1	5
			Miscellaneous	2	0
Totals	403	97		55	23
			GRAND TOTAL	458	120

FOREST INSECT CONDITIONS

Important Insects

Spruce Beetle, *Dendroctonus obesus* (Mann.)

The spruce beetle was the most important insect pest in the District. The spruce beetle section of this report is combined with the South Prince George report and is presented at the beginning of the Prince George Forest District report.

The following statements are a resume of the beetle's activities in West Prince George. Aerial and ground surveys resulted in an estimate of 244,840 acres of white spruce, eight inches dbh and over, attacked from 1961 to 1965. For a volume estimate during this period refer to the special report.

The 1964 attack accounted for about 14,240 acres, a marked decrease from the previous two years. About 66% of this area was classed as lightly infested (one to five stems per acre). Much of the 1964 attack occurred in areas infested in previous years.

Mountain Pine Beetle, *Dendroctonus ponderosae* Hopk.

A substantial increase of 27% over the 1964 total of red-top lodgepole pine trees was observed in the Tezzeron-Takla lakes region. As in 1964, areas of heaviest attack were Kuzkwa River with about 12,200 trees, Bivouac Creek with 10,300 and Sakeniche River, southeast, with 8,000. Areas of infestation as mapped from the air in August 1965 were similar to those mapped in 1964.

A helicopter flight, provided by the B. C. Forest Service, in the company of C. Steneker, silviculturist, was made on July 6; landings were made at the Kuzkwa River and Bivouac Creek infestations. Examinations of 1964-attacked trees indicated extremely high mortality of early larval stages and unsuccessful oviposition by parent adults. This mortality was credited to unfavorable weather conditions in 1964 and to a very heavy attack resulting in starvation due to competition for food. Negligible 1965 attack was found.

Table 2 gives the general location, number of red-topped lodgepole pine, acreage and estimated volume of timber killed at each locality.

Table 2

Lodgepole Pine Trees Killed by Mountain Pine Beetle, 1963 and 1964, as Determined by Aerial Surveys, West Prince George District, 1965

Locality	No. of trees	No. of acres	Est. gross volume (cu. ft.)
Kuzkwa R., southeast side	5,200	2,000	208,000
northeast side	7,000	1,500	280,000
Stuart L., south of northwest end	10	5	400
Tarnezell Cr., west	75	50	3,000
Trembleur L., east	200	100	8,000
Baptiste Cr.	20	10	800
Tochcha L., southeast	115	75	4,600
Kazchek L., north	20	10	800
Bivouac Cr.	10,300	3,000	412,000
Sakeniche R., southeast	8,000	1,500	320,000
Natowite L., northeast	600	300	24,000
Totals	31,540	8,550	1,261,600

An average volume of 40 cubic feet per tree was used to calculate the volume of timber killed in these areas. It is expected that little new attack will occur in 1966.

Douglas-fir Beetle, Dendroctonus pseudotsugae Hopk.

A total of 804 red-topped Douglas-fir trees killed in 1962-1964 by the Douglas-fir beetle represents a decrease of about 45% from the 1964 figure. The greatest concentrations were 290 trees killed on the south side of Tezzeron Lake and 246 trees killed along the north west shore of Stuart Lake. Smaller infestations were found elsewhere in much the same localities as in 1964 (Table 3).

A large proportion of the red-tops occurred near logging operations where seed trees were located. An average volume of 70 cubic feet per tree was used to calculate the volume of timber killed.

Table 3

Douglas-fir Trees Killed by Douglas-fir Beetle, 1962 to 1964 as Determined by Aerial Surveys, West Prince George District, 1965

Locality	No. of trees	Est. gross volume (cu. ft.)
Pinchi, southeast	15	1,050
Nancut, northwest	11	770
Stuart Lake, northwest shore	246	5,220
Pinchi Lake, southeast corner	100	7,000
south side	3	210
north side	33	2,310
northwest end	6	420
Tezzeron Lake, south side	290	20,300
Trembleur Lake, east end	70	4,900
Summit Lake, north	25	1,750
Davie Lake	5	350
Total	804	44,280

Western Balsam Bark Beetle, Dryocoetes confusus Sw.

Aerial surveys in 1965 indicated that this beetle continued to cause widespread light mortality of alpine fir in inaccessible areas at 3,000 to 5,000 feet elevation.

The majority of the red-topped alpine fir occurred over much the same areas as in 1964. Table 4 indicates the location and acreage of infestations causing light tree mortality from 1962 to 1964, as observed from the air in 1965.

Table 4

Alpine Fir Trees Killed by Western Balsam Bark Beetle 1962 to 1964 as Determined by Aerial Surveys, West Prince George District, 1965

Location	Acreage	Gross volume (cu. ft.)
Ogston Lake, north	3,690	166,050
Tarnezell Lake, east	430	19,350
Kazchek Lake, north	1,500	67,500
O'Ne-ell Creek	1,200	54,000
Gloyazikut Creek	1,780	80,100
Tochcha Lake, west side	1,800	81,000
Kloch Lake, north west	600	27,000
Takatoot Lake, east	1,200	54,000
Airline Lake, northwest	2,000	90,000

Table 4 continued

Location	Acreage	Gross volume (cu. ft.)
Tchentlo Lake, east end	2,500	112,500
Purvis Lake	600	27,000
Leo Creek	1,800	81,000
Sawtooth Mountain, east	7,300	193,500
Tsayta Lake, southwest	5,700	256,500
Parsnip River, headwaters	6,000	270,000
Chuyazega Creek	1,500	67,500
Tudyah Lake, east	800	36,000
Misinchinka River	31,500	1,417,500
Mischinsinlika Creek	4,600	207,000
Pine Pass, west	9,000	405,000
" " , north	1,000	45,000
Totals	86,500	3,892,500

In Table 4, 1.5 red-tops per acre were applied as an average figure over the total acreage. An average volume of 30 cubic feet per tree was used to calculate the gross volume of timber killed. Individual trees could not be counted as the areas involved were too large.

No significant changes in acreage of alpine fir red-tops were noted from the 1964 survey and no great increase is expected in 1966.

Two-year-cycle Spruce Budworm, Choristoneura fumiferana (Clem.)

The spruce budworm population decreased from 1963 at three of the four budworm study plots in the District. A slight increase occurred at the Big Creek plot, north of Fort St. James.

The plots were examined in June for larvae and infested tips. One 18-inch branch sample was taken from the mid-crown of each of the 10 sample trees at each plot, and the branch area measured. Buds were classified as infested, not infested, and killed, and the larvae were counted on each branch sample. Adventitious buds were noted if present.

Table 5 indicates the comparative numbers of larvae per square foot and percentage of tips infested at each of the four plots for the last three non-flight years.

Table 5

Comparative Numbers of Spruce Budworm Larvae per Square Foot of Foliage and Percentage Tips Infested in June 1961, 1963 and 1965, West Prince George District

Locality	No. of larvae per sq. ft.			% tips infested		
	1961	1963	1965	1961	1963	1965
Davie Lake	1.1	0.4	0.3	3	6	.1
Tudyah Lake	24.1	2.7	0.2	53	17	.1
Pine Pass	24.3	6.1	2.1	58	38	9
Big Creek	8.6	2.5	6.6	24	24	12

Spruce budworm in 1965 decreased in both frequency of occurrence and abundance from the 1963 level in random collections. The incidence of larvae in three-tree beating collections from white spruce and alpine fir during the larval period June 17 to July 10 for 1961, 1963 and 1965 is shown in the following table.

Host	No. of collections during larval period			% containing larvae			Av. no. of larvae per sample		
	1961	1963	1965	1961	1963	1965	1961	1963	1965
White spruce	29	20	40	20	25	5	4.6	11.6	2.0
Alpine fir	13	16	13	38	66	1	6.4	6.5	1.0

The mortality plots at four localities were examined to assess the damage to alpine fir and white spruce understory trees caused by spruce budworm feeding. One hundred alpine fir and white spruce were examined at each plot and the percentage defoliation of new and old growth recorded (Table 6).

Table 6

Average Spruce Budworm Defoliation on 100 Understory Alpine Fir and White Spruce Trees, West Prince George District, 1961, 1963 and 1965

Locality	Av. dbh (in.)	Av. height (ft.)	% defoliation					
			Current			Total		
			1961	1963	1965	1961	1963	1965
Davie Lake	1.8	9.3	-	3	0	-	1	1
Tudyah Lake	2.1	11.5	68	6	0	26	3	1
Pine Pass	2.4	8.4	-	10	1	-	5	1
Big Creek	2.1	7.9	63	9	1	13	4	0

Generally, the understory sample trees on the plots are in poor condition due to budworm feeding and to their being in a suppressed situation beneath the overstory. From the samples taken at the four study plots it is expected that defoliation will be lighter in 1966 than in 1964, with the possible exception of the Big Creek plot.

Ambrosia Beetle, *Trypodendron* sp. probably *lineatum* (Oliv.)

White spruce logs were examined at 11 mill sites between Fort St. James, Vanderhoof and Finlay Forks after mid-June for the presence of ambrosia beetle. At each mill site five square feet of the surface of decked white spruce logs were examined. No ambrosia beetle entrance holes were found at mills north of Merton or south of Summit lakes. Positive samples of light attack occurring at saw-mill sites adjacent to the Hart Highway north of Prince George were as follows:

Locality and mill	No. entrance holes	Av. no. entrance holes per sq. ft.
Merton Lake S/M	36	7.2
Bear Lake S/M	6	1.2
Mile 36 Hart Hwy., Ferguson S/M	1	0.2

An Engraver Beetle, *Ips engelmanni* Sw.

This engraver beetle was again abundant in white spruce log decks, wind-thrown trees and logging slash, but was not found in standing white spruce.

A Round-headed Borer, *Tetropium* sp.

Standing white spruce trees killed by the spruce beetle in 1964 and windthrown trees continued to be infested by this wood borer. Heaviest attack generally occurred in the lower stem of dead trees. Wood penetration was up to one inch. Little damage to log decks was found during 1965.

Black spruce borer, *Asemum atrum* Esch.

White spruce sample and trap trees felled for the spruce beetle survey were again lightly infested by the black spruce borer. As was generally the case with wood-boring beetles in 1965, little damage was caused in white spruce log decks.

Poplar Borer, *Saperda calcarata* Say

Trembling aspen trees along the Vanderhoof Highway from Hulatt turn-off to Vanderhoof and in the Sinkut Lake area were lightly infested by this borer. A small infestation persisted at Mile 18, Hart Highway.

Aspen Leaf Miner, Phyllocnistis populiella Cham.

The aspen leaf miner population continued to decline as evidenced from samples taken at eight leaf miner plots. In 1965, there was an average decrease of about 80% in number of leaf surfaces mined at the eight plots sampled. One apical branch was cut from the lower crown of each of 10 tagged sample trees at each plot. The data appear in Tables 7 and 8.

Table 7

Percentage of Aspen Leaf Surfaces Mined and Number of Aspen Leaf Miner Adults Produced per 100 Leaf Surfaces, West Prince George District, 1962 - 1965

Locality	% of leaf surfaces with mines				No. of adults produced per 100 leaf surfaces			
	1962	1963	1964	1965	1962	1963	1964	1965
Hart Hwy., Mile 8	76	45	11	1	21.1	9.5	8.0	0
Shelley	84	23	25	3	11.3	6.8	12.7	0.2
Hart Hwy., Mile 16	76	11	4	1	24.8	1.6	1.7	0
Mile 79	86	14	64	2	19.3	6.1	43.4	0.3
Mile 103	43	41	50	2	8.8	17.8	25.9	0
Uslika L. Rd., Mile 15	-	-	79	9	-	-	63.9	0.6
Vanderhoof	-	-	7	0	-	-	3.4	0
Endako	-	-	23	7	-	-	14.3	2.2

Table 8

Mortality of Aspen Leaf Miner in Cocoons, Based on 100-cocoon Samples at Eight Plots, West Prince George District, 1964-1965

Locality	% mortality							
	Parasitism				Other causes			
	1962	1963	1964	1965*	1962	1963	1964	1965*
Hart Hwy., Mile 8	22	28	20	0	25	26	5	67
Shelley	26	40	10	33	30	18	6	0
Hart Hwy., Mile 16	19	32	28	0	20	12	10	50
Mile 79	34	35	24	20	30	8	3	20
Mile 103	12	24	24	0	27	13	16	75
Uslika L. Rd., Mile 15	-	-	2	30	-	-	6	50
Vanderhoof	-	-	17	-	-	-	8	-
Endako	-	-	4	16	-	-	8	24

*Based on less than 100 cocoons.

A further slight population decrease may be expected in 1966 although the 1965 population was generally too low to permit the gathering of 100 cocoons at each plot for an accurate estimate of the population trend.

Black-headed Budworm, Acleris variana (Fern.)

The black-headed budworm population decreased slightly in 1965. The maximum larvae in any one collection was 19, collected from white spruce on June 28 at Mile 20, Uslika Lake Road. Small numbers of larvae occurred in random samples throughout the District. The following table compares the incidence of black-headed budworm larvae in three-tree-beating collections from white spruce taken during the larval period from June 13 to August 14.

No. collections during larval period			% collections containing larvae			Av. no. larvae per collection		
1963	1964	1965	1963	1964	1965	1963	1964	1965
67	86	78	4	46	42	1.3	4.1	2.5

Green-headed Spruce Sawfly, Pikonema dimockii Cress.

Green-headed spruce sawfly larvae occurred less frequently in samples in 1965 than in 1964. Incidence of larvae in three-tree-beating collections from white spruce June 12 to August 24 was as follows:

No. collections during larval period			% collections containing larvae			Av. no. larvae per collection		
1963	1964	1965	1963	1964	1965	1963	1964	1965
89	84	128	21	45	34	1.1	1.7	1.6

Yellow-headed Spruce Sawfly, Pikonema alaskensis Roh.

Although the percentage of collections containing yellow-headed spruce sawfly larvae decreased in 1965, the average number of larvae per collection remained the same as shown in the following table.

No. collections during larval period			% collections containing larvae			Av. no. larvae per collection		
1963	1964	1965	1963	1964	1965	1963	1964	1965
89	78	128	26	60	36	1.3	1.8	1.8

Engelmann Spruce Weevil, Pissodes engelmanni Hopk.

This weevil continued to cause light damage to white spruce reproduction. Two localities, where white spruce was plentiful, were examined in late August for weevil damage. Examinations consisted of a visual inspection of 100 young white spruce at each plot to determine the ratio of new to old attacks as indicated in the following table.

Locality	Elev. (ft.)	Av. ht. (ft.)	% trees with new attacks	% trees with old attacks
Mile 13 Merton L. Rd.	2800	8	5	8
Altezega Cr.	2400	6	1	2

Light attack may be expected to continue in 1966.

Douglas-fir Needle Midge, Contarinia pseudotsugae Condr.

A generally small population of this needle midge persisted on Douglas-fir reproduction along the Hart and Vanderhoof highways. Eight samples consisting of one terminal of current growth cut at breast height from each of five trees at eight locations were examined in late August. Results are shown in Table 9.

Table 9

Percentage of Douglas-fir Needles Infested by a Douglas-fir Needle Midge, West Prince George District, 1965

Locality	Total needles examined	% needles infested
Hart Highway, Mile 89	344	9.9
Mile 74	371	1.6
Mile 61	445	1.8
Mile 41	307	0.9
Mile 23	303	20.8
Vanderhoof Highway, Mile 37	402	0.9
Mile 25	315	5.7
Mile 9	401	1.2

Cooley Spruce Gall Aphid, Adelges cooleyi Gill.

This gall aphid was again common on white spruce and Douglas-fir along the Blackwater Road in Vanderhoof Ranger District and in Fraser Lake Ranger District. Light attacks occurred in the Bear Lake area on the Hart Highway.

A Spruce Bud Moth, *Zeiraphera fortunana* Kft.

The average number of spruce bud moth larvae per positive sample was practically unchanged from 1964, although the percentage of collections containing larvae increased in 1965. From one to 13 larvae were taken in positive white spruce collections. The following table compares collections of the insect during the larval period in 1964 and 1965.

No. collections during larval period		% collections containing larvae		Av. no. larvae per collection	
1964	1965	1964	1965	1964	1965
65	38	21	55	3.8	3.9

A Spruce Budworm, *Griselda radicana* Wlshm.

The percentage of collections containing larvae of this budworm remained practically unchanged from 1964, as did the average number of larvae per positive sample. Small numbers of larvae were collected through the District. The following table compares collections of *Griselda* from white spruce during the larval period June 25 to July 25, in 1964 and 1965.

No. collections during larval period		% collections containing larvae		Av. no. larvae per collection	
1964	1965	1964	1965	1964	1965
50	61	26	25	1.8	1.7

Other Noteworthy Insect Larvae

Insect	Host	No. of collections	Remarks
Caripeta angustiorata Wlk.	Pl	4	Grey pine looper; average of 1.2 per collection; decrease from 1964.
C. divisata Wlk.	Sw, Sb, Ba, F	16	Grey spruce looper; average of 1.4 per sample; down from 1964.
Ectropis crepuscularia Schiff.	Sw, Ba, Ds	3	Saddle-back looper; average of 1.3 per collection; slight increase from 1964.
Epirrita autumnata Harr.	Sw, Ba Dt	7	Green velvet looper; average of 1.0 per collection; down about 50% per sample from 1964.

Other Noteworthy Insect Larvae - continued

Insect	Host	No. of collections	Remarks
Lambdina fiscellaria lugubrosa (Hlst.)	Ba, F	5	Hemlock looper; average of 1.0 per collection; one pupa collected July 29 at Pine Pass; great decrease at Summit L., from 1964.
Laspeyresia youngana Kft.	Sw cones	0	Spruce cone moth; none collected 1965 due to light cone crop.
Petrova sp.	Pl	0	Pitch nodule maker; very light attack on reproduction in Bear L. area.
Pissodes terminalis Hopk.	Pl, terminals	0	Small population in young growth through District.
Pristiphora erichsonii (Htg.)	Le	0	Larch sawfly; none collected in 1965; same as 1964.
Zeiraphera sp.	Le	2	A larch bud moth; average of 1.0 per sample; decrease from 1964.

Other Noteworthy Insect Adults

Insect	Host	No. of collections	Remarks
Monochamus maculosus Hald.	Pl	1	Spotted pine sawyer; emerged July 12 from log sections on Blackwater Rd.
M. oregonensis Lec.	-	0	Oregon fir sawyer; none collected in 1965; low population level.
Pissodes alascensis Hopk.	Pl, Ba	2	N. of Prince George; S.W. of Vanderhoof.
P. piperi Hopk.	Ba	1	Bark weevil; immature stages from bark chambers at base of red-top, June 6.
Steremnius carinatus Boh.	-	0	None collected 1965.
Urocerus albicornis Fab.	Ba	2	Horntail; a few adults emerged during summer from log sections in Prince George area.

FOREST DISEASE CONDITIONS

Important Diseases

Western Balsam Bark Beetle - Disease Complex on Alpine Fir.

The current status of the western balsam bark beetle is discussed in the insect portion of this report. At the present it is not known to what extent the disease organism, *Ceratocystis dryocoetidis* Kendrick and Molnar contributes to the overall alpine fir mortality.

Flagging of Alpine Fir Branches

Less die-back of understory alpine fir branches was seen than in 1964. This condition is causing light damage.

Lodgepole Pine Dwarf Mistletoe

Light to heavy infections of *Arceuthobium americanum* Nutt. ex Engelm., on young and mature lodgepole pine occurred through much of this tree's range. Ten trees were examined at two widely separated localities where each tree examined was infected. North of Germansen Landing and at Bear Lake, infection rating was light to heavy on trees averaging six inches dbh in mature two-story stands. At both localities pine comprised more than 90% of the stand.

An Undetermined Needle Cast Condition

A needle cast condition was found on lodgepole pine foliage produced prior to 1965. The disease caused needles to discolor and drop in stands of varying ages along the Blackwater Road loop from Prince George to Vanderhoof. Damage was generally light. The same condition existed along the Mud River roads in the Beaverley area.

Needle Cast on Lodgepole Pine

A generally light needle cast infection caused by *Elytroderma deformans* (Weir) Darker occurred at Bear Lake. Infection was indicated by the presence of "flags" with discolored 1964 and older foliage on infected trees. Reddening 1964 needles and older dead needles were examined on mature trees on May 28. At that time overmature hysterothecia and mature pycnidia were present on 1963 foliage. No hysterothecia were seen on 1964 needles.

Lodgepole Pine Stem Canker

A light stem canker infection caused by *Atropellis piniphila* (Weir) Lohm. & Cash. was found on lodgepole pine trees along Lower Mud River Road as in 1964.

A Spruce Needle Rust

The rust *Chrysomyxa weirii* Jacks. caused widespread light to medium infection of 1964 white spruce foliage. Infected needles dropped in July.

A Spruce Needle Rust

The needle rust *Chrysomyxa ledicola* Lagh. caused widespread light infection of 1965 white spruce foliage. Its status was unchanged from 1964. To determine the incidence of this disease the lower crowns of three white spruce were examined at scattered localities.

Needle Rust of Alpine Fir

A generally light infection caused by *Pucciniastrum epilobii* Otth. occurred on the current foliage of alpine fir throughout the District. Traces of another needle rust, *Melampsora occidentalis* Jacks. were found in association with *P. epilobii*.

Needle Rust on Douglas-fir

Infections of *Melampsora medusae* Thuem. on 1965 foliage of Douglas-fir were generally very light throughout the host tree's range.

Douglas-fir Needle Blight

The needle cast or needle blight fungus *Rhabdocline pseudotsugae* Syd. caused light to medium infection of 1964 Douglas-fir needles at widely separated localities. The disease was indicated by reddish-brown needle lesions or as dark "slits" when visual examinations were conducted on the lower crown of three trees at each site.

A Die-back of Douglas-fir

The presence of die-back caused by *Dermea* sp. on young Douglas-fir trees at Beaverley was indicated by shrivelled 1965 foliage and unopened buds. Dead, red-brown 1964 terminals occurred on the same tree.

Leaf spot of Aspen

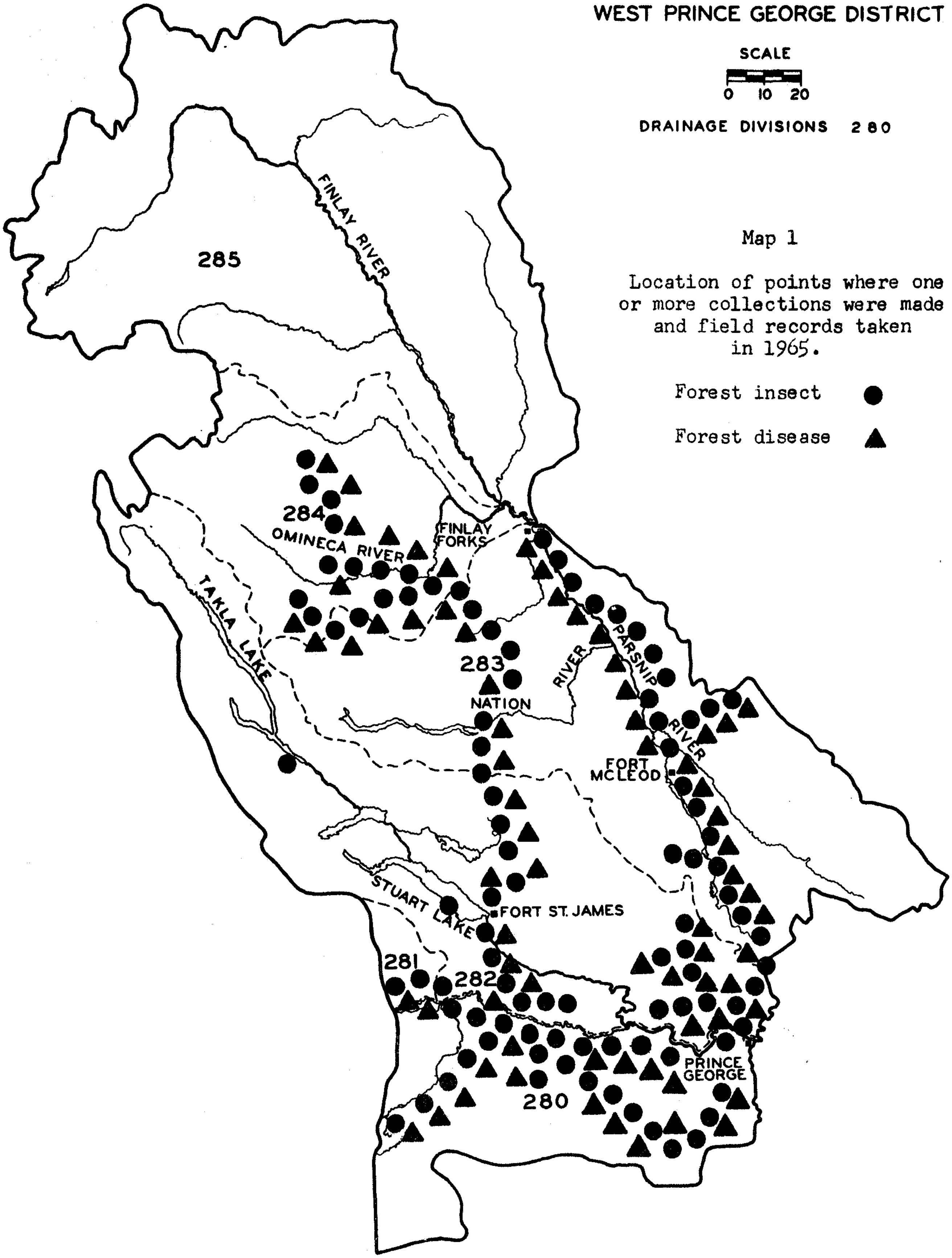
A leaf spot disease of aspen caused by *Marssonina brunnea* (Ellis & Everh.) Sacc. occurred along the north shore of Trembleur Lake to Middle River. Ground checks were not made but similar conditions noted in previous years, in conjunction with samples, were identified as being caused by this organism.

A Hyperparasite of Rusts on Douglas-fir

A new record of a hyperparasite of rusts, *Tuberculina maxima* Rostr., was found in association with *Melampsora medusae* Thuem. The sample was collected July 28 at Mile 23, Hart Highway.

Other Noteworthy Diseases

Host	Organism	Locality	Remarks
Aspen, trembling	*Fomes igniarius* (L. ex Fr.) Kickx	Ruby L.	Causes white trunk rot of heartwood of hardwoods.
	Peniophora rufa (Fr.) Boidin	Ruby L.	Decay fungus.
Douglas-fir	*Fomes pini* (Thore ex Fr.) Karst.	Mi. 41 Hart Hwy.	A wood-destroying fungus of living trees causing a white pocket trunk rot.
Fir, alpine	*Aleurodiscus amorphus* (Pers.) Rabenh. ex Cooke	Ruby L., Mile 7 Hart Hwy.	Causes cankers on the main stem and sometimes kills suppressed saplings of balsam firs; widespread as saprophyte. Ocasionally parasitic.
	Phaeocryptopus nudus (Pk.) Petr.	Beaverley, Ruby L., Mi. 7 Hart Hwy.	A needle cast disease.
Pine, lodgepole	*Coleosporium asterum* (Diet.) Syd.	Old Summit L. Rd.	A needle rust; not found since 1963.
Poplar	*Melampsora occidentalis* Jacks.	Mi. 74 Hart Hwy	A leaf rust.
Spruce, white	*Chrysomyxa arctostaphyli* Diet.	Germansen Lndg. vicinity	Causes witches brooms; incidence and distribution unchanged.
	C. woroninii Tranz.	Pine Pass, Mi. 82 Uslika L. Rd.	A branch tip needle rust.



Map 1

Location of points where one or more collections were made and field records taken in 1965.

FOREST INSECT AND DISEASE SURVEY

NORTH PRINCE GEORGE DISTRICT

1965

FOREST INSECT AND DISEASE SURVEY

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R. O. Wood

INTRODUCTION

Survey work in the North Prince George District in 1965 commenced on June 8 and terminated on August 20. One week of this period was spent in Yukon Territory. Thirty-six permanent sampling stations, established in the District during the past few years, were sampled once or twice during the season. The 315 forest insect and 48 forest disease collections submitted in 1965 are listed by host in Table 1; distribution of collections is shown on maps 1 and 2.

The B. C. Forest Service provided aircraft for 14 hours of aerial reconnaissance to map spruce budworm infestations in northeastern British Columbia.

From May 3 to June 4, the writer supervised the European Pine Shoot Moth survey in the southern Interior of British Columbia. September and part of October were spent assisting with the spruce beetle survey in the Prince George Forest District and with black-headed budworm egg sampling in other districts.

Table 1

Collections by Hosts

North Prince George District, 1965

Coniferous hosts	Forest insects	Forest diseases	Broad-leaved hosts	Forest insects	Forest diseases
Fir, alpine	9	1	Alder spp.	10	0
Larch, eastern	46	0	Aspen, trembling	20	6
Pine, lodgepole	50	2	Birch, dwarf	2	1
Spruce, black	20	4	Birch spp.	11	1
Spruce, white	124	16	Cottonwood, black	13	5
			Willow spp.	9	7
			Miscellaneous	1	5
Totals	249	23		66	25
			GRAND TOTAL	315	48

FOREST INSECT CONDITIONS

Important Insects

One-year-cycle Spruce Budworm, Choristoneura fumiferana (Clem.)

This was the second year in which spruce budworm infestations assumed widespread proportions in the North Prince George District. Aerial reconnaissance flights were made over the valleys of the Muskwa, Prophet, Fort Nelson and Fontas rivers, the Liard River Valley from Skooks Landing to Nelson Forks and the areas north, east and south-east of Kotcho Lake. White spruce stands along all the main rivers and many of their tributaries below 2,000 feet elevation suffered light to heavy defoliation and the infestation expanded south of its 1964 confines. Map 3 shows areas of defoliation.

The preferred host was white spruce but black spruce was also attacked in a few areas north of Fort Nelson. Understory alpine fir in areas of severe infestations, with few exceptions, had lost most of the current year's growth.

Defoliation of white spruce began at Mile 234, Alaska Highway, and increased in severity to the Kledo River area. Budworm feeding was heaviest on the current year's growth but in some areas, notably at Mile 330, Alaska Highway, feeding extended onto the 1963 growth. There was severe defoliation in the Smith River infestation between miles 494 and 538, Alaska Highway.

Areas of heaviest damage occurred along the Liard River where stands were predominantly white spruce. Some tree mortality, presumably caused by spruce bark beetle attacking trees weakened by budworm feeding, was reported in this area in 1964. It is not known if this tree mortality increased in 1965. Heavy defoliation occurred along the Muskwa and Prophet rivers and in many isolated pockets of white spruce growing in aspen stands. Light to moderate damage was noted along the Fort Nelson and Fontas rivers, south-east of Kotcho Lake and in other scattered areas. Many white spruce trees in affected areas developed adventitious buds and budworm damage resulted in deformed branches and loss of increment.

Larvae were collected from June 17 to July 6; the first pupa was noted on July 1 and the first adult on July 6 at Mile 235, Alaska Highway. Most adults were believed to have oviposited in early July and eggs had hatched before egg sampling began on August 2. Table 2 shows a comparison of random beating collections from coniferous hosts, 1962 to 1965, during the larval period of June 7 to July 15. This period is based on the earliest and latest collections containing larvae during the three years. Although the percentage of positive collections dropped, there was a slight increase in the number of larvae per sample on both white spruce and alpine fir.

Table 2

Summary of Spruce Budworm Collections,
North Prince George District

Host	No. of samples taken during larval period			% samples containing larvae			Av. no. of larvae per sample		
	1963	1964	1965	1963	1964	1965	1963	1964	1965
Sw	47	56	96	49	36	16	77.5	39.0	40.4
Sb	5	5	16	0	0	0	-	-	-
Le	9	7	26	55	43	4	3.6	2.0	1.0
Ba	2	5	8	50	60	25	1.0	17.6	18.5
Pl	6	13	42	17	0	0	2.0	-	-

Nineteen locations along the Alaska Highway were selected for sampling of spruce budworm populations and the appraisal of damage. The percentage of defoliation was obtained by estimating the defoliation of 10 trees; bud mortality was assessed by examining 50 white spruce tips at each location. Branch samples were taken from the mid-crown of trees ranging from eight to 14 inches dbh. Defoliation of current year's growth of white spruce ranged from five to 95% and bud mortality was up to 59%. The population of adults and the number of egg masses were determined by counting the pupal cases and empty egg masses on two branches at each plot and applying the result to 100 square feet of foliage. At Smith and Kledo rivers, some egg masses were quite small, possibly indicating a waning population. In southern areas, egg masses were large and appeared healthy. Egg parasitism was noted at Mile 247, Alaska Highway; only one parasitized egg mass was found. Data from plot studies are shown in Table 3.

Table 3

Percentage Defoliation of Current Year's Growth, Percentage of Terminal Buds Killed and Number of Spruce Budworm Adults and Egg Masses Per 100 Square Feet of White Spruce Foliage, North Prince George District, 1965

Mileposts, Alaska Hwy.	% defoliation of current year's growth	% of terminal buds killed	No. per 100 sq. ft. of foliage	
			Adults	Egg masses
234	5	12	0	0
241	50	10	49	172
247	90	2	310	230
265	75	4	48	202
270	30	0	70	0
292	30	12	15	63
320	60	22	42	75
322	80	0	0	50
327	10	2	0	0
335	95	59	400	0
337	75	0	12	35

Table 3 - continued

Mileposts, Alaska Hwy.	% defoliation of current year's growth	% of terminal buds killed	No. per 100 sq. ft. of foliage	
			Adults	Egg masses
342	70	1	100	0
346	25	0	43	0
494	95	0	70	30
502	95	42	150	0
506	90	3	210	110
514	95	58	280	260
528	75	46	200	30
538	95	26	510	170

On the basis of the egg mass-defoliation relationship established in eastern Canada moderate to severe defoliation is expected to occur in 1966 in the Smith River infestation and between miles 241 and 265, Alaska Highway; light to moderate damage is predicted in the Kledo River and Kotcho Lake regions and along the Fort Nelson River. A further southward expansion of the infestation is possible in 1966.

Two-year-cycle Spruce Budworm, *Choristoneura fumiferana* (Clem.)

The population of two-year-cycle spruce budworm on white spruce and alpine fir at the Link Creek plot was substantially increased in 1965 from the last non-flight year in 1963; the average number of larvae per square foot of foliage increased from 7 in 1963 to about 12 in 1965. Populations were higher at Link Creek than at other budworm plots in the South and West Prince George districts where average numbers of larvae per square foot of foliage ranged from 0.2 to 6.6 in 1965. The Link Creek plot was first examined on June 9. No larvae were found in 19 square feet of foliage from branch samples or in beating collections in the area. On July 24 additional branch sampling was done. There was an average of 13.2 larvae per square foot of foliage on alpine fir and 11.1 on white spruce. Twenty-four per cent of the branch tips on both hosts were infested. The estimated defoliation on 20 overstory and 100 understory trees at Link Creek in 1965 was 1% and 3% respectively. Table 4 gives details of plot studies.

Table 4

Percentage of Tips Infested and Number of Two-year-cycle Spruce Budworm Larvae Present, Link Creek, North Prince George District, 1965

Host	Tree no.	Branch area examined (sq. ft.)	No. tips examined	%. tips infested	No. larvae present	No. larvae per sq. ft. of foliage
Alpine	1	1.4	84	24	20	14.3
fir	2	1.0	63	25	16	16.0
	3	1.0	40	23	9	9.0

Table 4 - continued

Host	Tree no.	Branch area examined (sq. ft.)	No. tips examined	% tips infested	No. larvae present	No. larvae per sq. ft. of foliage
Average				24		13.2
White spruce	4	1.3	56	37	21	19.0
	5	1.0	33	12	4	4.0
	6	1.3	99	22	22	16.9
	7	1.8	36	42	15	8.3
	8	1.3	78	37	29	22.3
	9	.9	74	4	3	3.3
	10	1.4	49	12	6	4.2
Average				24		11.1

Black-headed Budworm, Acleris variana (Fern.)

Populations of this defoliator remained at a low level in the District in 1965. White spruce was the only host from which the species was taken; the percentage of collections with larvae increased from 31% in 1964 to 43% in 1965 during the larval period of June 15 to July 30. The average number of larvae per sample remained about the same: 3.6 in 1964 compared with 3.3 in 1965. The maximum number of larvae per collection was 14, taken along the Gold Bar Road west of Hudson Hope on June 22.

Larch Sawfly, Pristiphora erichsonii Htg.

Larch sawfly adults were in flight at Mile 29, Alaska Highway on June 21, and the first larva was collected on June 30 at Mile 290, Alaska Highway. Beating collections from eastern larch contained up to 170 larvae per sample. Colonies of larvae were noted in various parts of the District during the first two weeks of July and by July 30 many trees between miles 163 and 342, Alaska Highway, and along the Beaton River Road had lost up to 50% of their foliage. By August 12, many of the smaller trees along the Monkman Pass Road had been completely defoliated and larvae were still numerous and feeding. No specimens were collected north of Mile 547, Alaska Highway in 1965.

Sequential sampling at permanent sample points indicated a slight decrease in the degree of infestation in 1965. Samples consisted of two branches (removed with pole clippers) from the mid-crown of each tree. Table 5 shows a comparison of the degree of infestation for the years 1963 to 1965.

Table 5

Sequential Sampling for Larch Sawfly,
North Prince George District

Locality (mileposts)		No. of tip units examined (by 10's)			No. curled tips (cumulative)			1/ Degree of infestation		
		1963	1964	1965	1963	1964	1965	1963	1964	1965
Alaska Hwy.	163	15	4	4	30	19	19	M	S	S
	227	2	2	8	13	14	13	S	S	M
	238	2	10	16	17	18	10	S	M	L
	243	11	9	19	19	14	6	M	M	L
	247	16	2	5	30	16	3	M	S	M
	260	5	4	10	20	20	15	S	S	M
	275	5	2	15	21	15	2	S	S	L
	280	8	6	15	30	24	9	S	S	L
	342	18	1	7	52	10	25	S	S	S
	368	7	3	21	25	20	15	S	S	L
	547	-	6	20	-	1	1	-	L	L
Beaton R. Rd.	32.5	2	2	7	14	15	18	S	S	M
Gold Bar Rd.	4	-	-	14	-	-	2	-	-	L
Monkman Pass Rd.	7	7	10	7	0	17	9	L	M	M
	26.4	-	-	3	-	-	14	-	-	S
	28.4	11	21	12	19	26	6	M	M	L
Hart Hwy.	187	10	12	-	32	39	-	S	S	-
	207	20	7	10	12	26	4	S	S	L

1/ L= Light, M= Moderate, S= Severe

Spruce Beetle, *Dendroctonus obesus* (Mann.)

Two areas of old spruce beetle damage in the Chetwynd Ranger District were inaccessible by motor vehicle in 1965. The B. C. Forest Service reported that some salvage logging had been done in the beetle-damaged stands on Wartenbe [illegible]

Logging operators at Mile 104, Alaska Highway, reported that 15% of the spruce in spruce-balsam stands had been attacked by bark beetles. An examination revealed a few old beetle-killed trees but there was no current beetle activity.

The spruce beetle is suspected of causing some tree mortality in spruce trees weakened by spruce budworm defoliation in inaccessible areas along the Liard River. Tree mortality was also noted north and south of the junction of the Muskwa and Tuchodi rivers; approximately 130 beetle-killed trees were counted during aerial reconnaissance.

This insect is a potential hazard in the North Prince George District to spruce stands already weakened by spruce budworm feeding.

Forest Tent Caterpillar, <u>Malacosoma disstria</u> Hbn.

The five forest tent caterpillar sample plots in the Taylor area were examined on June 23; no defoliation was evident and no larvae were present. There was no damage in other parts of the District nor were any larvae collected.

Egg sampling was not done in the North Prince George District in 1965.

Aspen Leaf Miner, <u>Phyllocnistis populiella</u> Cham.

Populations of the aspen leaf miner in the North Prince George District were light in 1965. Aspen trees in the southern part of the District were relatively free from attack; in northern areas there were regions of heavy attack interspersed with tracts of lightly attacked trees.

Four permanent sample plots were visited early in August. At two plots a lack of cocoons prohibited cocoon sampling. At Smith and Hyland rivers there was an increase from 1964 in the percentage of infested leaf surfaces as well as the number of adults produced per 100 leaf surfaces. The percentage parasitism increased at the Smith River plot and decreased at Hyland River.

The results of examining leaves on one 12-inch branch from each of 10 trees at four plots are shown in tables 5 and 6.

Table 5

Percentage of Aspen Leaf Surfaces Mined and Number of Adults Produced per 100 Leaf Surfaces, North Prince George District

Location	Percentage of leaf surfaces with mines			No. of adults per 100 leaf surfaces		
	1963	1964	1965	1963	1964	1965
Prochniac Cr.	0.5	0.7	0	0	0	0
Smith River	11.7	2.9	7.9	2	0	0.9
Hyland River	1.9	5.3	7.9	0	2	4.3
Mile 45.5 Cassiar Rd.	1.6	2.1	0.9	1	0	-

Table 6

Mortality of Aspen Leaf Miners in Cocoons, (100-cocoon samples), North Prince George District

Location	Percentage mortality in cocoon stage					
	Parasitism			Other causes		
	1963	1964	1965	1963	1964	1965
Prochniac Cr.	40	42	-	15	18	-
Smith River	22	24	46	14	41	0
Hyland River	20	22	12	12	29	1
Mile 45.5 Cassiar Rd.	30	32	-	13	14	-

A Spruce Tip Moth, Zeiraphera fortunana Kft.

Spruce tip moth larvae on white spruce increased in the District in 1965. Larvae were collected from Mile 249, Hart Highway, in the south to Mile 290, Alaska Highway, in the north, but most of the positive collections were in the areas of Hudson Hope, Moberly Lake and the Halfway and Beaton rivers. The maximum number of larvae per collection increased from six in 1964 to 14 in 1965. In 1964 there was an average of 3.1 larvae in 23% of the collections compared with 3.3 larvae in 31% of the collections in 1965. Only one black spruce collection contained Z. fortunana larvae in 1965.

Western Balsam Bark Beetle, Dryocoetes confusus Sw.

Infestations of western balsam bark beetles continued in the Pine Pass region in 1965. Scattered clumps of red-topped alpine fir, mostly in inaccessible areas, were present between Azouzetta Lake and Mile 147, Hart Highway. Beetles were excavating egg galleries a red-topped alpine fir tree at Link Creek on June 9.

Additional tree mortality may occur in 1966 along the west slope of the Murray Range and between Bennett and Little Boulder creeks.

Yellow-headed Spruce Sawfly, Pikonema alaskensis (Roh.)

The percentage of white spruce collections containing larvae of this insect has been decreasing in the North Prince George District since 1960. In 1965 only 6% of the collections contained larvae compared with 20% in 1964. There was a slight increase in 1965 in the number of larvae per positive sample as shown in the following table:

Number of samples taken during larval period			% samples containing larvae			Average number of larvae per sample		
1963	1964	1965	1963	1964	1965	1963	1964	1965
32	107	86	28	20	6	1.2	1.1	1.6

One larva was collected from black spruce in 1965. Adults of this sawfly were in flight as late as June 29 at Mile 160, Alaska Highway.

Green-headed Spruce Sawfly, *Pikonema dimmockii* (Cress.)

Populations of this sawfly declined slightly to the lowest level since 1959. An average of 1.4 larvae was found in 20% of the collections from white spruce, a negligible change from the two preceeding years.

Green Spruce Looper, *Semiothisa granitata* complex

No larvae of the green spruce looper were collected in 1965.

Leaf Mites

Leaves of western white birch at Mile 20, Alaska Highway, were heavily infested with gall mites on June 21. Two 12-inch branch samples from each of two trees had from 57 to 73% of the leaves attacked. Several adults were reared from infested leaves but have not been identified to date.

Other Noteworthy Insects

Insect	Host	No. of collections	Remarks
Anoplonyx laricivorus Ross	Le	6	A native larch sawfly; maximum of 10 larvae per collection.
Epirrita a. omissa Harr.	Bi, Dt, W, Sb, Sw, Ba	8	A common defoliator.
Griselda radicana Wlshm.	Sw	9	Population slightly increased from 1964.
Operophtera bruceata (Hulst)	A, Cot, W	6	A common defoliator.

Other Noteworthy Insects - continued

Insect	Host	No. of collections	Remarks
Pissodes curriei Hopk.	Pl	3	Adults of this root-collar feeder were collected from miles 200 to 233, Hart Highway.
P. schwarzi Hopk.	Pl	3	A root-collar feeder; adults were collected in beating samples along Hart and Alaska highways.
Trypodendron lineatum (Oliv.)	Sw	1	Ambrosia beetles in log decks along Hudson Hope Rd.
Zeiraphera sp.	Le	6	A bud moth on larch; maximum of 12 larvae per sample.

FOREST DISEASE CONDITIONS

Important Diseases

A Needle Rust on Spruce

White and black spruce in the North Prince George District were severely infected by *Chrysomyxa ledicola* Lagh. in 1965. Damage was noted from about Mile 200, Alaska Highway, to Dawson Creek. Areas of heaviest infection were from Mile 172, Alaska Highway, to Fort St. John and along the Monkman Pass Road. Trees of all sizes were affected and some had an estimated 80% of the needles infected.

A Needle Rust on Alpine Fir

Alpine fir along the Dease Lake Road were infected by *Peridermium holwayi* Syd. Damage at Mile 9 was particularly severe; all trees examined, from seedlings to mature trees, were infected.

Winter Drying

An estimated several hundred acres of reddened lodgepole pine on the slopes of Caron Creek, visible from Mile 175, Hart Highway, was observed in 1965. The damage was characteristic of winter drying. The Department of Agriculture in Dawson Creek reported that this area is in the path of strong "chinook" winds which may contribute to the stand condition.

Mortality of lodgepole pine on Steamboat Mountain was obvious and many of the trees dropped 100% of their foliage. Reddening of needles on lodgepole pine in the Muncho Lake area was noticeable early in August but damage was not severe.

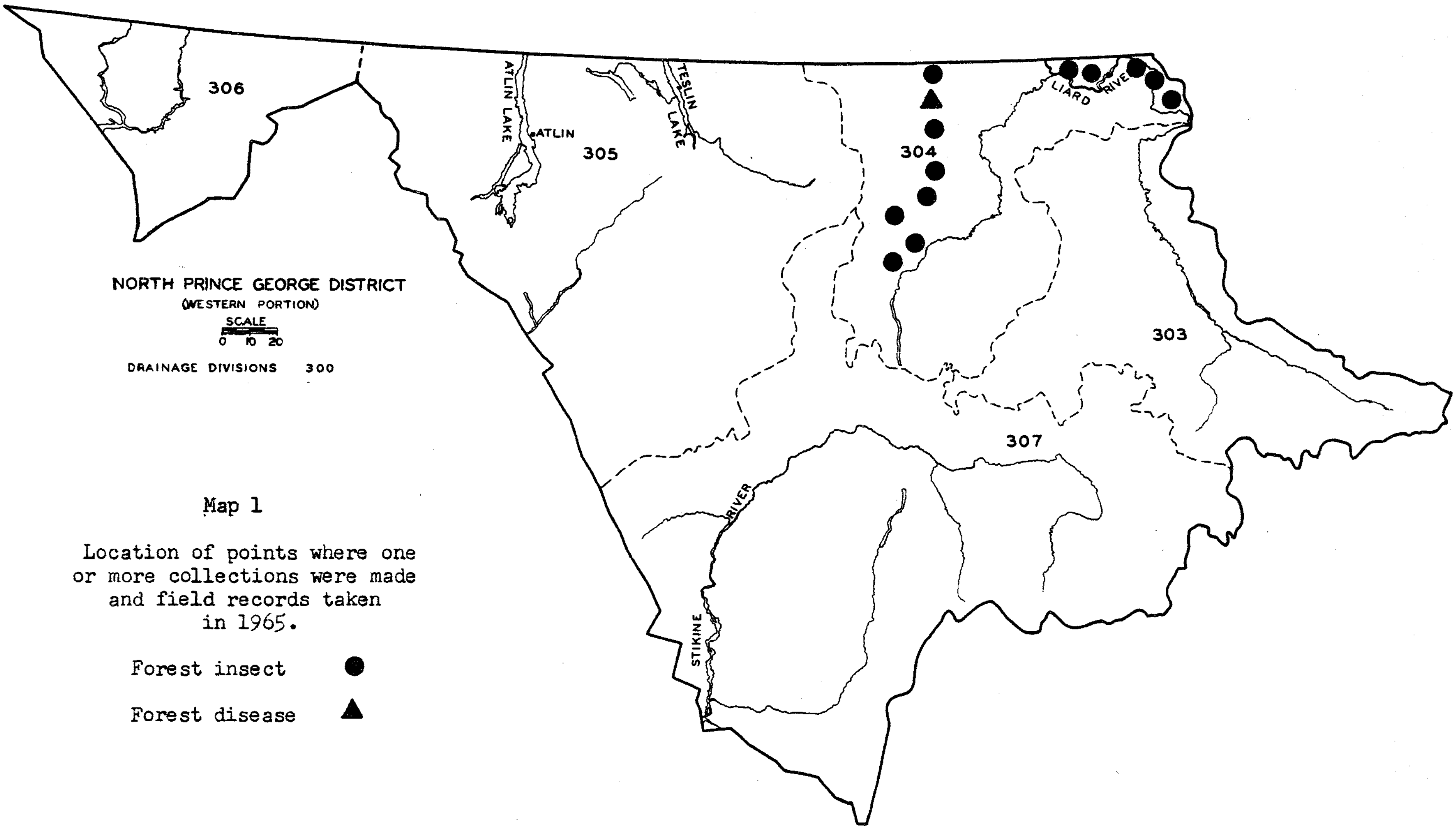
Several hundred acres of winter-killed lodgepole pine were observed during aerial reconnaissance north of the Alaska Highway between the Kledo and Dunedin rivers.

Exotic Plantations

Attempts to locate the plantation of *Pinus sylvestris* at Groundbirch were unsuccessful; it was apparently destroyed by road construction.

Other Noteworthy Diseases

Host	Organism	Locality	Remarks
Aspen, trembling	*Fomes igniarius* (L. ex Fr.) Kickx	Beaton R. Rd.	Causes white heart rot.
Labrador tea	*Chrysomyxa ledi* de By. var. *groenlandici* Sarile	Mi. 155 Alaska Hwy.	Also causes needle rust on white and black spruce.
	C. ledicola Lagh.	Mi. 155 Alaska Hwy.	As above.
Spruce, black	*Chrysomyxa arctostaphyli* Diet.	Mi. 367 Alaska Hwy.	Broom rust, common.
Spruce, white	*Chrysomyxa woroninii* Tranz.	Mi. 218 Alaska Hwy.	Needle rust.
	C. weirii Jacks.	Mi. 347 Alaska Hwy.	Needle rust.
	Coniothyrium sp.	Mi. 170 Alaska Hwy.	New host record.
Willow	*Melampsora epitea* Thuem.	Hudson Hope Rd.	Causes needle rust on alternate host, alpine fir.

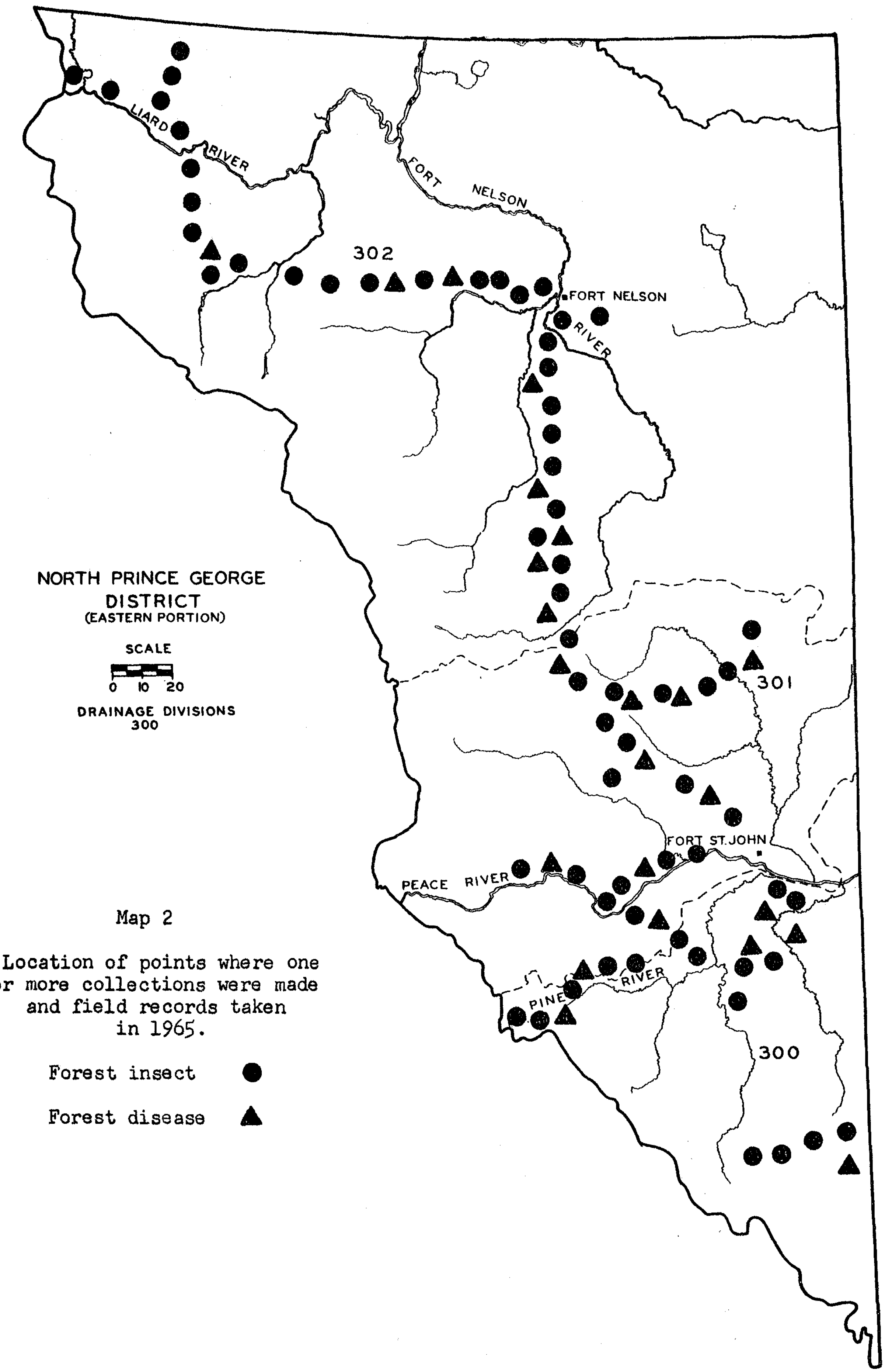


Map 1

Location of points where one or more collections were made and field records taken in 1965.

Forest insect ●

Forest disease ▲

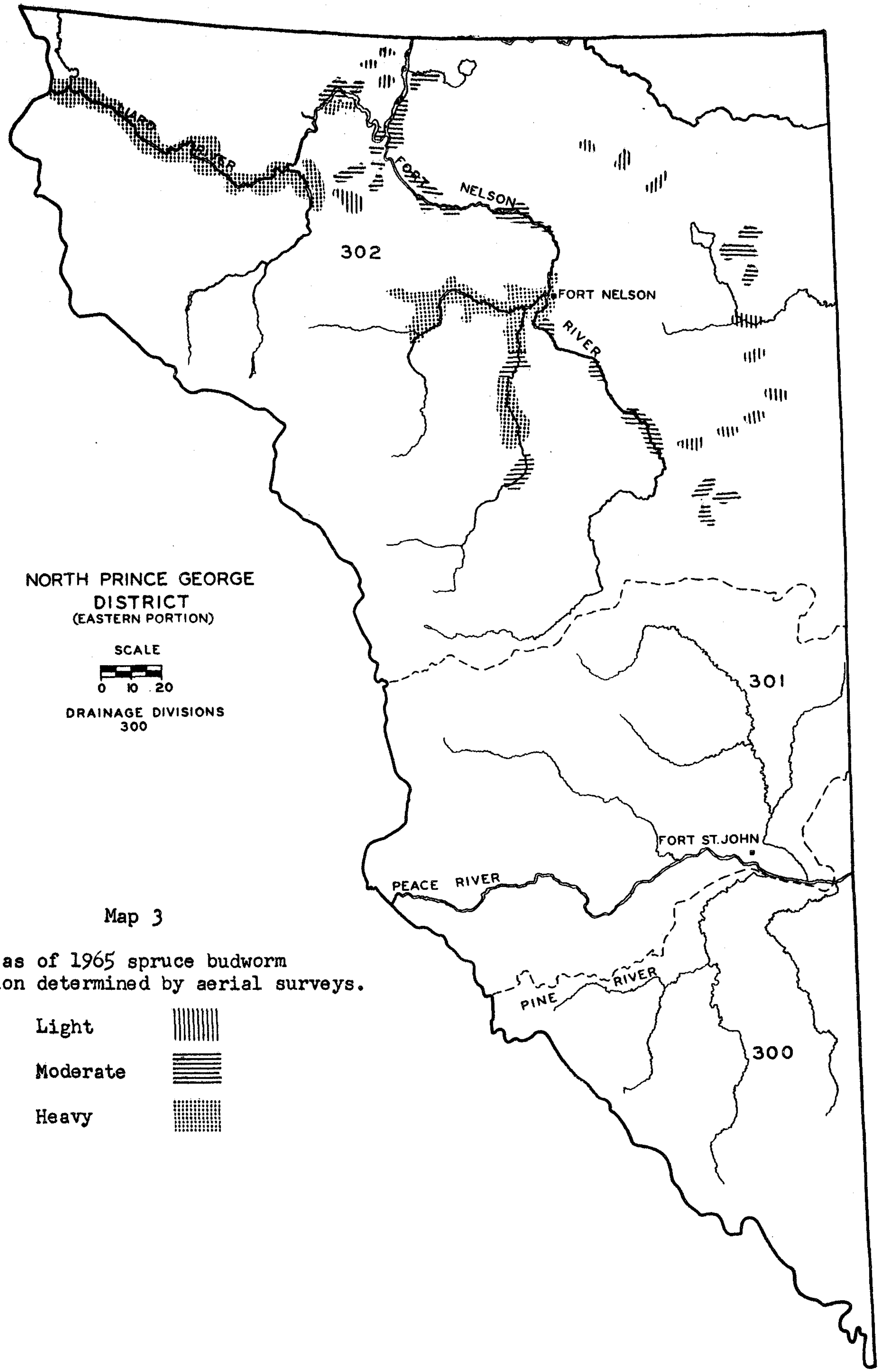


Map 2

Location of points where one or more collections were made and field records taken in 1965.

Forest insect ●

Forest disease ▲



Map 3

Areas of 1965 spruce budworm
defoliation determined by aerial surveys.

Light

Moderate

Heavy

FOREST INSECT AND DISEASE SURVEY

YUKON DISTRICT

1965

FOREST INSECT AND DISEASE SURVEY

YUKON DISTRICT

1965

R. O. Wood

INTRODUCTION

A change in the field survey staff of the forest insect and disease survey necessitated combining the Yukon and the North Prince George districts in 1965. Assessments of spruce budworm infestations in the North Prince George District required the majority of attention and resulted in only four days of survey work in the Yukon; this was done during the second week of July. Sampling was carried out only at the permanent sampling stations between Watson Lake and Mile 995, Alaska Highway.

Map 1 shows the distribution of the 41 forest insect and three forest disease collections submitted in 1965. Collections by hosts are listed in Table 1.

Table 1

Collections by Hosts

Yukon District, 1965

Coniferous hosts	Forest insects	Forest diseases	Broad-leaved hosts	Forest insects	Forest diseases
Fir, alpine	1	0	Alder spp.	1	0
Larch, eastern	1	0	Aspen, trembling	4	1
Pine, lodgepole	9	0	Poplar, balsam	1	0
Spruce, black	3	0	Willow spp.	2	0
Spruce, white	16	2	Miscellaneous	3	0
Totals	30	2		11	1
			GRAND TOTAL	41	3

FOREST INSECT CONDITIONS

Important Insects

Black-headed Budworm, Acleris variana (Fern.)

Larvae of A. variana were collected in beating samples from white spruce in the Yukon in 1965 with a maximum of one larva per sample; 25% of the collections were positive.

Aspen Leaf Miner, Phyllocnistis populiella Cham.

The plots established for studies of leaf miner populations in the Yukon District were not visited in 1965. Spot checks indicated a light to moderate population of the insect was present.

Other Noteworthy Insects

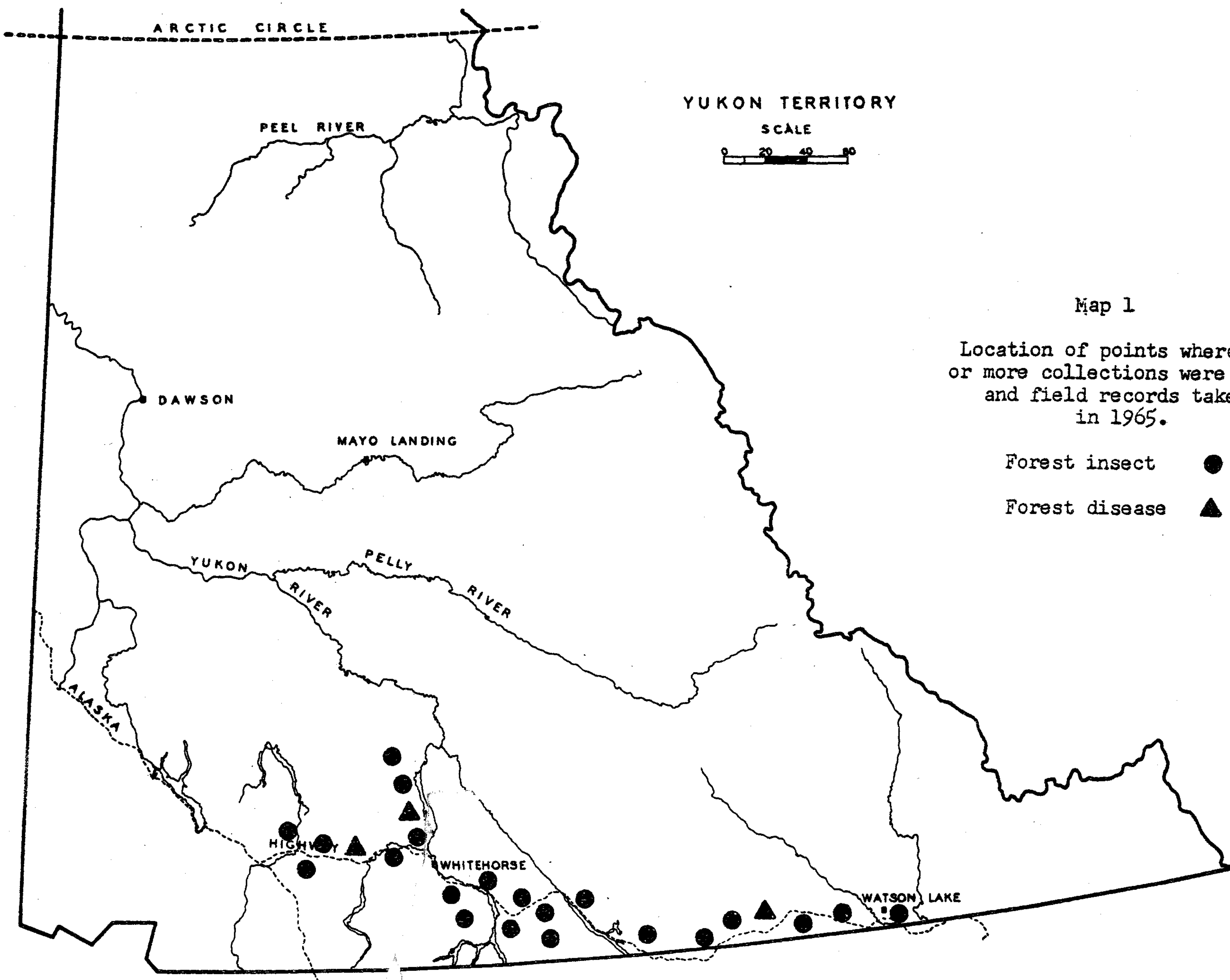
Insect	Host	No. of collections	Remarks
Pikonema alaskensis (Roh.)	Sw	2	A spruce sawfly; maximum of three larvae per collection.
P. dimmockii (Cress.)	Sw	6	A spruce sawfly; 37% of collections contained larvae.
Pissodes sp.	Pl	1	Larvae were found in root collar of host at Mile 898 A.H.
Zeiraphera fortunana Kft.	Sw	2	A spruce tip moth; maximum of four larvae per sample.

FOREST DISEASE CONDITIONS

Important Diseases

A Needle Cast on Spruce

A needle cast on white spruce caused by Bifusella crepidiformis Darker was collected in the Yukon District in 1965. The disease is capable of causing serious damage but infection in 1965 seemed to be at a low level.



Map 1

Location of points where one or more collections were made and field records taken in 1965.

Forest insect ●

Forest disease ▲