ANNUAL REPORTS OF FOREST BIOLOGY RANGERS

BRITISH COLUMBIA, 1960

FOREST ENTOMOLOGY AND PATHOLOGY LABORATORY

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FOREST BIOLOGY RANGERS' ANNUAL REPORT

1960

R. L. Fiddick

FOREWORD

Each year new areas become accessible as logging and mining companies develop extensive road systems. Some ranger districts have reached the point where it is not possible for the ranger to carry out a complete detection survey in all accessible areas and do the necessary appraisal and extension work required.

Only two changes in district assignments occurred in 1960. E. G. Harvey was assigned to the East Prince Rupert District to relieve D. G. Collis who replaced him in the South Vancouver Island District.

Minor changes in operational procedure allowed the ranger from South Prince Rupert to use the survey boat to cover the coastal section of the West Prince Rupert District, thereby assuring coverage of that area during the optimum insect period when that ranger was engaged on the Queen Charlotte Islands.

Several insects came into sudden prominence in 1960. A serious outbreak of the saddle-backed looper, Ectropis crepuscularia Schiff., occurred on about 14,000 acres at Kitimat. It was necessary to carry out chemical control on 1,800 acres to prevent heavy tree mortality.

The green-striped forest looper Melanolophia imitata Wlk., caused light to heavy defoliation in scattered areas between Tofino and Ououkinsh Inlet on the west coast of Vancouver Island.

Neither of these two insects have previously caused severe damage although high populations have been recorded.

Cold wet weather resulted in a decline of the black-headed budworm population on the Queen Charlotte Islands. Thirty thousand acres of prime hemlock and spruce were sprayed to prevent tree mortality.

The two-year cycle spruce budworm infestation in Central British Columbia increased in extent to more than 8,000,000 acres. No chemical control is contemplated for 1961.

The Douglas fir beetle continued to take its annual toll of Douglas fir in a number of districts in the interior of the province. Red topped trees were recorded in areas previously free of attack. Infested trees were usually found in association with recent logging.

An infestation of pine butterfly caused some damage to mature Douglas fir in MacMillan Park and surrounding area on the Alberni Highway. Large flights of the adults attracted considerable attention in late summer and early fall.

Continuing increased use of aircraft allowed a greater flexibility of program in egg and defoliation surveys. In many cases aircraft were supplied by the British Columbia Loggers Association or co-operating lumbering firms.

The following table lists forest insect and tree disease collections for each ranger district by the various agencies.

Table 1

Forest Insect and Forest Disease Collections
by Agencies

British Columbia and Yukon - 1960

Personnel involved		South Vancouver Island	North Vancouver Island	South Vancouver	North Vancouver	South Prince Rupert	West Prince Rupert	East Prince Rupert	West Kamloops	Central Kamloops	East Kamloops	West Nelson	Central Nelson	East Nelson	South Prince George	West Prince George	North Prince George	Yukon
Forest Biology Rangers Independently	Forest Insect	426	486	316	203	166	354	169	301	310	386	310	356	364	300	333	299	434
	Forest disease	51	39	54	112	26	68	61	7	18	14	47	29	21	34	26	14	27
Forest Biology Rangers with Forest Service Personnel													2					5
Forest Service Personal Independently		32	22	20	10		6	31		1	4		1	8				1
Other Co-operators		389*	6	10	1		44	3		1	14	1	1				1	1
Totals		898	553	400	326	192	472	264	308	330	418	358	389	393	334	359	314	468

* Includes collections from light-trap at Langford Insectary.

ANNUAL REPORT OF FOREST BIOLOGY RANGERS

BRITISH COLUMBIA

1960

VANCOUVER FOREST DISTRICT

VANCOUVER ISLAND SECTION

FOREST BIOLOGY SURVEY

VANCOUVER FOREST DISTRICT

VANCOUVER ISLAND SECTION

1960

D. G. Collis

INTRODUCTION

Forest Biology work on Vancouver Island during 1960 was carried out mainly by D. Collis in the South Vancouver Island District and S. J. Allen in the North Vancouver Island District.

The most serious insect problem was created by the green-striped forest looper on the west coast of Vancouver Island, where an estimated 26,000 acres of predominately hemlock stands were defoliated. Pine butterfly larvae were present in a number of valleys but apparently pose a threat only in the Cameron River Valley. Dead and dying grand fir trees were very common on the east side of Vancouver Island; the damage has been attributed to fir engraver beetles. The oak looper infestation continued around Christmas Hill near Victoria.

ANNUAL REPORT OF FOREST BIOLOGY RANGER

for

SOUTH VANCOUVER ISLAND DISTRICT

1960

FOREST BIOLOGY SURVEY

SOUTH VANCOUVER ISLAND DISTRICT

1960

D. G. Collis

INTRODUCTION

Survey work started with spruce weevil studies in April and ended with pine butterfly egg counts in mid-November. Portions of August, September and October were spent making pupal counts and assessing damage caused by the green-striped forest looper. Table 1 lists all the collections made in the South Vancouver Island district by hosts, of which 365 were made by the writer. The remainder were made mainly by the insectary staff at Langford and by various other co-operators. Fifty-one forest disease samples were also gathered. The approximate location of samples taken by the writer are shown on Map 1.

Table 1

Collections by Hosts

South Vancouver Island District - 1960

Coniferous hosts	Forest insects	Forest diseases	Broad-leaved hosts	Forest insects	Forest diseases
Cedar, western red	39	1	Apple	2	
Douglas fir	134	11	Arbutus	12	
Fir, amabilis	19	5	Ash	1	
Fir, grand	26	3	Alder, red	21	8
Fir, alpine	1		Cascara	9	
Hemlock, mountain	1	1	Cherry		1
Hemlock, western	135	2	Cottonwood	2	
Larch, European	1	6	Dogwood	10	
Pine, lodgepole	8	5	Locust, black		1
Pine, ponderosa	1		Maple, broadleaf	14	
Pine, Scots		2	Oak, Garry	51	2
Pine, western white	9	2	Poplar	1	1
Spruce, Sitka	13		Willow	37	
Spruce, Norway	1		No host	198	
Spruce, white	1		Miscellaneous hosts	68	
			Total	426	13
Total	389	38	Grand Total	815	51

STATUS OF INSECTS

Green-striped Forest Looper, Melanolophia imitata Wlk.

Introduction

The larva of this green geometrid have long been regarded as economical feeders and not likely to cause serious defoliation. In 1951, an increase in larval numbers was recorded, generally along Vancouver Island's west coast. The largest sample that year was made in Effingham Inlet, where 120 larvae were collected from three trees. Other samples contained up to 44 larvae in the area north of Tofino. Records show that in 1952, the population in Effingham Inlet had decreased but in the Tofino - Bedwell Sound area, samples containing 156 and 166 larvae were made with no visible defoliation resulting. In the same year, at Poett Nook, on the south side of Barkley Sound, as many as 800 larvae were collected from three trees and up to 30 per cent of the foliage was consumed. This situation occurred over a small area and was the only location where defoliation was recorded. In 1953 these large populations collapsed, although larvae were still found in small numbers.

In 1960, the supposition that the insect was an economical feeder was shattered and hemlock stands along Vancouver Island's west coast were, in patches, severely defoliated.

This report covers that portion of the infestations south of Estevan Point. The remainder of the information will be found in the North Vancouver Island section.

1960 Larval Populations

Annual survey records, as shown in Table 2, revealed a very large population increase from 1958 to 1959 in drainage division 005 and remained relatively constant in the remainder of the district, with the exception of division 003, also on the west coast, where a moderate increase occurred. Larval numbers increased again in 1960 in drainage division 005 and the locations where more than 50 larvae were found are shown in Table 3. This table also shows that the samples were made in early July, when the larvae were mostly in their third instar, about one half inch long and not yet consuming any great amount of foliage. Most of the large collections were made on July 12 during a heavy rain. Considering the small size of the insect, higher numbers of larvae might have been found under more ideal circumstances. The larvae from these July samples were too small for successful insectary rearing. Many of the larvae appeared sickly or diseased, but the presence of disease was not confirmed. On August 17, 18, 19, 151 last instar larvae were collected in the Kennedy Lake area from 13 locations. Only three of these larvae were killed by parasites. Many appeared diseased however and a light infection of polyhedral virus was present in three collections. It is not know if the degree of infection was sufficient to cause mortality. The fungus disease Empusa sp. was identified from another group of larvae and would definitely cause insect mortality. Eight *Dusoma* sp. larval parasites were found from 96 square feet of duff near Indian Reserve 24 on Millar Channel, and 10 in the Bedingfield Bay plot.

Table 2

Number of Green-striped Forest Looper per Three-tree Beating Sample Collected in the Respective Drainage Divisions of the South Vancouver Island District, 1958 - 1960.

Drainage division	Total no. samples taken during larval period			No. samples containing green-striped forest looper			* Average no. larvae per sample		
	1958	1959	1960	1958	1959	1960	1958	1959	1960
001	0	40	18	0	1	4	0	1.00	1.0
002	32	75	85	14	13	16	3.86	3.23	3.8
003	28	52	48	17	33	13	4.53	11.51	11.0
004	11	16	31	4	5	5	2.00	2.80	1.4
005	69	51	72	31	40	59	2.05	46.47	58.9
Totals	140	234	254	66	92	97	3.07	24.90	35.80

* Includes only collections containing larvae of the green-striped forest looper.

Areas defoliated

Because of breakdowns in departmental marine equipment, the areas where the highest larval populations were found, from Tofino to Hotsprings Cove (Map 2) were not revisited until September 9. Through the courtesy of the MacMillan, Bloedel and Powell River Company, a flight was made over most of Vancouver Island at this time. Defoliation was visible from Millar Channel through L493 to Bedingfield Bay on Herbert Inlet. Five other smaller suspected areas increased the total area of defoliation to 8,450 acres in the South Vancouver Island District. The locality and intensity of feeding is shown in Table 4.

Table 3

Location of Points Where 50 or More Green-striped Forest Loopers

Were Collected from Three-tree Beating Samples,

South Vancouver Island, 1960.

Location	Date	No. larvae	Host
Granite Creek (Nitinat River)	June 29	52	hemlock
Henderson Lake	July 6	75	cedar
Maggie Creek	July 7	59	hemlock
Lower Kennedy River	July 9	70	hemlock
L624 Tofino Inlet	July 10	215	hemlock
Robert Point	July 11	80	hemlock
Matlset Narrows	July 11	121	cedar
White Pine Cove	July 11	404	hemlock
W. side Herbert Inlet	July 12	262	cedar
Bedingfield Bay	July 12	406	Douglas fir
Ahousat	July 12	70	hemlock
L493 Millar Channel	July 12	489	hemlock
Shelter Inlet	July 12	71	hemlock
Young Bay	July 12	147	Douglas fir
N. end Sydney Inlet	July 13	58	hemlock
Riley Cove	July 14	99	hemlock

Table 4

Area of Green-striped Forest Looper Infestations by Localities

and Degree of Defoliation. South Vancouver Island, 1960.

Location	Defoliation in acres		
	Light	Medium	Heavy
Between Sydney and Holmes Inlet	0	260	0
Megin River mouth	190	0	0
Obstruction Island	0	510	0
Opposite Obstruction Island	0	320	0
Flores Island	0	830	0
Millar Channel	0	6,340	0
Total	190	8,260	0
Grand total		8,450	

Larval Feeding Habits

The preferred hosts are western hemlock and cedar, although extensive defoliation only appeared where hemlock was the dominant species. Within hemlock stands, cedar and balsam were severely defoliated, but where these species comprise the majority of stems they have not suffered visible defoliation although occasional hemlocks among them have. Feeding on fringe Douglas fir was evident in July and at that time the insect appeared to favour current foliage. Defoliation was quite light on dominant trees and heaviest on the intermediate and suppressed trees.

Stand Conditions

Methods

Plots were established in October at some of the defoliated areas along the West Coast to obtain a clearer picture of stand conditions and to estimate the possible 1961 larval population. In the areas sampled, two plots containing at least 50 trees each were laid out, and because this insect overwinters in the pupal stage in the forest litter, duff sampling was also conducted. These samples consisted of four one-foot square blocks of duff from each of the three trees, two blocks from the exposed side and two from the shaded side of each tree. This process was repeated four times in all locations visited, with the sample stations usually 20 chains apart.

In the L493 infestation, one plot was established just north of I. R. 24 and the other at the head of Bedingfield Bay.

Results

Defoliation of plot trees was summarized by hosts and crown class (Table 5). The pupae found per square foot in the duff samples are listed in Table 6.

Summary

The pupal counts, which averaged about two per square foot of duff, could in theory produce a population of about 8,000 larvae per tree next spring. This number would be greatly reduced by pupal parasites, predators, disease, poor weather during the mating and oviposition period, egg parasites and larval establishment. These control factors could reduce the population to a level that would not inflict any serious defoliation. The trees have already been badly defoliated, but tree mortality is not expected within the South Vancouver Island District. Since the green-striped forest looper overwinters as a pupa, the adults do not commence egg laying until late May or early June on the West Coast, and the eggs do not hatch until after an incubation period of about 10 days. The trees will thus be able to put on a considerable portion of their 1961 foliage before feeding begins and so replace a fair amount of their lost needles. No chemical control is proposed for the infestations in the South Vancouver Island District, but as pupal counts were as high here as anywhere on the West Coast, these areas will have to be watched carefully.

Pine Butterfly, Neophasia menapia Feld.

These large white butterflies can usually be seen fluttering around the tops of trees in Douglas fir stands during late summer. Since 1957, the butterflies have become more numerous in many of the valleys on Vancouver Island where Douglas fir is the predominate species. In 1957 a flight was observed at the headwaters of Englishman River and about 90 per cent of the 1957 foliage was consumed. No eggs were found to associate the damage with any insect. A small flight was observed in Cathedral Grove in 1958 and the butterflies were present in great numbers in 1959. Similar conditions prevailed in August of 1960. Flights were also reported from the Nanaimo, Cameron, and Chemainus River valleys. Egg counts made in November 1959, indicated that there would be a large larval population in the Cathedral Grove area in 1960.

Table 5

Average Percentage Defoliation by Host Trees and Crown Levels Caused by the Green-striped Forest Looper. South Vancouver Island District, 1960.

Locality	Hosts	Crown Class											
		Dominant			Co-dominant			Intermediate			Suppressed		
		Top 1/3	Mid 1/3	Lower 1/3	Top 1/3	Mid 1/3	Lower 1/3	Top 1/3	Mid 1/3	Lower 1/3	Top 1/3	Mid 1/3	Lower 1/3
North of I. R. 24, Millar Channel	H	26	27	24	41	31	25	48	43	33	41	30	18
	B	23	21	17	15	18	18	75	40	20	38	17	10
	C	-	-	-	-	-	-	-	-	-	75	20	20
Average defoliation by crown class, all hosts			22			28			41			29	
Head of Bedingfield Bay	H	14	14	14	57	47	31	53	41	27	76	60	51
	B	25	20	10	5	5	5	-	-	-	32	15	14
	F	20	20	20	-	-	-	-	-	-	-	-	-
Average defoliation by crown class, all hosts			15			39			40			51	

Table 6

Number of Green-striped Forest Looper Pupae per Square Foot of Duff at Sample Plots. South Vancouver Island, 1960.

Locality	Station	Position[1/] Exposed 1	Exposed 2	Shaded 1	Shaded 2	Total	No. pupae per sq. ft.
	A	3	19	15	1	38	3.17
N. of I. R. 24,	B	3	4	2	4	13	1.08
Millar Channel	C	4	3	2	2	11	0.92
	D	6	8	14	7	35	2.92
Total		16	34	33	14	97	2.02
Bedingfield Bay	A	2	5	3	0	10	0.83
	B	1	6	7	4	18	1.50
	C	1	17	11	1	30	2.50
	D	4	16	12	2	34	2.83
Total		8	44	33	7	92	1.92

1/ Position 1 against base of tree; position 2 midway between tree and periphery of crown.

Pine Butterfly - continued

Cathedral Grove Infestation

Larval collections were difficult to make because the insect is a crown feeder and Douglas fir in the infested stand are up to 250 feet in height. Small numbers of larvae were collected from understory trees. On July 12, 26 larvae were found on three small hemlocks. The only large larval collections were made from a recent windfall. Frass drop did not become noticeable until about the first of July and was heavy from then until early August when pupation began. During this period, the dropping pellets sounded like fine falling rain and every smooth surface was covered with a thin coat of frass. There was no evident drop under cedar, hemlock or balsam trees.

Pupation commenced around July 25. Larvae dropped on silk threads to the ground and moved about in search of suitable pupation sites. These included crevices in old logs and stumps, the underside of sword fern, (the favorite site) small twigs on old branches lying on the ground and crevices in the bark of living trees. Observations indicated that pupae were more frequent at ground level in open areas; where the stand was closer together and the tree trunks and ground shaded, they were more difficult to find. Not all the larvae pupated on the ground as pupae were found all the way up the tree trunks and on the foliage. On August 5, only one adult had emerged out of 91 pupae collected on the ground, although many adults were flying around the tree tops.

The number of larvae and pupae collected and the parasite emergence is shown in Table 7. Parasitism was heavy in the larval collections made on July 25 and August 5. The larval parasites were mainly Tachinidae, most of which died or did not emerge. The main pupal parasite was Apecthis ontario (Cresson).

Table 7

Number of Pine Butterfly Larvae or Pupae Collected and the

Number of Parasites that Emerged. South Vancouver Island, 1960.

	No. of insects collected		No. of insects parasitized	
Date	No. larvae	No. pupae	Larvae	Pupae
July 19	172		2	
July 20	26		2	1
July 25	196		74	1
August 5	37	91	27	11

Feeding was much lighter than the heavy frass drop indicated. Defoliation of three trees felled in Cathdral Grove did not average over 15 per cent. The insects showed a preference for needles one and two years old. There was almost no feeding on current foliage.

For egg samples, three branches were selected randomly from the upper third of the crown, and one branch from the mid-crown and the lower third of the crown of each sample tree. The area of each branch was calculated in square feet, and the foliage examined for eggs. Egg counts are summarized in Table 8, for 1959 and 1960.

Based on the 1960 egg counts and the expected defoliation the stands in the Cameron River Valley are not in serious danger of tree mortality in 1961. It is also believed that the stands in MacMillan Park will not be greatly weakened by defoliation of up to 45 per cent. If the population in MacMillan Park is found to be relatively greater than outside the park where the egg counts were made, it may be desirable, because of the esthetic value of the trees involved, to consider chemical control as a precautinary measure.

Cameron River Valley

A large moth flight was reported in the Cameron River Valley in 1960. This area adjoins Cathedral Grove and is a similar type of stand. Two egg samples were made in this valley, the first in block 35, two and one half miles south of Cathedral Grove and the second in block 81, five miles south of the Grove (Table 8). In block 35, total defoliation did not exceed 10 per cent and in the second area feeding was barely visible. The small number of eggs indicate the population in 1961 will be light.

Dunsmuir Creek Area, Nanaimo River Valley

During the regular summer survey frass drop was observed in the Dunsmuir Creek area. Egg counts were light, indicating light defoliation for 1961, as it was in 1960. Moth flights were reported over much of the Nanaimo River and Lakes country.

The Fir Engraver Beetle, *Scolytus ventralis* Lec.

Top killed, dying and dead grand fir trees have been recorded for some time on the east coast of Vancouver Island. In 1960, the dead trees were more abundant than usual, especially on the Saanich Peninsula. The attack usually starts at the top of the tree, sometimes only an area as large as a completed gallery pattern is killed; on larger trees 10 to 20 such patch kills have been found. Pole sized trees suffered the heaviest damage; the whole cambium area was completely eaten out and the bark was loose like a stove pipe. Wood peckers have exercised some control on the younger thin barked trees. Large mature grand fir trees have been dying in the Chemainus River Valley and the logging company decided to salvage the timber. Some 400,000 board feet was removed. Though not more than one quarter of these trees were dead when salvaged, the logs were mostly unsuitable for lumber manufacturing because of the dead pockets in the logs. The beetle attack had been in progress for some years as callus tissue had grown over the dead areas, but disease often gained entrance and pocket rot developed. The whole volume was eventually shipped to a pulp mill because of this defect, although the trees were up to four feet in diameter. Some of these logs were inspected in the spring of 1960, and although attacks were numerous, only two *Scolytis ventralis* Lec. adults could be found. In November of 1960, two grand fir trees in this valley with dead tops were felled and examined. The areas where the dead cambium began were not infested. In the dead portion, galleries of several species of beetles were found, but the beetle galleries were not believed responsible for the dead tops. Typical *Scolytus ventralis* Lec. galleries were in these tops, some attacks at least four years old. The dead spots were filled with pitch and bark had grown over them. The large ambrosia beetle, *Platypus wilsoni* Sw. was active in some adjacent dying trees.

Table 8

Number of Sound Pine Butterfly Eggs.

South Vancouver Island, 1959 - 1960.

Locality	Crown Section	1960			1959
		Area of foliage examined (sq. ft.)	No. eggs found	No. eggs per sq. ft.	No. eggs per sq. ft.
Cathedral Grove	A	104.67	1,178	11.25	10.73
	B	56.00	568	10.14	9.74
	C	84.20	1,963	23.31	4.23
	Totals	244.87	3,709	15.14	7.44
Block 81	A	48.30	18	.37	
Cameron	B	57.60	1	.02	
River	C	51.90	0	.00	
	Totals	157.80	19	.12	
Block 35	A	39.17	57	1.45	
Cameron	B	25.25	21	0.83	
River	C	52.00	68	1.31	
	Totals	116.42	146	1.25	
Dunsmuir	A	58.60	218	3.72	
Creek,	B	42.70	71	1.66	
Nanaimo	C	48.00	31	.65	
River					
	Totals	149.30	320	2.14	

Oak Looper, Lambdina somniaria (Hulst)

Garry oak trees near Victoria were severely defoliated in the Christmas Hill area bounded by Douglas Street, Rogers Avenue, Quadra Street and McKenzie Avenue. Most of the oak trees were completely defoliated, Douglas-fir trees in the same area suffered from heavy feeding and one grand fir was almost completely denuded. Several land owners sprayed their coniferous trees to prevent their destruction. Many of the oak trees leafed out again and the new leaves were still green in early December. The larvae fed from the centre of the crowns outward on both oak and coniferous hosts. Frass from oak trees was brown while that from coniferous trees was green. Larval and pupal parasitism was extremely light, but a virus disease killed many of the larvae.

Egg counts were made by collecting one half square foot of moss from the trunk of each of three oaks on Quadra Street and from three trees south of Rogers Avenue. The number of eggs found in this moss is shown in Table 9. An explanation for the scarcity of eggs in the Rogers Avenue samples is not known. Fir trees in this area were sprayed but this should not have had any great affect on the oak populations. The two sample points were not more than one half mile apart. Heavy defoliation can be expected in 1961.

Table 9

Number of Oak Looper Eggs per Half Square Foot of Moss in Two Localities in Saanich. South Vancouver Island District, 1960.

Area	Tree No.	Eggs found per half sq. ft.
Quadra Street	1	270
	2	520
	3	733
Rogers Avenue	4	26
	5	15
	6	19

Black-headed Budworm, Acleris variana (Fern.)

The frequency with which this insect has been found has declined steadily since 1957 (Table 10). The four larvae found were all collected on the West Coast between July 6 and July 12.

Table 10

Number of Black-headed Budworm per 3-tree Beating Sample Collected in the Respective Drainage Divisions of the South Vancouver Island District, 1960.

Drainage divisions	Total no. samples taken during larval period			No. samples containing black-headed budworm			Average no. larvae per sample		
	1958	1959	1960	1958	1959	1960	1958	1959	1960
001	1	3	0	0	0	0	0	0	0
002	37	29	0	2	1	0	1.5	1.0	0
003	21	32	0	7	4	0	2.57	2.25	0
004	5	0	0	1	0	0	1.0	0	0
005	14	29	33	5	5	3	1.80	1.60	1.33
Totals	78	93	33	15	10	3	2.06	1.80	1.33

Western Hemlock Looper, Lambdina fiscellaria lugubrosa (Hulst)

Thirteen larvae were found in 11 locations, nine of these samples were from the western side of Vancouver Island from the Nitinat River north to Hot Springs Cove. The other two collections were from Cathedral Grove.

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

Larva of this species were found exclusively on the western side of the district. Collections contained a total of 87 larvae, the largest number of insects in one sample was 30, collected at Kennedy Cove.

Saddle-backed Looper, Ectropis crepuscularia Schiff.

This insect appeared mostly in collections associated with Melanolophia imitata Wlk. and Nyctobia limitaria (Stkr.) on the West Coast. Only 22 larvae were found in 15 samples.

Silver-spotted Tiger Moth, Halisidota argentata Pack.

These larvae hatch in late summer and overwinter in colonies on coniferous trees. The insects are active on warm winter days and make webs wherever they feed. Larval development is usually completed in May, by which time large brown webs have been formed, often covering more than one branch. The preferred host is Douglas fir, although colonies are sometimes found on hemlock, cedar, spruce and grand fir. Web counts made by road surveys in the spring of 1959 and 1960 show a considerable colony increase. The number of webs counted over various stretches of road on the southern end of Vancouver Island increased in 1960 compared with similar counts in 1959 (Table 11).

Table 11

Road Side Web Counts of Silver-spotted Tiger Moth Colonies

in the Spring of 1959 and 1960. South Vancouver Island.

Area surveyed	No. webs recorded	
	1959	1960
Victoria to Duncan	14	57
Duncan to Nanaimo	20	84
Nanaimo to Parksville	81	86
Parksville to Cameron Lake	42	34
Duncan to Lake Cowichan	1	33
Lake Cowichan to Youbou	47	83
Totals	205	377

Fall Webworm, Hyphantria cunea Harr.

Large unsightly webs created by this insect were common on the east side of the district. Hosts included alder, willow, dogwood, maple, apple, cherry and pear. The greatest number of webs were evident just south of Ladysmith, where 83 webs were counted in one mile.

Tip Defoliation of Balsam Trees

Tips of the leader and upper branches of intermediate and understory balsam trees were fed upon and often completely defoliated over much of Vancouver Island. The red needles and bare tips were not noticed until August and no insect species could be associated with the damage.

Balsam Woolly Aphid, Adelges piceae (Ratz.)

Heavily gouted trees were located at three nurseries on the Saanich Peninsula. At one, balsam woolly aphids were identified from Abies concolor (Gord and Glend) Lindl. The second and third nurseries contained specimens of Abies lasiocarpa (Hook) Nutt. and Abies lasiocarpa var. arizonica (Merrian) Lemm. which had all the appearance of a heavy attack and it is assumed that the malformations were caused by this insect.

Douglas-fir Terminal Damage

The forest industry and the British Columbia Forest Service became concerned over damage to the leaders of Douglas fir regeneration in several areas on Vancouver Island in 1960. Broken leaders were collected along the Port Renfrew Road near Bear Creek in the late summer of 1960 and the damage was mainly caused by insect attack. Larvae, possibly Dioryctria abietivorella (Grote) were found boring into the broken leaders. The break usually occurred at the larval entrance hole, or in some cases at the base of the leader when insect feeding had taken place there. Browsing, while restricted mostly to lateral branches resulted in some leader damage. Another type of damage was the loss of terminal buds, probably by birds. Not all broken leaders were weakened by insect galleries, and it might be possible that birds, such as grouse, reaching for the terminal buds, may have sufficient weight to break the tender leaders. Four 1 x 2 chain plots were laid out in the fall of 1960 at Bear Creek, Nitinat River, Shaw Creek, and above Bear Creek Camp. The results of this work are shown in Table 12.

Killed leaders on the four plots in 1960 averaged 18.8 per cent. This was almost a 3-fold increase over the 6.5 per cent killed in 1959. The percentage of killed leaders from 1954, the oldest recorded damage, to 1958 was very low, indicating that the incidence of leader damage has increased greatly in the past two years. Dead leaders were found on trees ranging from two to 52 feet in height.

Considering leader damage of all ages, 24.7 per cent of the trees in Plots 1 - 4 have been damaged at least once since 1954. Some trees have been attacked up to three times.

Records were made on browsing damage and terminals with buds missing. On plots 1 - 4, 20 of the 292 trees were browsed. Only on five of the trees were the leaders killed, browsing on the remaining 15 trees was restricted to lateral branches. Terminal buds were missing on 21 trees (7.2 per cent). This figure is a minimum as the buds could not be observed on the higher trees. All these buds were from living terminals so there is a possibility that some of these trees might develop multiple leaders.

Table 12

Number of Douglas-fir Terminals Killed by Insects and Other Causes

South Vancouver Island, 1960.

Plot No.	Locality	No. trees	Height Range (feet)	Year leaders killed or damaged 1960	1959	1958	1957	1956	1955	1954	Total no. leaders	No trees damaged
1	Bear Creek	94	2-32	18	9	0	1	1	0	1	30	23
2	Nitinat River	67	2-29	8	6	3	2	0	1	0	20	13
3	Shaw Creek	83	2-31	17	2	0	1	0	0	0	20	18
4	Above Bear Creek Camp	48	34-58	12	2	2	1	0	3	2	22	18
	Total	292		55	19	5	5	1	4	3	92	72
	Per cent			18.8	6.5	1.7	1.7	0.3	1.4	1.0		24.7

Other Damage

Plot no.	Trees browsed: Leaders killed	Leaders not killed	Terminal buds missing
1	5	0	11
2	0	14	2
3	0	1	8
Total	5	15	21
Per cent	1.7	5.1	7.2

MISCELLANEOUS INSECTS

South Vancouver Island, 1960.

Name	No. of collections	Hosts	Remarks
Abebaea subsylvella Wlshm.	3	oak	Leaf miner, Victoria
Achytonix praeacuta Sm.	1	H	Cutworm, Alberni
Acleris senescens Zell.	1	D	Budworm, Sarita River
Anacamptodes emasculata Dyar	1	D	Looper, Ladysmith
Anomogyna mustelina Sm.	4	H,F,B	Cutworm, Alberni, Cowichan
Anthelia hyperborea Hulst	5	F,H,C	Looper, Galiano Is., Tofino Nitinat Lk., Hot Springs Cove
Biston cognataria Gn.	4	D,W	Looper, Victoria, Ladysmith
Campaea perlata Gn.	2	D,W	Looper, Gabriola Island
Caripeta divisata Wlk.	6	H,F	Looper, Ucluelet
Celama minna Butl.	1	W	Nolidae, Lantzville
Contarinia cuniculator	1	F	Needle miner, Cameron River
Contarinia pseudotsugae	2	F	Needle miner, Cameron River
Elpiste lorguineria Gump.	4	Mb, W	Looper, Saltspring Island, Alberni.
Eucordylea atripictella Die.	2	F, Bg	Gelechiidae, Gabriola Island
Enypia packardata Tayl.	5	F, H	Looper, Coleman Creek, Saltspring Island, Alberni.
Enypia venata Grt.	6	H	Looper, Cowichan, Parksville, Alberni.
Epirrita autumnata (Gn.)	17	H, B	Looper, Port Renfrew, Parksville, Nanaimo, Cowichan.
Epirrita pulchraria Tayl.	1	H	Looper, Nanaimo
Epithecia annulata Hulst	1	F	Looper, Cowichan
Eupithecia l. bifasciata Dyar	1	F	Looper, Alberni
Eupithecia unicolor Hulst	8	C, H	Looper, Cowichan Lake

MISCELLANEOUS INSECTS - continued

Name	No. of collections	Hosts	Remarks
Feralia jocosa Gn.	1	F	Cutworm, Duncan
Gabriola dyari Tayl.	7	F,H,D	Looper, Barkley Sound Alberni, Tofino
Halisidota m. angulifera Wlk.	2	W	Woolly bear caterpillar, Shawnigan Lake, Nitinat.
Hyalophora euryalus (Bdv.)	1	F	Looper, Victoria
Hydriomena manzanita Tayl.	1	O	Looper, Victoria
Telphusa sedulitella Busck.	1	O	Gelechiidae, Victoria
Lithophane pertarricla (McD.)	2	O	Cutworm, Victoria
Limenitis l. burrisoni (Mayn.)	1	shrub	White admiral, Gabriola Island
Neoalcis californiaria Pack.	15	H,F,C,O,Bg	Looper, Sooke, Cowichan
Neomyzaphis abietina Wlk.	3	S	Spruce aphid, Sooke
Nepytia unigrovenaria Pack.	1	F	Looper, Cowichan, Port Alberni.
Orthosia transparens Grt.	1	Arb	Cutworm, Victoria
Panthea portlandia Grt.	2	F	Caterpillar, Saltspring, Cowichan
Papilio rutulus Luc.	1	D	Swallowtail, Shawnigan
Pero morrisonarius Hy. Edw.	1	D	Looper, Parksville
Pikonema alaskensis Roh.	2	H	Sawfly, Tofino
Pikonema dimmockii Cress.	6	H,S,Hm	Sawfly, Nanaimo, Tofino, Bamfield.
Polia l. glaucopis Hamp.	2	S	Cutworm, Tofino
Promylea lunigerella Rag.	1	Bg	Budworm, Gabriola Island
Semiothisa spp.	5	H,S	Looper, Duncan, Cowichan, Jordan River.
Semiothisa teucaria Stkr.	1	O	Looper, Victoria
Stenoporpia albescens Hulst	1	H	Looper, Duncan
Synaxis pallulata Hulst	1	F	Looper, Nanaimo
Syngrapha a. interalia Ottl.	8	F,H	Cutworm, Alberni, Sooke

MISCELLANEOUS INSECTS - continued

Name	No. of collections	Hosts	Remarks
Syngrapha rl nargenta Ottl.	2	H,Pw	Cutworm, Port Renfrew
Triphosa haesitata (Gn.)	1	cascara	Looper, Nanaimo
Venusia pearsalli Dyar	2	D,Mb	Looper, Cowichan

STATUS OF FOREST DISEASES

Important Diseases

Mistletoe on Amabilis Fir

A new host record for dwarf mistletoe, probably Arceuthobium campylopodum Engelm. f. tsugensis (Rosendahl) Gill, for Vancouver Island was discovered in the San Juan River Valley. Mistletoe plants were found growing on amabilis fir at an elevation of 1,800 feet on the west side of Harris Creek. Amabilis fir of all sizes and crown classes were found to be supporting this parasite plant. The predominant species in the stand was hemlock, which was also heavily infected.

Pear Rust (Gymnosporangium fuscum) in North America.

The establishment in North America of a pear rust, caused by Gymnosporangium fuscum DC. (G. sabinae Dicks. ex Wint.) was discovered in Victoria for the first time. It is assumed that the fungus was introduced into British Columbia from Europe on juniper seedlings about 15 years ago. For unknown reasons the rust does not seem to have spread further than 1,000 feet since it was introduced. This is surprising because of the amount of junipers used as ornamentals in the greater Victoria area.

Weather Injury

The only weather injury found in 1960 affected several acres of Douglas fir, hemlock, cedar and alder regeneration at Round Lake near Northwest Bay. The trees were suffering from broken leaders, laterals and damaged buds and bark. Examination of the trees showed that scars or cankers occurred on the top of the branches only, and on not more than three sides of the main stem. The undamaged side was always to the south. No pathogen was found that could be responsible for the damage, the only reasonable explanation is hail damage. Storms of such intensity do not occur often on Vancouver Island.

Twig Dieback on European Larch

Botrytis ? *cinerea* Pers. ex Fr. and *Cladosporium* sp. were identified from dying European larch, *Larix decidua* Mill. twigs. This is the first time these fungi have been reported on this host. Their role in causing disease on this size class of host is not fully understood.

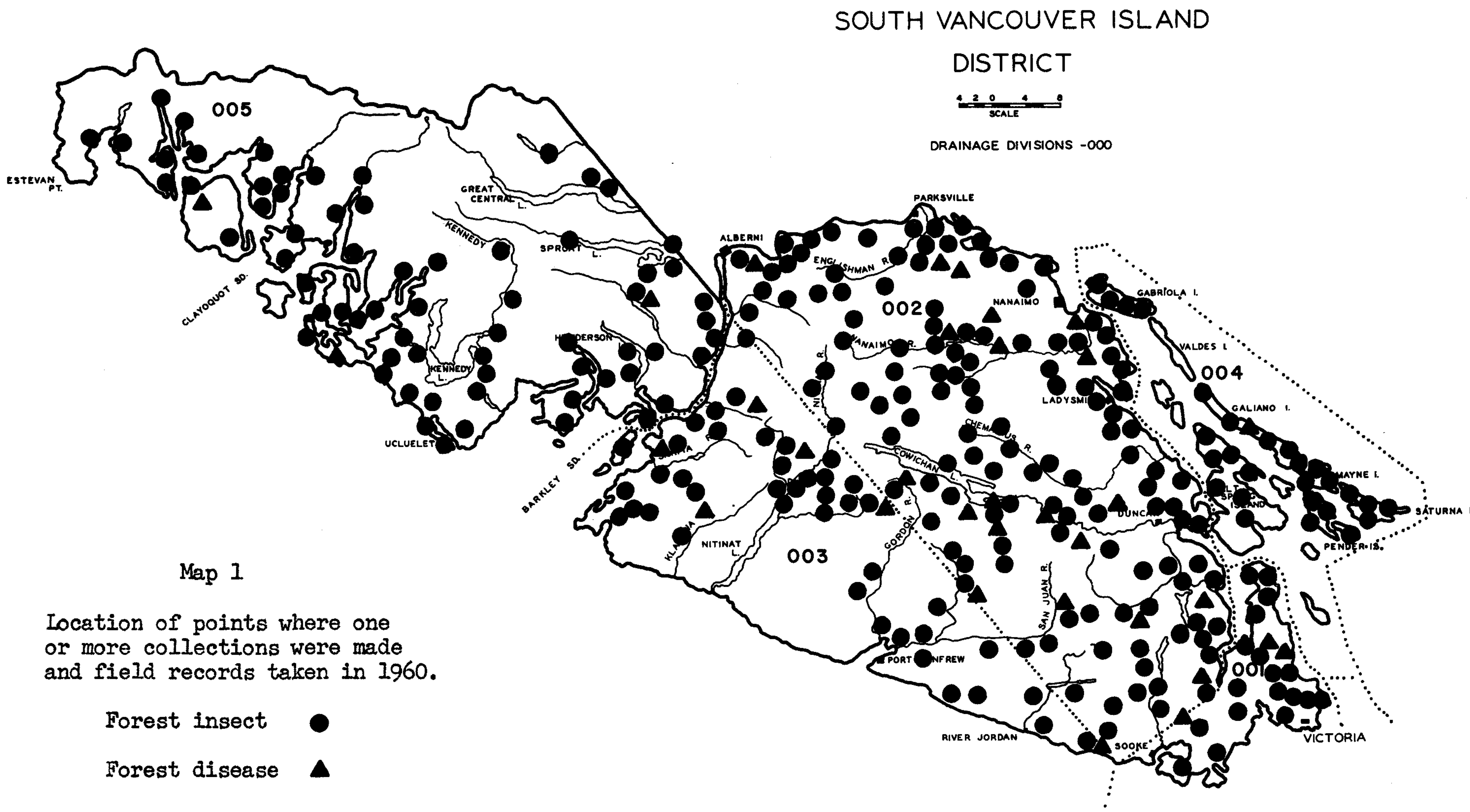
Exotic Plantations

Nine plantations were examined during 1960. Anything of interest discovered in these examinations is listed below:

XP No.	Location	Exotic species	Remarks
28 B	Robertson River	European larch	One tree dead, infected with *Armillaria mellea* (Vahl ex Fr.) Quel. Other green trees infested with buprestid larvae under the bark.
28 C	Robertson River	European larch	Trees growing well, *Botrytis*? *cinerea* and *Cladosporium* sp. were isolated and identified from twig diebacks. Some sap sucker damage also found.
32	Sutton Creek	Red pine	Some trees snow bent, upper branches taking over as leaders.
76	Cedar	Mixed hardwoods	Most of the species have failed due to various causes. Drought injury in 1958 was a major cause and stem girdling by rodents also contributed to mortality
	Ucluelet	Silver poplar	A leaf spot fungus, identified as *Marssonina castagnei* (Desm. & Mont.) Magn. is a new record for this host.

OTHER NOTEWORTHY DISEASES

Host	Organism	Locality	Remarks
Alder, red	*Taphrina japonica* Kusano	Sooke to Sarita River	Only small clusters of leaves infected.
Pine, shore	*Atropellis pinicola* Zellar & Goodd.	Tofino	A weak branch canker fungus.
Fir, grand	*Peridermium pseudo-balsameum* (Diet. & Holw.) Arth. & Kern.	Cowichan Lake	A rust disease which caused light mortality of current needles on true fir.
Cedar, western red	*Merulius himantioides* Fr.	Cowichan Lake	Determined by culture, found to have caused brown cubical butt rot in cedar. Its occurrence on this host is a new record, at least for British Columbia.

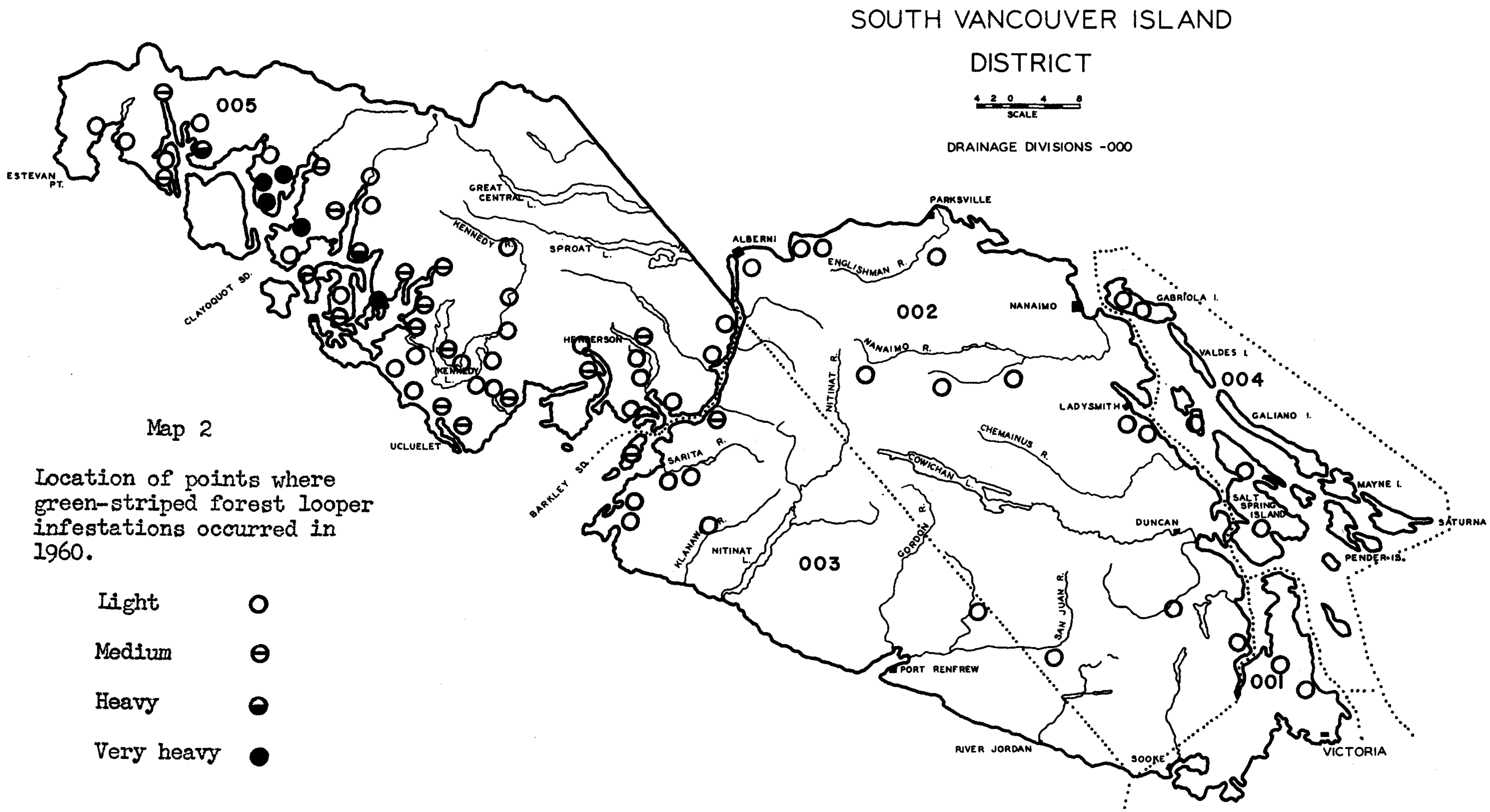


Map 1

Location of points where one or more collections were made and field records taken in 1960.

Forest insect ●

Forest disease ▲



Map 2

Location of points where green-striped forest looper infestations occurred in 1960.

Light

Medium

Heavy

Very heavy

ANNUAL REPORT OF FOREST BIOLOGY RANGER

for

NORTH VANCOUVER ISLAND DISTRICT

1960

FOREST BIOLOGY SURVEY

NORTH VANCOUVER ISLAND DISTRICT

1960

S. J. Allen

INTRODUCTION

The forest biology survey of North Vancouver Island commenced May 19 and ended November 4. Table 1 lists collections by hosts and Map 1 shows the locations of points where collections were made.

The population level of the green-striped forest looper continued to increase in Drainage Division 023 and decreased or remained static in the other areas of North Vancouver Island. This was probably due to the retarded summer season in 1960 which consisted of a cool wet May and June, an excessively hot July and a cool wet August and September.

Thirty-nine tree disease samples were submitted to the Victoria laboratory for identification. Of these samples nine were identified, five sent to Ottawa, seven retained for further study, six could not be identified, three were insect damage, one physical damage and five were special collections.

Table 1

Collections by Hosts

North Vancouver Island District - 1960

Coniferous hosts	Forest insects	Forest diseases	Broad-leaved hosts	Forest insects	Forest diseases
Cedar, red	26	1	Alder, red	3	-
Douglas fir	84	4	Cherry	1	-
Fir, alpine	1	-	Willow	6	3
Fir, amabilis	35	3	Miscellaneous	2	2
Fir, grand	13	-	No host	2	1
Hemlock, mountain	2	-			
Hemlock, western	253	8			
Pine, lodgepole	3	6			
Pine, red	2	1			
Pine, Scots	1	-			
Pine, white	2	5	Total	14	6
Spruce, Sitka	50	5			
Total	472	33	Grand Total	486	39

STATUS OF INSECTS

The Green-striped Forest Looper, Melanolophia imitata Wlk.

The green-striped forest looper prevailed in an evenly distributed population over the North and East coastal portions of North Vancouver Island District and reached infestation proportions on the west coast area (Map 2). Populations remained at a low level on the east coast areas south of Kelsey Bay and decreased noticeably on the north end of the Island in the Quatsino Region Drainage Division 025.

Defoliation at Villaverde Island and other west coast areas was reported by the Tahsis Company in August. Defoliation was found in 28 areas extending from Checleset Bay south-east to Clayoquot Sound on the west coast outside waterways of Drainage Division 023, the fog-belt zone. The total area was 17,665 acres, of which heavy defoliation was recorded on 4,640 acres (Table 2). The heaviest defoliation was found at Villaverde Island, Bligh Island, Eelstow Passage, Port Eliza and the McKay Cove - Easy Inlet area. Ground examinations indicated that the heaviest defoliation occurred in hemlock dominated stands and in the top third of the tree crowns. Douglas fir, amabilis fir, and western red cedar were all heavily defoliated when they occurred in the same stands, but even-aged hemlock stands were found to be most susceptible to attack as was evident at Villaverde Island where the average defoliation was 93 per cent (Table 3). The scrubby western red cedar dominated stands of the uneven age class, which form a high percentage of west coast forest cover, suffered light defoliation.

Due to heavy rains and cold weather larval development was retarded and none were found in June. In July an unusually hot spell of weather prevailed and larval development was rapid. By mid-August pupation had begun and was near completion when the area was revisited. Pupae and pre-pupae were found in the duff while many dead larvae were found on the top of the frass layer. No larval beating samples were available in Drainage Division 023 due to the mistimed visits to this area in June and August, hence no record of the average numerical increase per three-tree beating sample was obtained to insert in the summary table under Drainage Division 023 (Table 4).

A survey was conducted during October and November and a number of plots established throughout the infestation. Three plot areas were established apart from Villaverde and Bligh islands at Ououkinsh Inlet. Eelstow Passage and Port Eliza. In these areas, two plots of 50 trees each were established for recording defoliation. Pupal sampling was conducted as follows:

Four groups of three trees each were sampled in each area, two in the first plot and the following two at 20 chain intervals. The method used for pupal counts consisted of taking four one-foot square duff samples from under each tree, two from the exposed side and two from the shaded side of the tree. Samples on either side of the tree were located 1) against the base of the tree, and 2) mid way between the base of the tree and the periphery of the crown. Table 5 shows the average number of pupae found per square foot of duff in plots 1 to 3, and on Villaverde and Blight islands. The heaviest pupal populations were found at Villaverde Island and Eelstew Passage, 2.1 and 1.5 pupae per square foot of duff respectively.

Larval parasitism of the green-striped forest looper was light in 1960. Out of 317 larvae reared from the Quatsino Region, (Drainage Division 025), 27 were parasitized. The duff samples in Drainage Division 023 from which 198 pupae were collected also contained 66 pupal specimens of Dusoma sp., a larval parasite.

Contrary to 1959, very few larvae of the yellow-lined forest looper, Nyctobia limitaria (Stkr.), and the saddle-backed looper, Ectropis crepuscularia Schiff., were found accompanying the green-striped forest looper in 1960. At Ououkinsh Inlet in July, Tahsis Company cruisers noticed hemlock looper larvae in the vicinity of the mouth of Power Creek on the fringe of the green-striped forest looper infestation. The hemlock looper was also present at Holberg Inlet in numbers in excess of the green-striped forest looper numbers.

Defoliation in 1961 depends on pupal survival, adult emergence, the success of mating and oviposition, and larval establishment. Pupal loss by parasites and predators is unknown, and mating, oviposition, and larval establishment is to a large extent dependent on weather conditions. With so many unknown factors it will be necessary to wait until the spring of 1961 to determine the status of the outbreak.

Although the small number of pupae does not appear to represent a heavy population, chemical control may be carried out in 1961 if the early larval population is considered large enough to warrant control action.

Hemlock Looper, Lambdina fiscellaria lugubrosa Hulst

The hemlock looper population increased slightly in the north-western extremity of North Vancouver Island in 1960. Since 1958 a gradual increase of this population has been evident in the Holberg Inlet area. The largest numbers this year were found at Dahlstrom Point where 52 larvae and 54 larvae per three-tree beating samples were collected from western hemlock and Sitka spruce. An egg sample was taken here in November. The sampling method was as follows:

Three hemlock trees were felled and one 6 x 12 inch bark sample was taken from each of the top three-quarter crown levels of each tree, numbered A, B and C from the top. A total of two eggs were found, both in crown level C of tree 3.

Tahsis company cruisers reported hemlock looper larvae hanging from trees in the area west of Power Creek at Ououkinsh Inlet. An egg sample was taken in this general area in November. The sampling method was the same as that used at Dahlstrom Point. A total of 19 eggs were found in the nine samples: 11 on tree number 1, one on tree number 2, seven on tree number 3. The average number of eggs per sample unit was 2.1, considerably below the 10 believed to indicate outbreak proportions.

Hemlock looper larvae occurred in small numbers in 12 areas in Drainage Division 023 from Silverado Creek to Kashutl Inlet in 1959. In the Nimpkish River Valley the population showed a very slight drop from 1959, (Drainage Division 024, Table 6). Elsewhere throughout the district, occurrence of

Table 2

Area of Infestations of the Green-striped Forest Looper and

Intensity of Defoliation, West Coast North Vancouver Island.

1960.

Location	Defoliation in Acres		
	Light (1 - 25%)	Medium (26 - 50%)	Heavy (51 - 100%)
Johnson Lagoon	130		
Nasparti Inlet	1,020		
Ououkinsh Inlet	1,020		
Power Lake	30		
Malksope Inlet	130		
Easy Inlet	1,340		
Chamiss Bay		1,600	
McKay Cove			860
North of Kyuquot		190	
Moketas Island		30	
Hankin Cove			770
Yaku Bay			190
Markale Pen.		30	
S/Pinnace Channel	1,220		
Hohoae Island		900	
Union Island	510		
Whitley Island	30		
South of Amai Inlet	385		
South of Tahsish Inlet	30		
Narrowgut Creek	1,540		
Kapoose Creek		190	
Port Eliza		1,220	
Little Espinosa Inlet		450	
Zeballos Inlet		510	
Strange Island	260		
Bligh Island			2,560
Hanna Channel	260		
Villaverde Island			260
Total	7,905	5,120	4,640

GRAND TOTAL - 17,665 acres

Table 3

Per cent Defoliation by the Green-striped Forest Looper by Host and Crown Class, Plots 1 to 3 and Villaverde Island and McKay Cove.

Plot Locality and number	Crown Class Host	No. trees	Dominant top 1/3	Dominant mid 1/3	Dominant low 1/3	Co-dominant top 1/3	Co-dominant mid 1/3	Co-dominant low 1/3	Intermediate top 1/3	Intermediate mid 1/3	Intermediate low 1/3	Suppressed top 1/3	Suppressed mid 1/3	Suppressed low 1/3	Average defoliation
Plot 1 Ououkinsh Inlet	H	98	25.2	19.2	16.7	33.6	19.8	17.7	31.8	25.2	23.1	20.0	12.9	10.8	22.4%
Plot 2 Eelstow Pass	H	107	55.2	44.5	29.2	68.9	46.6	42.6	71.4	59.3	48.5	45.2	34.2	32.1	
	B	2	-	-	-	-	-	-	75	15	15	15	10	5	55.8%
	C	3	-	-	-	-	-	-	35	23	16	-	-	-	
Plot 3 Port Eliza	H	92	60.6	40.1	48.8	72.5	65.0	70.7	62.7	56.6	49.7	49.7	45.8	36.6	
	F	2	Tr.	Tr.	Tr.	30	20	20	-	-	-	-	-	-	53%
	C	4	15	15	15	-	-	-	30	20	20	100	90	80	
	H	2	-	-	-	90	80	60	-	-	-	100	90	80	
Villaverde Is.	H	83	-	84.1	-	-	97.2	-	-	95.4	-	-	89.4		
	F	10	-	75	-	-	100	-	-	99.0	-	-	100		93.1%
	C	7	-	55	-	-	70	-	-	88.5	-	-	90		
McKay Cove	H	49	-	66.0	-	-	84.1	-	-	87.6	-	-	87.1	-	
	C	5	-	30	-	-	-	-	-	75.0	-	-	95	-	82.5%
	F	2	-	-	-	-	60	-	-	-	-	-	-	-	

Table 4

Summary of Green-striped Forest Looper Found by Drainage Division,

North Vancouver Island 1958 - 1960.

Drainage division	Total number of samples taken during larval period			Number of samples containing larvae			Average number larvae per sample		
	1958	1959	1960	1958	1959	1960	1958	1959	1960
021	89	124	72	45	22	34	4.03	3.2	3.8
022	47	42	60	26	12	23	2.2	2.3	3.0
023	37	59	-	33	41	-	12.0	25.0	-
024	7	55	46	5	44	21	2.6	14.8	4.3
025	62	42	88	39	35	58	4.3	24.5	9.3
026	5	5	6	3	4	5	2.6	3.7	2.8
Total	247	327	272	151	158	141	4.4	16.7	6.02

Table 5

Number of Green-striped Forest Looper Pupae per Square Foot of Duff at Sample Plots. North Vancouver Island, 1960.

Plot locality and number	Station	Position: Exposed 1	Exposed 2	Shaded 1	Shaded 2	Total	No. pupae per sq. ft.
Ououkinsh	A	2	6	0	1	9	0.75
	B	1	1	2	2	6	0.50
Inlet (Plot 1)	C	0	3	1	0	4	0.33
	D	0	1	0	1	2	0.16
Total		3	11	3	4	21	0.44
Eelstow	A	3	2	4	3	12	1.00
	B	9	4	7	2	22	1.83
Passage (2)	C	3	5	8	8	24	2.00
	D	4	3	4	1	12	1.00
Total		19	14	23	14	70	1.46
Port	A	2	1	2	1	6	0.50
	B	3	1	1	1	6	0.50
Eliza (3)	C	4	0	1	3	8	0.67
	D	1	1	0	0	2	0.16
Total		10	3	4	5	22	0.46
Bligh	A	5	3	3	0	11	1.38
	B	3	0	0	1	4	0.50
Island	C	0	1	0	0	1	0.12
	D	0	0	0	0	0	0.00
Total		8	4	3	1	16	0.50
Villaverde	A	0	4	1	1	6	0.75
	B	2	3	3	3	11	1.38
Island	C	3	5	3	9	20	2.50
	D	12	7	9	1	29	3.62
Total		17	19	16	14	66	2.06

the hemlock looper has been intermittent and the population has remained almost static.

Map 3 shows locations of hemlock looper collections.

Table 6

Summary of Hemlock Looper Collections by Drainage Division, North Vancouver Island.

Drainage division	Total number of samples taken during larval period			Number of samples containing larvae			Average number larvae per sample		
	1958	1959	1960	1958	1959	1960	1958	1959	1960
021	85	30	57	4	2	2	1.3	1.5	1.0
022	49	0	60	2	0	1	2.0	0.0	2.0
023	37	34	-	6	15	-	1.5	2.3	-
024	6	45	46	0	6	5	0	1.7	1.0
025	68	43	88	9	6	14	3.2	5.3	9.0
026	2	0	6	0	0	0	0	0	0
Total	247	152	257	21	29	22	2.2	2.8	6.0

Black-headed Budworm, Acleris variana (Fern.)

The black-headed budworm population decreased in 1960. In 1959, 27 collections containing black-headed budworm averaged 1.4 larvae each compared to 10 collections in 1960 which averaged 1.8 larvae (Table 7). The first larva was found on June 18 and the last on August 7. Six of the 18 larvae were parasitized, two by the parasite, Eubadizon pleurale, Cress. The annual egg survey was carried out in October and a total of eight eggs was found. The average number of eggs per 10-inch tip was 0.023, a decrease from 1959, and about equal to the 1958 average (Table 8). The eggs were found at Englewood, Port McNeill, Port Hardy and Holberg.

Table 7

Summary of Black-headed Budworm Collections by

Drainage Division, North Vancouver Island.

Drainage division	Total no. samples taken during larval period			No. samples containing larvae			Average no. larvae per sample		
	1958	1959	1960	1958	1959	1960	1958	1959	1960
021	84	66	72	4	0	1	1.2	0	1.0
022	45	36	60	2	2	2	1.0	2.0	2.5
023	39	23	-	10	2	-	1.6	1.0	-
024	0	49	46	0	10	3	0	1.0	1.7
025	0	43	88	0	13	4	0	1.7	1.8
026	4	0	6	2	0	0	1.0	0	0
Total	172	217	272	18	27	10	1.4	1.4	1.8

Antique Tussock Moth, Orgyia antiqua badia (Hy. Ed.)

Along with other defoliators the antique tussock moth showed a gradual increase in the Quatsino Region yearly since 1958, (Drainage Division 025, Table 9), Map 3. In this region, the one area with an outstanding increase in population was the south side of Drake Island. One hundred and thirty larvae were collected from a three-tree-beating sample from western hemlock, 16 from Dougas fir and 38 on Sitka spruce. Defoliation wasn't noticeable in this area even though the larvae were feeding gregariously on one hemlock tree.

Of 148 larvae reared five larvae were parasitized and seven were diseased. Three of the pupae reared were parasitized and 26 were diseased. The first larva of this insect was found on July 14 and the last on August 20 in 1960.

Table 8

Black-headed Budworm Egg Counts at Sample Points on Northern Vancouver Island, 1956 - 1960.

Locality	Average number of eggs per 10-inch sample unit				
	1956	1957	1958	1959	1960
Holberg - Airforce road	0	0.17	0.17	0	-
Holberg - P1335	0.7	1.0	0	-	-
Holberg Inlet	2.0	0.17	0	0	-
Holberg Mortality Plot	2.2	0.17	0.20	0.20	0.07
Holberg NE main	1.8	0.5	0	-	-
Dahlstrom Pt.	1.0	0.17	0	0	0.07
Mahatta River	1.5	0.5	0	-	-
Opposite Jeune Landing	5.0	0	0	0	-
Jeune Landing	1.8	0.17	0	0.07	0
Teeta Creek	7.0	0	0	0.07	0
Port Alice	17.5	0.33	0	0.07	0
Alice Lake Bl. 25	3.8	0	0	0.07	0
Port Hardy B.C.F.S.	1.0	0	0.13	0.53	0.07
Alice Lake Br. 2	27.8	0	0	0	0
Rupert Inlet	3.5	0.33	0	0	0
Port Hardy Airport Road	4.2	0	0.07	0.07	0.13
Nine-mile Lake	1.8	0	0.07	0	0
O'Connor Lake	1.2	0.17	0	0	0
Port McNeill N. main	0.3	0	0	0	0
Port McNeill	10.7	0.66	0	0	0
Port McNeill E. main	12.0	0	0	0	0.07
Nimpkish - Kilpala River	2.1	0	0	-	-
Nimpkish Lake road	0.2	0.17	0	0	0
Nimpkish Br. 8	0.8	0	0	0	0
Englewood Grade mi. 3	2.7	0	0.07	0	0.13
Beaver Cove	2.0	0.5	0.07	0	0
Kokish R. E.	1.2	0	0.07	-	-
Ida Lake	4.7	0.17	0	0	0
Robson Bight	2.0	0	0	0.07	0
Tsitika River	1.7	0	0	-	-
Naka Creek	4.3	0	0	0	0
Salmon River	2.3	0.17	0	0	0
Total	138.6	5.52	0.82	1.16	0.54
Average	4.08	0.16	0.024	0.04	0.023

Table 9

Summary of Antique Tussock Moth Collections by

Drainage Division, North Vancouver Island.

Drainage division	Total no. samples taken during larval period			No. samples containing larvae			Average no. larvae per sample		
	1958	1959	1960	1958	1959	1960	1958	1959	1960
021	88	36	17	1	0	0	1.0	0	0
022	50	36	18	1	2	1	1.0	1.0	1.0
023	30	0	-	0	0	-	0	-	-
024	7	38	44	0	3	0	0	1.0	0
025	59	43	77	15	7	12	2.53	9.7	17.5
026	4	-	6	0	-	0	0	-	0
Total	238	153	162	17	12	13	2.36	6.1	15.8

Hemlock Sawflies, Neodiprion spp.

Hemlock sawfly larvae were found intermittently from May 26 to September 16 throughout the district. The hosts were western hemlock, grand fir, amabilis fir, Douglas fir and Sitka spruce. Larvae were found in colonies causing slight defoliation to grand fir at Little River and on amabilis fir at Erik Creek. There was a slight over-all decrease in population compared with 1959, but a noticeable increase from Parksville to Campbell River (Drainage Division 021) Table 10. Distribution of collections was similar to that of 1959.

Pine Butterfly, Neophasia menapia Feld.

Pine butterfly larvae were found at Comox Lake and Davie River. Moth flights were observed at Cathedral Grove and Heber River in August of 1960. Egg samples were taken in the Cathedral Grove area (see South Vancouver Island Ranger Report).

Table 10

Summary of Neodiprion spp. Sawfly Collections by

Drainage Division, North Vancouver Island.

Drainage division	Total no. samples taken during larval period			No. samples containing larvae			Average no. larvae per sample		
	1958	1959	1960	1958	1959	1960	1958	1959	1960
021	89	119	135	22	11	23	3.9	1.5	16.0
022	61	71	72	11	8	13	2.6	2.1	2.0
023	39	59	51	11	19	4	3.8	4.3	2.0
024	7	49	46	1	20	16	2.0	14.9	4.7
025	75	42	88	12	25	29	5.1	9.4	3.8
026	4	5	6	0	0	0	0	0	0
Total	275	335	398	57	83	85	3.8	7.8	6.6

Yellow-lined Forest Looper, Nyctobia limitaria Stkr.

In 1960 a total of 14 larvae were found in 10 samples compared to 856 larvae found in 92 samples in 1959 (Table 11). No sign of parasitism was found. The larval period started on July 4 and ended August 21 in 1960.

Saddle-backed Looper, Ectropis crepuscularia Schiff.

The population of the saddle-backed looper decreased greatly in 1960. A total of only five larvae were found in five samples compared to 196 larvae found in 35 samples in 1959 (Table 12). The larvae were collected between July 5 and August 20.

Table 11

Summary of Yellow-lined Forest Looper Collections by

Drainage Division, North Vancouver Island.

Drainage division	Total no. samples taken during larval period			No. samples containing larvae			Average no. larvae per sample		
	1958	1959	1960	1958	1959	1960	1958	1959	1960
021	86	88	54	18	5	1	5.4	1.0	1.0
022	50	54	60	19	1	1	1.6	2.0	3.0
023	35	59	-	23	34	-	6.0	13.6	-
024	7	55	62	2	20	4	1.0	1.3	1.25
025	54	42	77	19	31	4	3.0	11.5	1.25
026	4	5	6	0	1	0	0	2.0	0
Total	236	303	259	81	92	10	3.1	9.3	1.4

Sitka Spruce Weevil, *Pissodes sitchensis* Hopk.

Examination and measurement of 273 spruce saplings in the Echo Lake plantation showed a light new attack for 1959 by the spruce weevil and numerous old attacks which the majority of the trees have outgrown. Twenty per cent of the plot trees remain in good form, 28 per cent fair, 48 per cent poor and four per cent unknown, (Table 13).

The dead terminals of past attacks are replaced and in most instances the stems remain straight. Most of the poor growth is due to site deficiency and *Adelges cooleyi* Gill. attack.

Western Tent Caterpillar, *Malacosoma pluviale* (Dyar)

Tent caterpillar larvae were found in the Comox area and north-west of Horne Lake in 1960. Damage was confined to isolated branches of red alder and wild rose.

Table 12

Summary of Saddle-backed Looper Collections by

Drainage Divisions, North Vancouver Island.

Drainage division	Total no. samples taken during larval period			No. samples containing larvae			Average no. larvae per sample		
	1958	1959	1960	1958	1959	1960	1958	1959	1960
021	86	72	45	4	2	2	1.0	1.0	1.0
022	54	48	60	6	2	2	1.3	1.0	1.0
023	39	59	-	13	13	-	1.6	3.5	-
024	7	49	44	0	3	0	-	2.0	0
025	59	43	77	11	15	1	1.6	9.5	1.0
026	4	5	6	1	0	0	1.0	0	-
Total	249	276	232	35	35	5	1.4	5.7	1.0

Fall Webworm, Hyphantria cunea Harr.

The infestation of fall webworm found on the east coast from Campbell River to Parksville increased in 1960. The area between Oyster Bay and Comox Logging road remained approximately the same as 1959 with 148 webs counted along three and one-half miles of road. From Oyster Bay to Courtenay 247 webs were counted on the east side of the highway, a distance of 16 miles. Webs were seen on red alder, willow, apple, pear, hawthorn, Japanese plum, wild cherry and wild rose. Two colonies were submitted to the insectary for rearing but no parasites were obtained.

Spruce Gall Adelgid, Adelges cooleyii (Gill.)

Galls of this adelgid were collected where present in the North Vancouver Island district in 1960 for distribution records. No new attacks were found in coastal areas of Drainage Divisions 023, 024, and 025. In these areas Douglas fir was present but scarce. Douglas fir contained very few nymphs of the spruce gall adelgid during 1960 compared to 1956 and 1957 when fir foliage was "white" with nymphs. At the Echo Lake plantation near Campbell River where 273 stems were examined for incidence of weevil attacks Adelges cooleyii had deformed 89 per cent of the trees examined, (Table 13).

Table 13

Condition of Sitka Spruce Trees at Echo Lake Plantation,

North Vancouver Island, 1960.

		Shaded	Partially Shaded	Open
No. of trees		94	62	117
Average Height		16.1'	17.0'	13.7'
Average D. B. H.		2.6"	2.4"	2.7"
Total No./weevil attacks recorded		163	107	87
No. of 1959 attacks		12	0	2
No. of trees with)	Light	36	1	19
)	Medium	23	19	22
Adelges attacks)	Heavy	12	90	20
Tree Form	) Good	17	26	11
	) Fair	22	36	17
	) Poor	51	49	32
	) Unknown	4	6	2

Fir Engraver, Scolytus ventralis Lec.

Grand fir in the Union Bay - Courtenay area and in the vicinity of Port Alberni showed symptoms of attack in 1959 and 1960. Most of the attacked trees were top-killed while a few were killed outright. Due to the cross-grain gallery cut in the cambium layer by the adult beetle, the attacked trees show symptoms very quickly by their foliage changing color to brick-red. In one case, two attacked trees changed color within a two-week period. Most of the beetle-damaged trees showed signs of previous damage such as surface compression by a new roadway, root disturbance, or butt abrasions on the bark prior to beetle attack.

Douglas fir Beetle, Dendroctonus pseudotsugae Hopk.

A few individual Douglas-fir trees attacked by this beetle were reported by Canadian Forest Products Company foresters in the Nimpkish River valley. One attack affecting five trees was found on the shoreline of Buttle Lake. The shoreline trees are subjected to a verying water level of up to six feet throughout the season. The trees were old growth Douglas fir which were probably weakened by the change of water level and so more susceptible to bark beetle attack.

A fire in 1958 at Myra Creek at the south end of Buttle Lake damaged a large area of old growth Douglas fir. Trees in this area, most of which were fire-scarred and weakened, have been attacked by Douglas fir beetle. The attacks were confined to the fire-scorched trees.

Silver-spotted Tiger Moth, Halisidota argentata Pack.

During 1960, the spring survey of the silver-spotted tiger moth webs showed a slight increase in the number of webs on roadsides when 97 webs were counted between Parksville and Campbell River. In the spring of 1959 65 webs were counted. Larval dispersal was very rapid in 1960. By May 20, no larvae were evident and the webs were collapsing and disintegrating enough to make the damage undiscernible. No new webs were noticed in the areas north of Parksville in the fall of 1960.

Green Velvet Looper, Epirrita autumnata Harr.

The population of the green velvet looper decreased slightly in 1960 compared with 1959 (Table 14).

Spruce Budworm, Choristoneura fumiferana Clem.

Only two spruce budworm larvae were found in 1960, both in the vicinity of the Tsable River valley.

Spruce Tip Moth, Zeiraphera diniana Gn.

Spruce tip moth attacks were found at Tahsis Inlet and Zeballos River valley in 1960. Due to the heavy May and June rainfall in these areas spruce growth was very heavy. At the time of sampling, 25 per cent of the tips had been infested, and insects were present in about 12 per cent of the infested tips. Some tips contained up to three larvae.

Sequoiae Pitch Moth, Vespamia sequoiae Hy. Edw.

Attacks by this pitch moth on lodgepole pine and yellow pine have been noticeable in exotic plantations at Campbell River and Echo Lake since 1950. Other areas of native lodgepole pine at Comox Lake and Loon Lake were attacked by this pitch-moth. One larva was found in a pitch stream on the trunk of a large Douglas fir at Stamp Falls Park.

Table 14

Summary of Green-Velvet Looper Collections by

Drainage Division, North Vancouver Island.

Drainage division	Total no. samples taken during larval period			No. samples containing larvae			Average no. larvae per sample		
	1958	1959	1960	1958	1959	1960	1958	1959	1960
021	84	136	22	21	19	8	5.2	5.6	2.07
022	50	57	64	4	11	10	2.0	3.0	2.6
023	7	59	48	1	9	8	1.0	2.2	2.0
024	-	21	-	-	2	-	-	4.0	-
025	-	-	-	-	-	-	-	-	-
026	4	10	6	0	0	0	0	0	0
Totals	145	283	140	26	41	26	4.5	4.1	2.7

Hemlock Twig Miner, Olethreutid sp.

During October and November, 1960, several hemlocks were observed with drooping lateral twigs of current foliage at Ida Lake, Port Hardy and Holberg Inlet. Several of these were collected and found to contain one twig mining larva in each affected twig. These were tentatively identified as Olethreutid species. Positive identification will be obtained if efforts to rear larvae are successful.

Douglas fir Terminal Damage

Larvae tentatively identified as Dioryctria sp. have been boring galleries in the basal half of the leaders of Douglas-fir trees up to 30 feet in height. These galleries are large in size and weaken the leader which is subsequently broken.

Mr. Bruce Devitt of Reforestation Division, B. C. Forest Service, supplied plot records from Mohun Lake, Sayward Forest. An average of seven 1/100 acre plots showed that 18 per cent of the Douglas fir had missing or broken leaders, an average of 214 per acre.

MISCELLANEOUS INSECTS COLLECTED IN

NORTH VANCOUVER ISLAND DISTRICT, 1960.

Name of Insect	Hosts	No. of collections	Remarks
Anomogyna mustelina Sm.	H,B,C,F	17	Alberni to Campbell R. - Gold R. and Zeballos Maximum of three larvae per collection.
Anthelia hyperborea Hulst	H,B	8	Courtenay to Englewood, all on E. coast except one at McBride Bay.
Caripeta divisata Wlk.	H,F,S	13	Parksville to Sayward, Buttle Lake and Quatsino.
Enypia packardata Tayl.	H,B,F	17	Spring and Fall - Alberni valley and east coast Parksville to Robert's Lake.
Enypia venata Grt.	H, B	8	Spring and Fall - Courtenay to Campbell R., Elk R., Gold R., and Buttle Lake.
Eupithecia annulata Hulst	H,Bg,F	4	Langley Lake and Campbell River
Eupithecia unicolor Hulst	H, C	7	Parksville to Sayward, Elk R., Muchalat Inlet, Adams R.
Feralia jocosa Gn.	H, F, B	4	Port McNeill - Port Alice and Merville.
Gabriola dyari Tayl.	H, F	13	Alberni, Qualicum, Courtenay, Tlupana Inlet, Zeballos Inlet, maximum of six larvae per collection.
Hyalophora euryalus Bdv.	F	1	Browns River Falls.
Hydriomena irata Swett.	H, B, S	4	Quatsino Region and Horne Lake
Hydriomena speciosata Pack.	F	1	Bowser
Malacosoma disstria Hbn.	H	1	Stuart Pt. Holberg Inlet

MISCELLANEOUS INSECTS - continued

Name of insect	Host	No. of collections	Remarks
Neoalcis californiaria Pack.	H, F, Bg	26	East Coast - Parksville to Sayward, West - Tlupana Inlet and Gold R., G. Central Rd. and Elk River - Heber R.
Nepytia u. nigrovenaria Pack.	H	2	Buttle Lake and Loon Lake
Panthea portlandia Grt.	B, F, C	4	Nimpkish Lake, Bonanza Lake Holberg Inlet and Horne Lake
Phenacaspis pinifoliae Fitch	Pr	1	Bowser
Pikonema alaskensis (Roh.)	H, S	3	Adam River, Naka Creek, and Nimpkish River mouth.
Pikonema dimmockii (Cress.)	H, B, S	8	Piggott Creek, Johnstone Strait, Nimpkish Lake, Holberg Inlet.
Promylea lunigerella Rog.	H, Bg	2	Campbell River and Tsable R.
Protoboarmia p. indicatoria Wlk.	H, F	3	Horne Lake, Great Central Lake
Syngrapha a. interalia Ottol.	H, B, F	15	Port Alberni to Campbell River, Upper Campbell Lake, Gold River, Tlupana Inlet.
Syngrapha r. nargenta Ottol.	H, B, F, S	10	Campbell River to Alberni, Gold River, Tlupana Inlet
Syngrapha selecta	H	1	Tlowils Lake

STATUS OF FOREST DISEASES

Important Diseases

Flag Canker of Pine

Atropellis pinicola Zeller and Goodd. was found at the east end of Beavertail Lake on white pine in 1960. The fungus usually attacks branches of white pine causing girdling cankers. The distal portion of the branch flags and dies. In the last two years it was common to find the disease on living white pine which had been infected by white pine blister rust, Cronartium ribicola J. C. Fisch. Samples have been taken from white pine at Merville, Horne Lake and Comox Lake areas in 1958 where blister rust attacks were numerous. Infections causing flag cankers were rare in 1960.

Hyper-parasitism of Peridermium pseudo-balsameum (Diet. & Holw.) Arth. and Kern.

Darluca filum (Biv.-Bern. ex Fr.) Cast., fungi imperfecti, was found on Peridermium pseudo-balsameum, a foliage rust collected on grand fir at Langley Lake near Union Bay in 1959. This constituted a new record of hyper-parasitism. The range of Peridermium pseudo-balsameum is co-incident with that of its host, grand fir on the east coast of Vancouver Island from Parksville to Kelsey Bay.

Exotic Plantations examined in 1960.

Eleven plantations designated for examination were scrutinized for defects in 1960 and only three showed any change in disease conditions from 1959. The defects occurred in the form of mechanical damage, particularly browsing. The remainder, including Scots pine, Norway spruce, Port Orford cedar and European larch showed continued good growth and no visible infection during 1960. Table 15 lists the defects of the three affected plantations.

Table 15

Exotic Plantations Affected by Mechanical Damage,

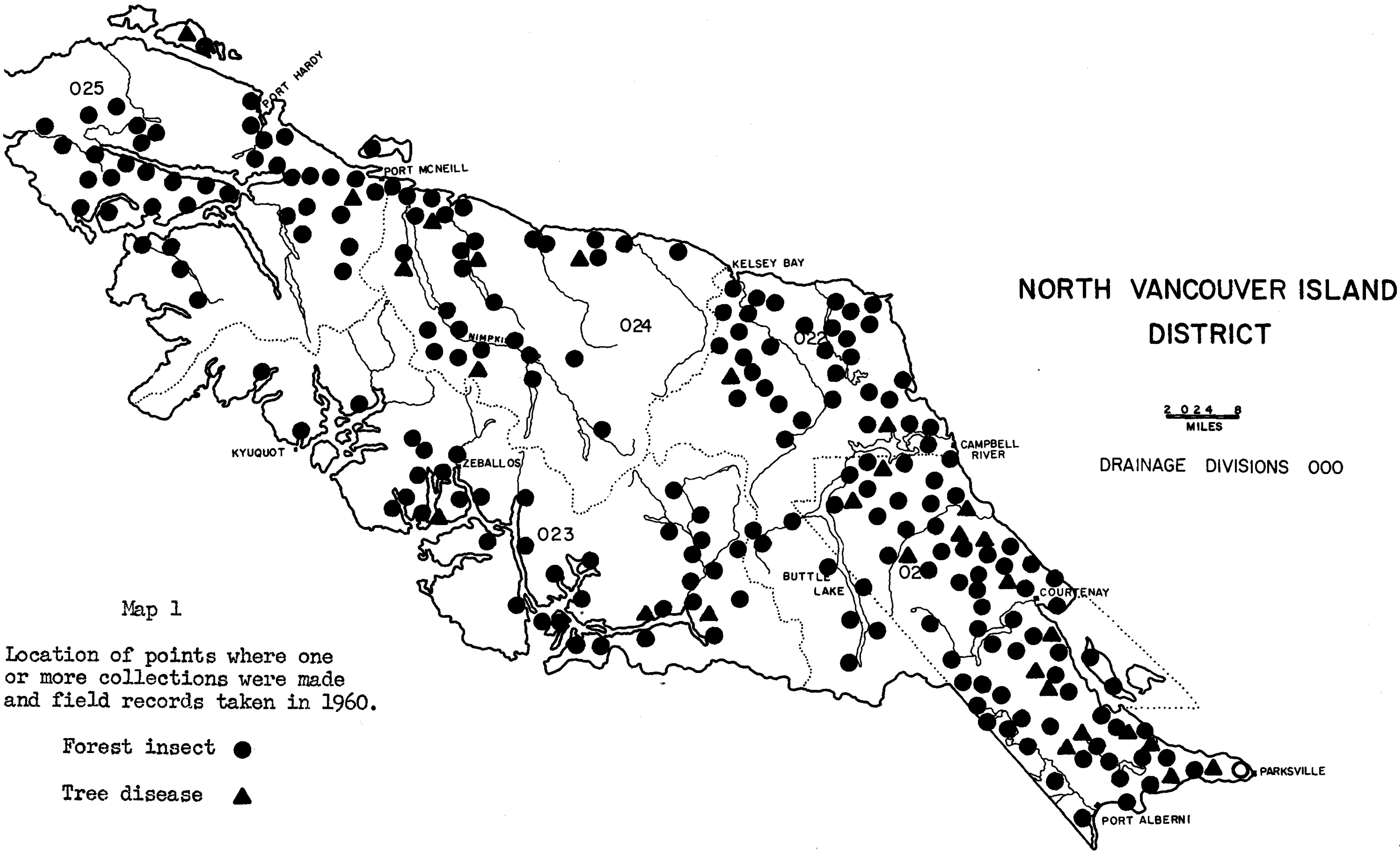
North Vancouver Island, 1960.

Plantation Number	Location	Exotic species	Remarks
13	Tsolum River	Scots pine	25/50 remain in plot; browsing to ground level; some recovery and 1960 growth to 12" height by fall, 1960.
14	Tsolum River	Norway spruce	Recovered well after 1959 weed killer damage; 1960 leader growth good, heights from 3 to 5 feet.
26	Campbell River	Scots pine	Growth continuing well, 8/50 trees attacked by pitch-moth. 2/50 sapsucker attacks.

Table 16

Other Noteworthy Diseases

Host	Organism	Locality	Remarks
Ground	Polyporus perennis L. ex Fr.	Nimpkish River near Kaipit Creek	This fungus is usually associated with decay of Douglas fir and western red cedar; it has also been found on willow.
Hemlock, western	Caliciopsis sp.	Horne Lake and Espinosa Inlet	Branch canker of hemlock which is found on lower shaded branches near crown base of trees of all ages.
Labrador tea	Chrysomyxa ledicola Lagerh.	Quinsam River valley	Found in telial stage in 1960 near Middle Quinsam Lake; no aecial stage found; no Sitka spruce in vicinity which is the alternate host for this rust.
Pine, lodgepole	Armillaria mellea (Vahl ex Fr.) Quél.	Quinsam River valley	Signs of shoestring root rot were found on root collar of one weevil attacked seedling
Pine, lodgepole	Cronartium comptoniae Peck.	Quinsam River valley	Blister rust of pines; caused cankers on the butts and main stems of seedlings; 10/50 of seedling pines examined were attacked.
Willow	Fomes igniarius (L. ex Fr.) Kickx.	Langley Lake road	Found on decadent willow in 1960 and 1958 at Campbell River Experimental forest.

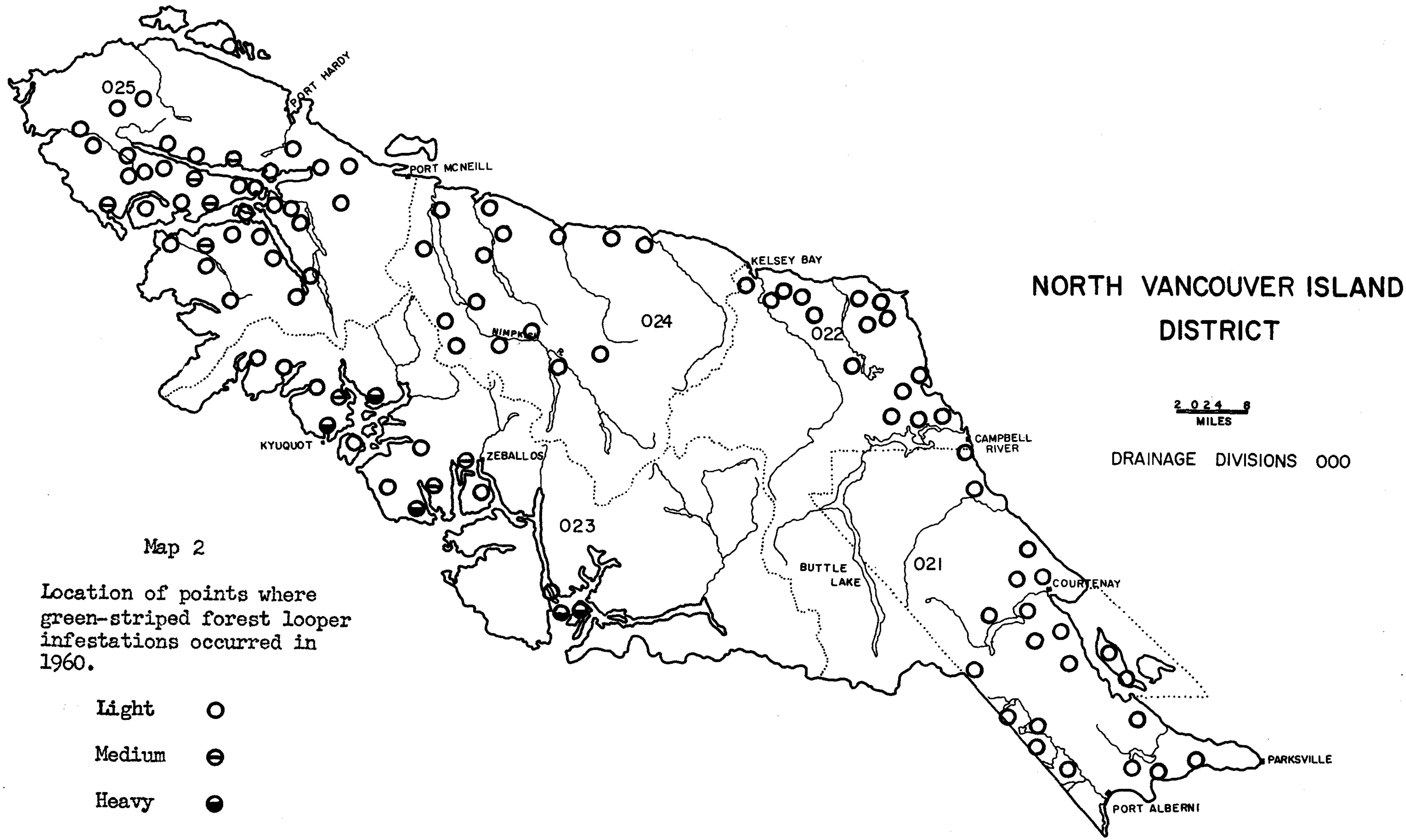


Map 1

Location of points where one or more collections were made and field records taken in 1960.

Forest insect ●

Tree disease ▲



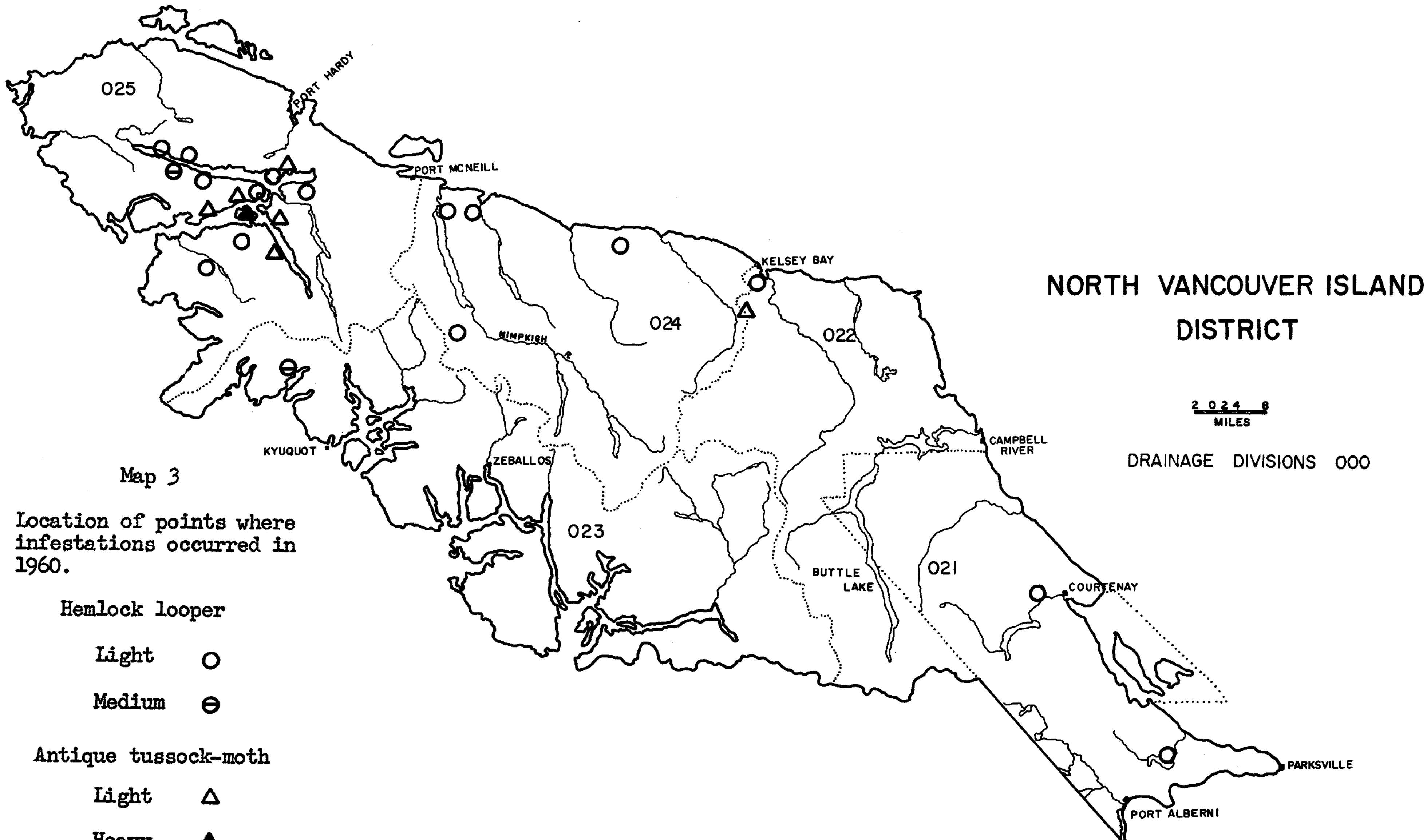
Map 2

Location of points where green-striped forest looper infestations occurred in 1960.

Light ○

Medium ⊖

Heavy ◒



Map 3

Location of points where infestations occurred in 1960.

Hemlock looper

Light ○

Medium ⊖

Antique tussock-moth

Light △

Heavy ▲

ANNUAL REPORT OF FOREST BIOLOGY RANGERS

BRITISH COLUMBIA

1960

VANCOUVER FOREST DISTRICT

MAINLAND SECTION

FOREST BIOLOGY SURVEY

VANCOUVER FOREST DISTRICT

MAINLAND SECTION

1960

D. H. Ruppel

INTRODUCTION

During 1960 Forest Biology Rangers were assigned to districts as follows:

D. H. Ruppel - South Vancouver

A. K. Jardine - North Vancouver

No recurrence of the spruce budworm infestation on Douglas fir at Pemberton or Boston Bar took place. Trees which were heavily damaged from 1954 to 1958 appear to be making a good recovery.

The known range of balsam woolly aphid was extended to Chapman and Woodfibre creeks. It is suspected to occur on Indian River and east of Squamish. Experimental releases of insect predators were made on Mt. Seymour and Grouse Mountain. An aerial survey indicated continued amabilis fir mortality due to these aphids.

Hemlock sawflies increased on western hemlock in the Sechelt area but no serious damage occurred. Sawflies were also taken from willow, red alder and lodgepole pine in several areas.

The European pine shoot moth, introduced to the Vancouver area on nursery stock, was the object of a special search. Damage to native trees was found for the first time on lodgepole pine at Halfmoon Bay near Sechelt. Mugho and Scots pines and Colorado spruce in Vancouver nurseries showed damage but no living insects were found on any samples.

Poplar and willow borers have now been found in most of the District. Willow is the preferred host but black cottonwood reproduction is often attacked. Several attacks were found on a hybrid poplar, Populus regenerata, in a nursery at Sardis.

Spruce tip moths damaged 60 to 100 per cent of Sitka spruce, Douglas fir, amabilis fir, and western hemlock tips on Cormorant and Malcolm islands and at Granite Lake on Malaspina Peninsula.

Bark beetles were active in several areas. Douglas firs at Earl Cove were attacked by Douglas-fir bark beetles. Pole-sized Douglas fir and western white pine on the Skagit River watershed continue to deteriorate with Douglas fir and mountain pine bark beetles a major factor. Engelmann spruce at Lightning Lake were infested by Engelmann spruce beetle.

The number of unsightly fall webworm tents on deciduous hosts increased in the Fraser Valley and Sechelt Peninsula areas.

The pine needle fascicle miner infested lodgepole pine in the Fraser Delta and reached Hope and Garibaldi. This insect was not previously common in these areas.

It was determined from 1960 and previous records that the spruce gall aphid range covers that of its hosts, spruce and Douglas fir, in the District.

Western tent and forest tent caterpillars increased greatly in the Fraser Valley on a variety of deciduous hosts, including fruit and shade trees.

Hemlock loopers, black-headed budworm, and green-striped forest loopers were at low population levels in the District.

ANNUAL REPORT OF FOREST BIOLOGY RANGER

for

SOUTH VANCOUVER DISTRICT

1960

FOREST BIOLOGY SURVEY

SOUTH VANCOUVER DISTRICT

1960

D. H. Ruppel

INTRODUCTION

Field work in the South Vancouver District commenced the middle of May and continued until mid September. The spring was cold and retarded but midsummer brought a hot dry spell. A short fire closure caused no loss in work time. One week was spent in the North Vancouver District.

A total of 316 insect and 54 tree disease collections were made. Disease collections included exotic plantations. Insect collections included negatives. Table 1 and Map 1 detail collections by host and locality respectively.

Survey work included an aerial survey of balsam woolly aphid areas and a reconnaissance of the Squamish River Valley.

STATUS OF INSECTS

Spruce Budworm, *Choristoneura fumiferana* (Clem.)

The spruce budworm population remained at a very low level in the previous infestation areas at Pemberton and Boston Bar. No budworm larvae were collected on any of the plots at Pemberton. In the Boston Bar area nine collections from Douglas fir containing the insect averaged 2.3 larvae per collection with a maximum of four larvae. Two collections containing 14 and 11 larvae were taken from Douglas fir at Hell's Gate. The week following this an attempt was made to obtain a mass collection and the population had dropped to less than half the figures indicated. Many larval feeding sites were minus an occupant.

Larvae were collected in small numbers from Douglas fir and western hemlock at Hope, Brandywine Falls, and Point Atkinson. The largest collections were obtained in Queen's Park, New Westminster, where up to 24 larvae and pupae were obtained from Douglas fir, Sitka spruce, grand fir, western hemlock, Colorado spruce, Norway spruce and Japanese larch.

Douglas fir on six study plots in the Pemberton area were examined in late August. No budworm eggs were found. Overall defoliation estimates are shown in Table 2. Foliage recovery has been very good on all trees. There was some current damage to understory Douglas fir foliage by the spruce gall aphid, *Adelges cooleyii* Gill., mentioned under separate heading.

The spruce budworm is not expected to be an important problem in the South Vancouver District in 1961.

Table 1

Collections by Hosts

South Vancouver District - 1960

Coniferous hosts	Forest insects	Forest diseases	Broad-leaved hosts	Forest insects	Forest diseases
Cedar sp.	1		Alder, red	8	2
Cedar, western red	14	2	Alder, Sitka	1	
Douglas fir	109	20	Apricot		1
Fir, alpine	3		Aspen, trembling	1	
Fir, amabilis	12	3	Birch, western white	1	1
Fir, grand	2	2	Cottonwood, black	6	2
Hemlock, mountain	1		Dogwood sp.		1
Hemlock, western	74	2	Dogwood, red ozier	1	
Juniper sp.		1	Hazelnut	1	
Larch, Japanese	1		Maple spp.	4	
Larch, western		1	Maple, sugar		1
Pine, lodgepole	16	4	Maple, vine	1	1
Pine, Mugho	3		Plum		1
Pine, ponderosa	1		Poplar spp.	6	3
Pine, Scots	3	1	Willow	13	1
Pine, shore	1		Miscellaneous	6	1
Pine, western white	4		No host	9	
Spruce, Colorado	2				
Spruce, Engelmann	4				
Spruce, Norway	2				
Spruce, Sitka	4				
Spruce, white		1			
Yew, western	1	1			
Miscellaneous		1			
			Total	58	15
Total	258	39	Grand Total	316	54

Western Hemlock Looper, Lambdina fiscellaria lugubrosa (Hulst)

The western hemlock looper was at a low level in the District. Eight collections from western hemlock, western red cedar and Douglas fir contained larvae of this pest. A collection near the zoo in Stanley Park contained 18 larvae. The park was sprayed in 1958 and 1959 but the zoo area was avoided both years. Elsewhere Stanley Park was relatively free of this defoliator. The general increase expected this year did not materialize and no damage is anticipated in 1961.

Table 2

Ocular Estimate of Per Cent Defoliation on Douglas fir Trees on Study Plots. Figures are an Average of 10 Trees. South Vancouver District. August, 1960.

Area and Plot		Defoliation 1959 shoots		Estimated total defoliation 1959			Defoliation 1960 shoots		Estimated total defoliation 1960		
		Av.	Sd.	Av.		Sd.	Av.	Sd.	Av.		Sd.
South of	1-1	0		22	±	15	0		11	±	7
Joffre	1-2	0		18	±	7	0		9	±	2
Creek	1-3	0		55	±	16	0		17	±	14
Cariboo	2-1	0		24	±	7	0		11	±	5
Trail	2-2	0		20	±	8	0		7	±	3
(I.R.#687)	2-3	0		31	±	12	0		12	±	5
Tenas	4-1	0		29	±	9	0		14	±	3
Lake	4-2	0		38	±	13	0		18	±	7
Rogers	5-1	T 1/		30	±	11	0		17	±	8
Creek	5-2	T		37	±	13	0		14	±	5
Skookum-	6-1	T		36	±	16	0		27	±	10
chuck	6-2	0		38	±	14	0		21	±	10
1.3 miles	7-1	0		26	±	14	0		9	±	4
north of	7-2	0		29	±	15	0		7	±	4
Gowan Cr.											

1/ T = Trace

Note - Plot 3, sections 1, 2, and 3, south of L2679 was logged off in 1959.

Green-striped Forest Looper, <u>Melanolophia imitata</u> Wlk.

This defoliator was less common in the District in 1960 than in 1959. Only small numbers of larvae were found on various hosts during the larval period. The population trend of green-striped forest looper on Douglas fir, western hemlock, western red cedar and other coniferous hosts is shown in Table 3.

The green-striped forest looper has occurred in infestation proportions with western hemlock looper in Stanley Park for the past several years. Spray projects were carried out there in 1958 and 1959. The maximum collection in the park this year was eight larvae.

No population increase took place on Greater Vancouver Waterboard watersheds. Table 3 indicates a general decrease in numbers and distribution of the insect. No serious damage is expected to occur in 1961.

Table 3

Population Trend of Green-striped Forest Looper, <u>Melanolophia imitata</u> Wlk. by Drainage Divisions as Determined by Collections for Host Species During the Larval Period. South Vancouver District 1960.

Drainage division	Total number of samples taken during larval period			Number of samples containing green-striped forest looper			Average number of larvae per sample		
	1958	1959	1960	1958	1959	1960	1958	1959	1960
040	53	30	16	2	28	4	3.0	0.9	0.4
041	25	5	11	2	0	2	1.5	0	0.3
042 1/	145	115	47	68	84	16	44.0	13.6	0.6
043	26	9	4	2	2	0	3.0	0.2	0
044	24	40	14	1	8	6	1.0	0.5	0.6
045	47	27	31	6	4	3	4.0	0.3	0.1

1/ Includes Stanley Park

Western Cedar Bark Beetle, Phloeosinus punctatus Lec.

The western cedar bark beetle outbreaks noted in 1959 have apparently subsided. No further attacks were found in 1960. Plots at Maple Bay (Cultus Lake), and Silverdale were examined and most trees have survived, but up to three quarters of the top of the crown is dead on some individual trees.

The beetle attack seems to have been secondary to the 1958 drought damage. Western red cedars which survived the attack now have dead tops.

Poplar and Willow Borer, Sternochetus lapathi (L.)

This weevil continued to be a serious pest of native willows in most parts of the District. Attacks on black cottonwood have been less prevalent and mostly confined to stems under four inches d.b.h. Table 4 summarizes quantitative samples for the poplar and willow borers in 1960. The samples on which the table was based contained a minimum of 10 stems for each species. Evidence of attack on an exotic poplar, Populus regenerata (a hybrid), was found in a nursery at Sardis. No insects were found for positive identification. Planted black cottonwood in the University of British Columbia Forest at Haney were found to be attacked by weevils for the second consecutive year.

Balsam Woolly Aphid, Adelges piceae (Ratz.)

The known range of balsam woolly aphid is about the same as previously determined but it is now suspected to extend northward to Indian River and east of the Squamish River as far north as Cheekye River. Map 2 shows areas known or suspected to have infestations of balsam woolly aphid on amabilis fir.

An aerial survey was again conducted in the Vancouver (Mainland) Forest District. The flight covered the area bounded by Howe Sound, Burrard Inlet, Indian Arm, Indian River and Cheekye River - Garibaldi Park. A subsequent courtesy flight included the more important parts of the Squamish River drainage.

The previously reported infestations on "North Shore" drainages showed little change from 1959. Small numbers of suspect trees were seen on Cheekye River, Mashiter Creek, Ring Creek and Stawamus River. A superficial ground check of these areas revealed very little balsam woolly aphid but there is a deterioration of amabilis fir, much of which is mature or overmature. In the Indian River Valley 800 trees exhibited severe aphid attack symptoms but have not yet been ground checked. No accurate standard has been devised for relating symptoms observed from the air with ground checks.

Table 4

Examinations for Poplar and Willow Borer, Sternochetus lepathi (L.).

South Vancouver District 1960.

Locality	Host	Percentage infested stems	Accompanying deciduous species and percentage of stand
Squamish River	W	0	W-80 Cot-10 Mb etc.-10
Pemberton Meadows	W	0	W-70 Cot-10 Bi-6 D-4
Stulkawhits Creek (Hope)	W	100	W-10 Bi-10 D-80
Nicolem Creek (Hope - Princeton)	W	90	W-10 Cot-30 Mv-10 D-30
Ring Creek (Squamish)	W	100	W-1 Cot-3 D-10
Harrison Lake	W Cot	50 5	W-10 Cot-25 D Bi
Manning Park	W Cot	95 70	W-30 Cot-5 Mv-40 D-20
Manning Park	Cot	90	Cot-100
Plantations			
UBC Forest (Haney)	Cot	30	Continuation of 1959 attack on some stems
Sardis	* Populus regenerata	20 stems in group - evidence of attack	Stock from which cuttings are taken - no insects present.

W = willow spp. Mb = broadleaf maple Mv = vine maple

Cot = black cottonwood Bi = white birch D = red alder

* Exotic poplar.

Four different parasites were introduced and released on Seymour Mountain in May and June on or near fresh aphid attacks. The parasites were:

Laricobius erichsoni Rosenh.

Aphidecta obliterata L.

Scymnus pumilio (Ws.) (flavifrons) (Blkb.)

Pullus impexus Muls.

All the above are small beetles and all except the first are ladybird beetles. It will be a year or more before survival or effectiveness of the predators can be determined.

The balsam woolly aphid is a continuing serious threat to amabilis fir in the southwest portion of Vancouver (Mainland) Forest District. It is presently unknown what seasonal fluctuations in population levels may result from variations in climate.

Black-headed Budworm, Acleris variana (Fern.)

The black-headed budworm population remained at a very low level in the South Vancouver District in 1960. Six collections from western hemlock and other hosts averaged 1.8 larvae. An additional three collections in Queen's Park averaged 4.3 larvae from Colorado spruce, Norway spruce and Douglas fir.

Alder Sawfly, Hemichroa crocea (Fourc.)

Sporadic small infestations of this insect occurred on red alder near Ioco and elsewhere in the Fraser Valley. Medium defoliation of the host took place in these areas.

Forest Tent Caterpillar, Malacosoma disstria Hbn. and Western Tent Caterpillar, Malacosoma pluvialle Dyar

Tent caterpillars were responsible for light to heavy defoliation of various deciduous hosts including fruit and shade trees from Ladner to Abbotsford south of the Fraser River. The defoliation was confined mostly to brush and reproduction in agricultural and industrial areas. Numerous egg masses were noted during the late summer indicating a possible high population in 1961. No attempt was made to assess the ratio of forest and western tent caterpillars but both species were found where examinations were made.

Fall Webworm, Hyphantria cunea Harr.

The infestation of fall webworm between Hope and Ladner on the south side of the Fraser River increased in 1960. Red alder and various other deciduous hosts were attacked. One colony was found on broadleaf maple, the only attack on this host noted in the past two years. Table 5 shows web counts of fall webworm in the Fraser Valley on various deciduous hosts as determined by measured strips in 1959 and 1960. More than a threefold increase was noted at Pierdonville and Cultus Lake. Several isolated groves of black cottonwood and red alder in the Yarrow district were practically covered with webs. A small amount of top kill was noted on several alders known to be heavily attacked in 1959.

Table 5

Web Counts of Fall Webworm, Hyphantria cunea Harr., in the Fraser Valley

on Various Deciduous Hosts as Determined by Measured Strips.

South Vancouver District, 1960.

Location	Miles travelled		No. of webs		Webs per mile	
	1959	1960	1959	1960	1959	1960
Pierdonville west	3.0	3.0	21	67	7.0	22.3
Pierdonville east	N.S.*	2.5	-	310	-	124.0
Rosedale north	2.8	2.8	20	43	7.1	15.4
Chilliwack (Camp rd.)	7.4	7.4	27	52	3.6	7.0
Cultus Lake (S.E. side)	3.2	3.8	69	258	21.6	67.9
Yarrow east	3.5	3.6	80	97	22.9	24.2

* N. S. - no survey.

A Small Leaf Rolling Larva, Archips rosana Linn.

This insect was plentiful and widespread in the district on most deciduous trees. Damage to forest trees was not severe but the rolled leaves on shade and ornamental trees caused some concern to residents, particularly in the Chilliwack area. This defoliator is known to reach infestation proportions periodically but no serious losses of the hosts have been recorded.

Spruce Gall Aphid, *Adelges cooleyii* Gill.

Spruce gall aphids are widespread on Douglas firs and spruce, chiefly Sitka spruce in the South Vancouver District. Widely separated collections and examinations indicate the presence of the insect throughout the range of the hosts mentioned in this District.

In 1960 this aphid was in heavy infestation proportions on the current foliage of Douglas fir reproduction and plantings in Stanley Park. In some cases 100 per cent of the current needles were attacked. Douglas fir reproduction at Tenas Lake and northwest of Lillooet Lake was also heavily infested in places. Plantations in the U. B. C. Forest at Haney showed varying degrees of attack. Damage may result in a loss of foliage on Douglas fir.

Pine Needle Fascicle Miner, *Zelleria haimbachi* Busck.

Lodgepole and shore pines over much of the District were infested with needle miners. The heaviest attack was in the Delta - Surrey area where up to 100 per cent of tips had one or more larvae. At North Bend the attack averaged five to ten per cent with as many as 50 per cent of the tips infested. Near Cheekye up to 50 per cent of tips were infested and damage was noted at Pt. Atkinson, Indian Arm, Tisdall, Boston Bar and Roger Creek.

The stands presently infested are not of high commercial value but the infestations could extend to more valuable stands in the north and east of the District. The insect was not previously a serious pest in this part of the province.

European Pine Shoot Moth, *Rhyocionia buoliana* (Schiff.)

A special survey was made to determine the presence of European pine shoot moth. No living specimens were found. Damaged tips, including empty pupal cases, were found in nurseries at Steveston, Sardis, and Vancouver International Airport. The hosts were Mugho and Scots pines and Colorado spruce. No damage was found on native pines adjacent to the above nurseries. The intrusion of this insect may have been stopped or the population is at a low level. Further examinations will be necessary.

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

A small collection of this insect was taken from lodgepole pine near Tsawassen. There were indications of light feeding on Douglas fir in the general vicinity.

A Sawfly, Neodiprion sp.

Lodgepole pine reproduction over an area of one square mile at the northwest end of Chilliwack Lake sustained heavy defoliation of current foliage. Examination took place after the larval feeding period. The area is set aside for park use and a second year of heavy attack could jeopardize the trees for park cover.

A Web-spinning Sawfly, Cephalcia sp.

A small but interesting outbreak of this insect was found on lodgepole pine seedlings in Manning Park. Eighty-nine larvae were hand picked from terminals of pine seedlings which would be covered by snow during the winter. The larvae were feeding less than 18 inches above ground level. Damage was not serious.

Antique Tussock Moth, Orgyia antiqua badia (Hy. Ed.)

Very few of the above insect were found except for a flourishing spot infestation in Queen's Park. The upper crown levels of several Colorado spruce were heavily defoliated. A larva was also collected from Japanese larch. This insect is an important defoliator of native trees.

Phantom Hemlock Looper, Nepytia phantasmaria (Stkr.)

This looper was found in very small numbers in 1960. A mass collection was taken from Douglas fir in Hope Municipal Park. The number of larvae per beating sheet varied from zero to five in the park. No damage was apparent and no serious problem is anticipated in 1961.

Sequoia Pitch Moth, Vespamia sequoia (Hy. Ed.)

Pitch moths were mentioned in the 1959 report as a major pest of ponderosa pine in plantations at Alouette Lake and Green Timbers. Figure 1 shows a typical ponderosa pine at Alouette Lake. Surrounding reproduction was removed to facilitate taking the picture. The only thriving pine in this plantation had been planted on a rocky knoll where competition from surrounding native species was at a minimum. There was a continued heavy attack on lodgepole pine north of Squamish to Garibaldi.

Douglas-fir Bark Beetle, Dendroctonus pseudotsugae Hopk. and
Mountain Pine Beetle, Dendroctonus monticolae Hopk.

Bark beetles are an important factor in the continued deterioration of pole-sized Douglas fir and western white pine on the Skagit River drainage. About 3,200 acres of timber were affected on the lower Skagit and about the same in Manning Park. The results of a strip cruise at Snass Creek are shown in Table 6. Timber sizes ranged to 28 inches D.B.H. for Douglas fir and 16 inches D.B.H. for western white pine. Fresh attacks were noted on Douglas fir outside the strip.

A small number of red-topped Douglas firs were noted on Anderson River. Some log decks were freshly attacked.

Table 6

Results of a 1 x 6 Chain Cruise Strip of Bark Beetle Damage

at Snass Creek in Manning Park.

South Vancouver District, 1960.

Tree species	Healthy	Green Infested	Red-topped	Old Grey
Douglas fir	67	0	2	24
Western white pine	1	3	1	20
Western hemlock	8	0	0	0
Engelmann spruce	0	0	0	1

Engelmann Spruce Beetle, Dendroctonus engelmanni Hopk.

An area of Engelmann spruce not exceeding 30 or 40 acres at Lightning Lake in Manning Park was infested by this bark beetle. Thirty-eight of 135 spruces on an area of two acres were dead or dying. They ranged in diameter from 12" to 36". Wood peckers had been very active and may be helping to control the outbreak. Sanitation measures practised in conjunction with projected park developments in the area could have an effect on this outbreak.

Sitka-spruce Weevil, Pissodes sitchensis Hopk.

Sitka spruce plots 1-C and 1-D, plantation 68, within Green Timbers Experimental Forest, were examined for weevil damage in 1960. The plots were established in 1930 and 1932. Weevil attacks were recorded from 1937 to 1949. Plot 1-C was re-examined May 10 and plot 1-D, September 23, 1960.

Information was recorded on 325 trees, of which 235 were still living and 90 had died. The average height of living spruce was 17 feet and all but three trees had sustained one to 10 or more weevil attacks. Two unattacked trees were below average height but the third was approximately 57 feet high and 6.4 inches d. b. h. There was one other tree comparable to this on an adjacent unrecorded plot. Weevil-attacked trees ranged from 7.0 to 28 feet in height and 0.8 to 7.0 inches d. b. h.

Tree form was tallied as

straight (likely to yield a 16' log)	- 89
poor (unlikely to yield a 16' log)	- 88
cabbage (useless)	- 58
	235

Many trees had double stems and numerous trees were forked at various heights. "Cabbage" types had a strong development of one or more laterals. "Straight" and "poor" types had not maintained laterals to any great extent.

Dead trees, many of which had rotted away, were found to have been described in previous examinations as follows:

Attacked by weevils	39
Attacked by weevils and browsed	4
Browsed	25
Not attacked by any agency	20
Root rot	2
	90

All of these trees were below average size at the time they died. Most were described as "stunted" and "suppressed". Browsing was by deer and occurred mostly in 1940, 1941, and 1942. The only root rot referred to was Armillaria sp.

Conclusion

No normal growth figures are available for the Green Timbers area but the 55 to 60 foot height attained by two vigorous trees not attacked by weevils is more than double the height growth of the tallest weevil-attacked trees. With the exception of the apparently weevil resistant tree on the plots, the weevils attacked spruces which were fairly vigorous or exposed at the time of attack. Dead stems, mostly suppressed or stunted, had few or no recorded attacks.

Spruces subjected to repeated attacks are poorly formed. There is a strong tendency to revert to one leader but even though sawlog form may be attained it is likely the incidence of rot will be high. "Cabbage" trees are unlikely to ever become merchantable. The weevil attack has been continusous since 1937, or before, and a number of current attacks were noted.

MISCELLANEOUS INSECTS

South Vancouver District 1960

Insect	Host	No. cols.	Remarks
Achytonix praecuta Sm	Pl	1	Defoliator
Acronicta hesperida Sm.	P. regenerata	1	Defoliator
Adalia bipunctata Linn.	H, Norway spruce	2	Adults perching
Adelges tsugae (Annand)	H	3+	Widespread but low level this year.
Adoxus obscurus Linn.	H	1	Adults perching
Altica tombacina Mann.	Fireweed	1	Adults and eggs
Anomogyna mustelina Sm.	F	3	Defoliator
Anthelia hyperborea Hulst	F	1	Defoliator
Biston cognataria Gn.	C, P. regenerata	2	Defoliator
Buprestis langii Mann.	F	1	Adult perching
Caripeta divisata Wlk.	H, F	5	Max. collection 7 larvae
Chilocorus stigma Say.	F	1	Adults perching
Coccinella californica Mann.	F, Mv, H	4	Adults perching
Cycloneda sanguinea Linn.	F	1	Adults perching
Diacrisia virginica Fabr.	Lady fern	1	Defoliator
Ectropis crepuscularia Schiff.	H	2	Defoliator
Elpiste lorquinaria Gn.	Hazel	1	Defoliator
Enypia packardata Tayl.	H	1	Defoliator
Enypia venata Grt.	H, F	3	Defoliator
Epicnaptera americana Harr.	F, W	2	Defoliator
Epirrita autumnata Gn.	H, F	7	Max. collection 1 larva
Erranis vancouverensis Hulst	Hazel	1	Defoliator
Eupithecia annulata Hulst	F	2	Defoliator

MISCELLANEOUS INSECTS - continued

Insect	Host	No. cols.	Remarks
Eupithecia unicolor Hulst	H	2	Defoliator
Feralia jocosa Gn.	F, H	3	Defoliator
Gabriola dyari Tayl.	H, F	2	Defoliator
Hydriomena irata Swett.	D, F	2	Defoliator
Neoalcis californiaria Pack.	H, F, B	12	Max. collection 2 larvae
Nyctobia limitaria Wlk.	F, H	3	Defoliator
Orthosia hibisci Gn.	W	1	Defoliator
Pero behrensarius Pack.	F	2	Defoliator
Pikonema alaskensis (Roh.)	Se	1	Defoliator
Pikonema dimmockii (Cress)	Se	1	Defoliator
Pissodes fasciatus Lec.	F	1	Adult perching
Promylea lunigerella Rog.	H, F	3	Defoliator
Sarrothrippus cinereana N. & D.	Cot	1	Defoliator
Stenoporpia albescens Hulst	Pl	1	Defoliator
Stilpnotia salicis Linn.	A	1	Sample not quantitative
Synaxis pallulata Hulst	H	1	Defoliator
Syngrapha a. interalia Ottol.	H, F	5	Max. collection 3 larvae
Tolype dayi Blkmre.	Pl, F	2	Defoliator
Trichiosoma triangulum Kby.	W	1	Defoliator
Trypodendron lineatum (Oliver)	F, H, C.	1	Logdeck, Alice Lake
Venusia pearsalli Dyar	F, W. Mv	4	Defoliator
Zale d. largera Sm.	Pl	1	Plus several cols. Zale sp.
Zeiraphera diniana Gn.	F	3	Cone borer

STATUS OF FOREST DISEASES

Important Diseases

Drought

Disease symptoms attributable to the weakening effects of the 1958 drought have declined with the exception of flagging on Douglas fir in Chilliwack, Sardis and surrounding areas. Foliage on a trace to 50 per cent of terminal twigs on exposed windbreaks, overmature residuals, and fringe trees, most noticeably on the eastern exposure, had turned a bright red colour by early summer. The twigs were dead. No obvious signs of fungus parasites or insects were found.

Secondary insect attacks on drought weakened western red cedar and grand fir decreased to a very low level. No current attacks were found on either host.

A Needle Rust

Needle rust caused by *Melampsora occidentalis* Jacks. was quite common on Douglas fir throughout the district. The rust was heaviest on exposed reproduction and low hanging branches. The disease occurred in association with the spruce gall aphid in most places. There was no suggestion, however, of any relation between the two. The heaviest attacks were noted at Harrison Lake and near Pemberton. Both agencies cause needle drop and both attack current foliage.

Lodgepole Pine Dwarf Mistletoe

A heavy infection of dwarf mistletoe, *Arceuthobium americanum* Nutt., was noted south of Pemberton and along the Lillooet River northwest of Harrison Lake on lodgepole pine. Pine stands in these areas are unthrifty and occur on very poor growing sites.

Dieback of Weeping Willow

For at least the past two years a dieback has occurred on weeping willows in the Sardis - Chilliwack area. Lesions on the stems of current growth girdle and kill the shoot. Some of these ornamentals were in poor condition from repeated infection. The cause of this disease has not yet been determined.

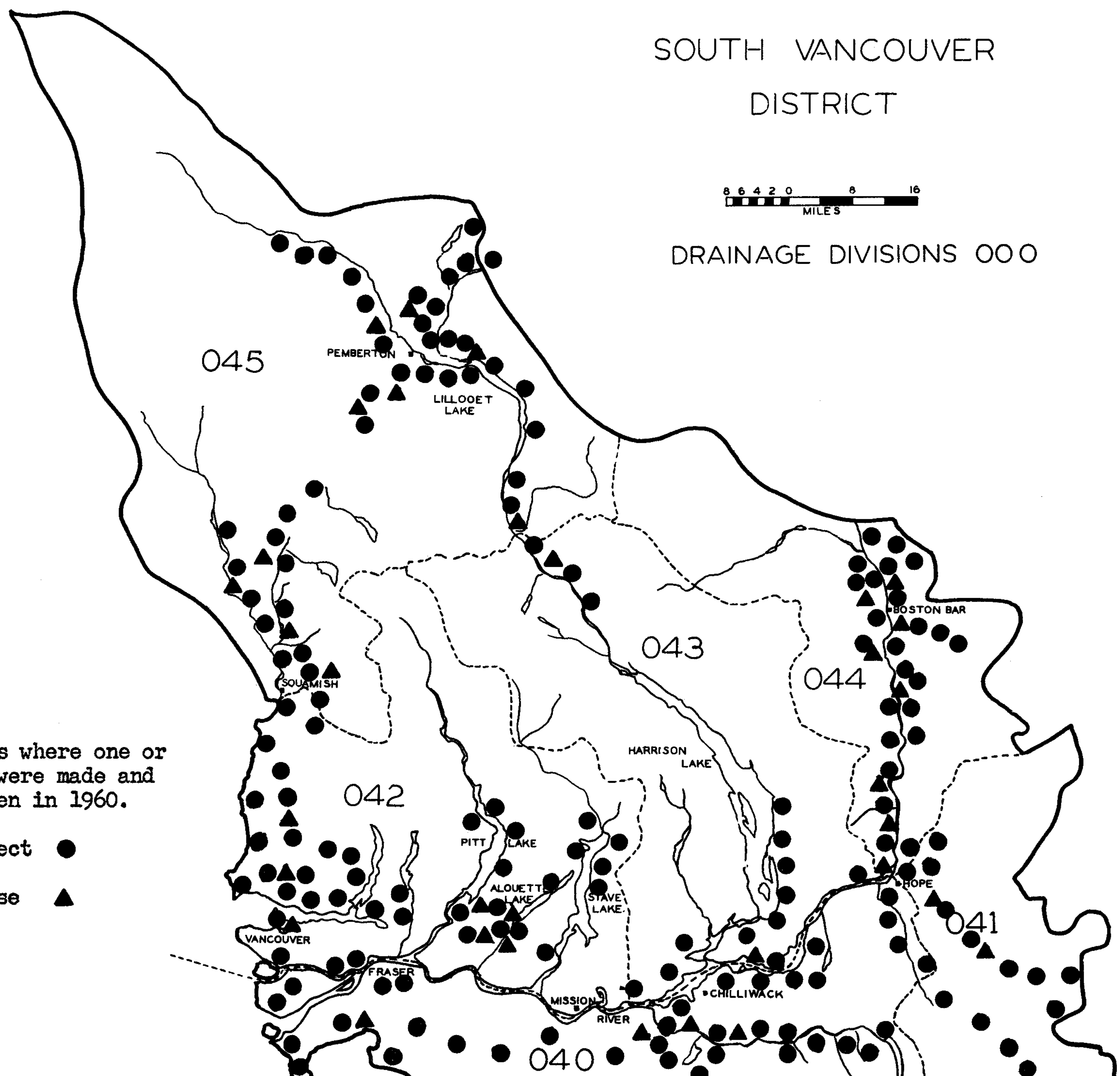
Exotic Plantations

Examinations were made of 24 plots in various exotic plantations. Five new plots were examined in the U. B. C. Forest, Haney.

Excessive damage to Scots pine by bears at Alouette Lake was discussed in the 1959 report. Figure 2 shows an example of damage to a Scots pine, five inches d. b. h.

Other Noteworthy Diseases

Host	Organism	Locality	Remarks
Cottonwood, black	*Cytospora* sp.	Agassiz	A weakly parasitic canker and dieback fungus.
Douglas fir	*Rhabdocline pseudotsugae* Syd.	Alouette Lake	A needle cast of Douglas-fir - not overly abundant
Douglas fir	*Caliciopsis pseudotsugae* Fitzp.	General	Twig canker
Douglas fir	*Phaeocryptopus gaeumannii* (Rohde) Petr.	Hope	A foliage disease of Douglas fir.
Fir, amabilis	*Aleurodiscus amorphus* (Pers.) Rabesch, ex Cooke	Cypress Creek	A canker of amabilis fir
Fir, amabilis	*Arceuthobium* sp.	Squamish N. Vancouver	Dwarf mistletoe, quite scarce on amabilis firs in these areas.
Hemlock, western	*Melampsora epitea* f. sp. *tsugae*	Mission	A needle rust of hemlock

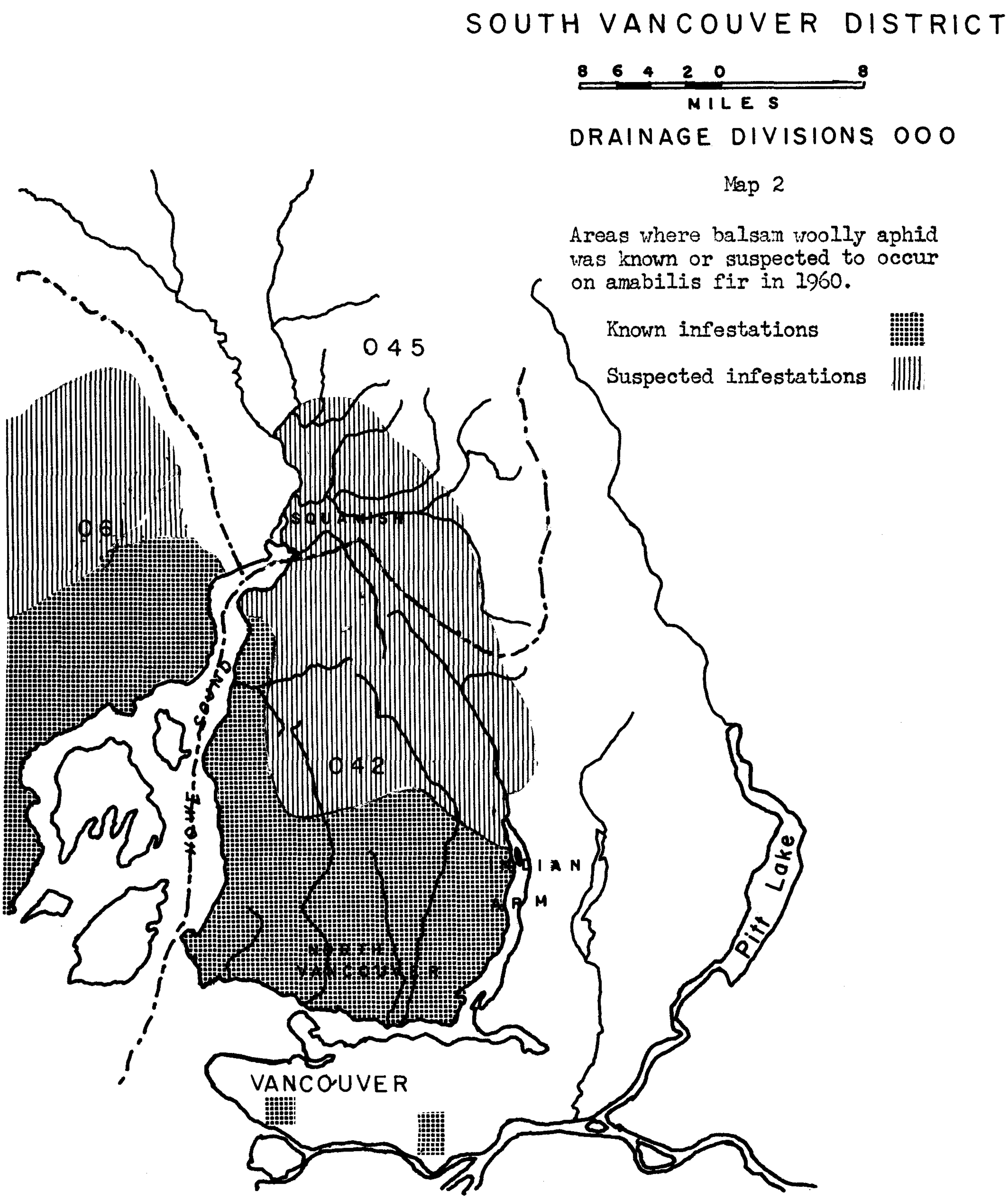


Map 1

Location of points where one or more collections were made and field records taken in 1960.

Forest insect ●

Tree disease ▲


SOUTH VANCOUVER DISTRICT
8 6 4 2 0 8
MILES
DRAINAGE DIVISIONS 000
Map 2
Areas where balsam woolly aphid was known or suspected to occur on amabilis fir in 1960.
Known infestations
Suspected infestations
045
042
HOWE SOUND
VANCOUVER
Pitt Lake

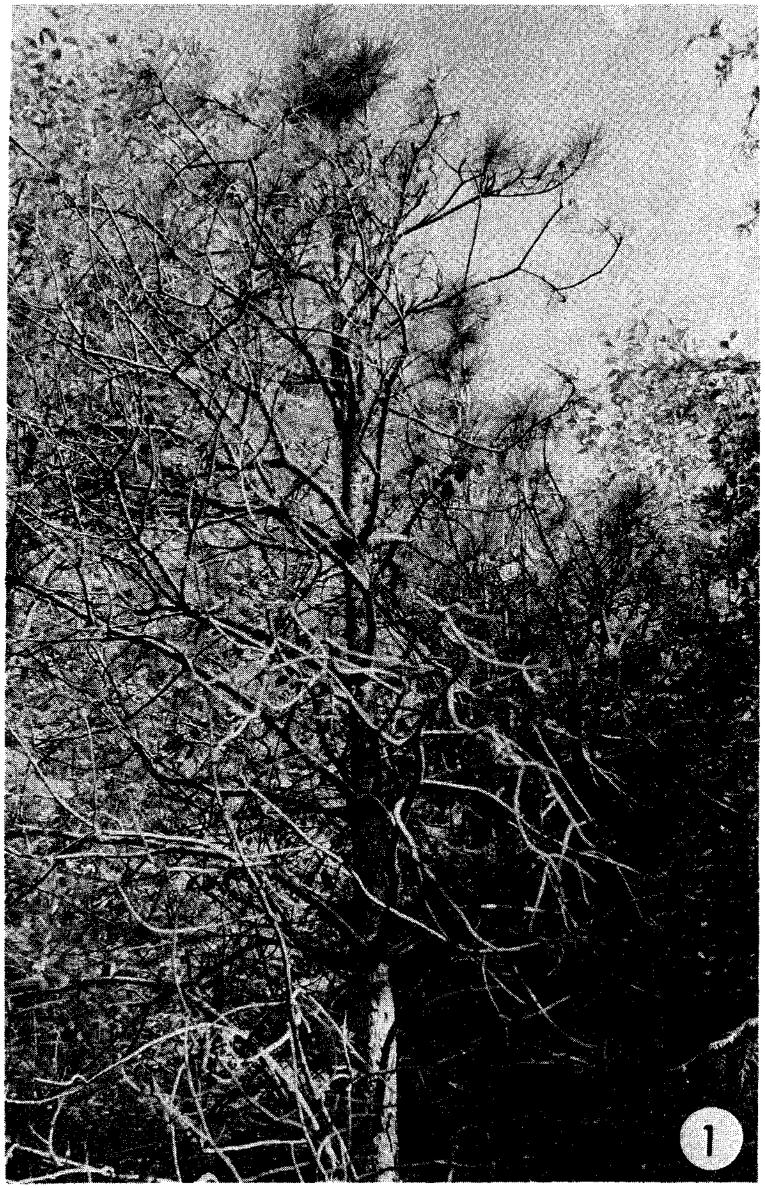


Figure 1. Ponderosa pine tree damaged by sequoia pitch moth. Alouette Lake, South Vancouver District, July 1960 Photo by A. Craigmyle

Figure 2. Scots pine tree damaged by bears, Alouette Lake, South Vancouver District, July 1960. Photo by A. Craigmyle

ANNUAL REPORT OF FOREST BIOLOGY RANGER

for

NORTH VANCOUVER DISTRICT

1960

FOREST BIOLOGY SURVEY

NORTH VANCOUVER DISTRICT

1960

K. Jardine

INTRODUCTION

The survey of the southern portion of the North Vancouver District commenced on May 11 with boat work in Howe Sound, concentrating on the suspected areas of balsam woolly aphid attacks. Normal survey by vehicle continued on the Sechelt Peninsula until June 3 when a survey of the inlets began with the M/V Forest Biologist. Approximately two weeks were spent surveying these inlets as well as the Johnstone Strait islands. With the exception of 10 days spent assisting the ranger of the South Vancouver District, the remainder of the season was spent in the North Vancouver District.

Another balsam woolly aphid aerial survey was made over the southern portion of the district in 1960 to map new areas of attack. A special survey of this insect was also conducted in the Rainy River Valley, to determine the incidence of attack on balsam.

A total of 203 insect and 112 forest disease collections were submitted to the Victoria laboratory. Of the disease collections, 54 were identified, 18 have been forwarded to Ottawa for identification, seven samples of a foliage disease on lodgepole pine will be reported on at a later date, sixteen had insufficient fruiting for positive identification, the damage in nine was attributed to insect, mechanical or other unknown causes, and eight collections were lost in the mail. A summary of insects by hosts is shown in table 1. Localities where collections were made are shown in Map 1.

STATUS OF INSECTS

Balsam Woolly Aphid, Adelges piceae (Ratz.)

The balsam woolly aphid aerial survey this year indicated a marked increase in the area of dead and attacked trees compared with 1959. Flights extending to the ends of the valleys in most instances indicated that the heaviest attacks occurred in the central portion of the valley bottoms in stands consisting mainly of mature amabilis fir and hemlock. Gouting was visible from a height of 150 to 200 feet above the tree tops. Ground surveys this year revealed two new areas of attack, at Chapman and Woodfibre creeks. Gouting was also observed on grand fir at Madeira Park.

Balsam woolly aphid has been found in stands extending over 220 square miles, and areas suspected of containing this aphid cover another 502 square miles (Map 2).

Table 1

Collections by Hosts

North Vancouver District - 1960

Coniferous hosts	Forest insects	Forest diseases	Broad-leaved hosts	Forest insects	Forest diseases
Cedar, western red	10	1	Apple	1	-
Douglas fir	38	30	Alder, red	20	12
Fir, amabilis	5	3	Cascara	1	-
Hemlock, western	51	8	Cottonwood	1	2
Pine, lodgepole	5	20	Crabapple, wild	1	-
Pine, white	2	4	Maple, broadleaf	2	2
Pine, Mugho	1	5	Maple	2	-
Spruce, Sitka	28	5	Oak	1	-
Spruce sp.	1	-	Willow	27	16
			Miscellaneous	4	4
			No host	2	-
			Total	62	36
Total	141	76	Grand Total	203	112

Balsam woolly aphid is present in the Chapman Creek area 6.8 miles north of the main highway at Wilson Creek at an elevation of 1,000 feet in immature pole hemlock-amabilis fir stands. Twenty amabilis fir suffering from severe gout attack were counted during a ground survey. There was some top kill and two trees completely dead. The aerial survey failed to locate any more attacked trees in this valley. Dead trees observed on side hills at the time of the ground survey were white pine probably killed by blister rust.

Ground observations showed that many mature balsams three miles north of Woodfibre at 1,300 feet elevation were heavily gouted at the top with some top kill. There were no signs of stem attack. Slight gouting occurred on young immature trees at lower elevations.

Heavy gout attacks can be seen on mature balsam along the roadside at various intervals between Dakota Creek and Langdale.

An aerial survey count of balsam woolly aphid attacks in 1960 is shown below. A total of 691 dead, dying, and green infested balsam were recorded.

Location	No. trees	
Mill Creek	60	
Woodfibre Creek	100	
Potlatch Creek	125	
McNab Creek	120	
Rainy River	190	
McNair Creek	75	
Dakota Creek	20	
Roberts Creek	1	(from ground observation)
Total	691	

Sawflies, Neodiprion spp.

Consistently large numbers of this sawfly have been found throughout the North Vancouver District for the past four years with no appreciable defoliation occurring at any one point. Although some collections contained a considerable number of larvae, the economical feeding habits of this insect kept the damage to a negligible level. However, this season there was a very noticeable increase in the larval population, particularly in the Porpoise Bay area of the Sechelt Peninsula. The population at Burnet and Angus Creek locations increased to infestation proportion. The host was western hemlock. Two samples taken at Burnet Creek contained a total of 2,176 larvae. Feeding was conspicuous on the lower crowns of the trees. Comparatively large collections of Neodiprion larvae were found as far north as Carlson Creek in the Sechelt Inlet. Eleven collections taken in the lower portion of the Sechelt Inlet including Porpoise Bay, averaged 382 larvae per collection.

There was very little disease or parasitism in collections reared from this area; therefore a high population can be expected in 1961.

Sawfly, Tenthredinid sp.

Two localized infestations of a species of sawfly on willow as yet unidentified occurred in the district in 1960. One outbreak on the northern outskirts of Wildwood along the main highway, contained within an alder sawfly infestation, caused from 50 to 100 per cent defoliation of all willow within a two mile area along the roadside. The other outbreak occurred along the same road approximately three miles from the first outbreak. Here in a very localized area all mature willow were completely defoliated. The only other location where this tenthredinid was found was along the Mahood logging road near Stillwater, where one colony was found on willow.

Alder Sawfly, Hemichroa crocea Fourc.

A small localized infestation of this sawfly which occurred approximately 1/4 mile north of Wildwood along the Powell River Lund highway resulted in 40 to 60 per cent defoliation of the lower foliage. Although the main portion of the infestation was contained within a two mile area, light feeding was observed at intervals along the main road to within five miles of Lund and extended east to Okeover Inlet.

This was the first outbreak of the alder sawfly reported in the North Vancouver District since the comparatively large infestation in approximately the same area in 1949.

Spruce Tip Moth, Zeiraphera diniana Gn.

Attacks by this tip moth caused considerable damage to Sitka spruce on Cormorant and Malcolm islands. Although the preferred host is spruce it was found on Douglas fir, amabilis fir, and hemlock. The largest collection of 11 larvae was made on young amabilis fir at Granite Lake in the Mahood logging operation. Examination of these trees showed that from 60 to 100 per cent of the tips had been attacked.

Douglas fir Bark Beetle, Dendroctonus pseudotsugae Hopk.

Damage by this bark beetle was observed in two areas this year. Approximately 50 red-topped overmature Douglas fir were counted in an area of regeneration between Pender Habour and Earl Cove; several of these trees were completely red. A considerable volume of timber is involved as many of the trees contain over 10,000 bd. ft. each. Approximately three dozen red-topped Douglas-fir trees were counted five miles west of this area in Agamemnon Channel, also on the peninsula.

European Pine Shoot Moth, Rhyocionia bouliana (Schiff)

The presence of this insect has become evident on lodgepole pine for the first time in the North Vancouver District since its initial introduction from Europe some time ago. Several young pine with crooked leaders were discovered two miles west and 1.2 miles north of Halfmoon Bay. Samples were forwarded to the Victoria laboratory for identification. Examination of these samples showed that an attack by this shoot moth had occurred although no larvae were present. An examination of lodgepole pine stands elsewhere in the district failed to reveal further evidence of damage by this insect.

Poplar and Willow Borer, Sternochetus lepathi (L.)

This weevil caused heavy damage to willow stands throughout the Sechelt Peninsula. The known area now extends from Port Mellon in Howe Sound to approximately three miles north west of Madeira Park. Attacks were found at elevations from sea level to 3,000 feet. The first attack on cottonwood in the district was found at Dakota Creek where a light attack was discovered on young saplings. Willow was still the preferred host in this locality.

Mountain Pine Beetle, Dendroctonus monticolae Hopk.

There has been no recent mention of this bark beetle in the district. However, damage still continues at a low level in the southern portion of the district which contains a considerable amount of white pine. An aerial survey over the area this year revealed an appreciable number of red and discolored pine, especially in the area between Sechelt and Port

Mellon. The largest concentration of damaged trees observed was on the eastern slope of Porpoise Bay where 100 red-top trees were counted.

Black-headed Budworm, Acleris variana (Fern.)

Only three budworm larvae were collected this year, two in separate collections at Freda Creek along the Alice Lake logging road and one at Porpoise Bay. All three collections were from hemlock. Although there is a slight decline in the number of samples containing this species compared with 1959, it is not an indication that it is disappearing as the survey of the district was not complete.

Spruce Gall Aphid, Adelges cooleyii Gill.

A special survey of this insect conducted in the district this year revealed that the spruce gall aphid is present in all spruce stands examined. A total of 15 collections was made. Twelve of these were from the preferred host, Sitka spruce. The remaining three were found on the alternate host, Douglas fir. Attacks on all trees were classed as light, with the exception of an extremely heavy attack on the current growth of an immature Sitka spruce on Helmcken Island in Johnstone Strait. An attack of equal intensity was found on young Douglas fir at Chapman Creek on the Sechelt Peninsula. Several young trees had 100 per cent of their foliage affected. They had a distinct discoloration of foliage and loss of vigor. The general effect of the aphid attacks has been a stunting of the current twig growth as well as a general stunting of the entire tree.

Green-striped Forest Looper, Melanolophia imitata Wlk.

This geometrid has been consistently found in collections throughout the district for the past three years. Although quite widely distributed in 1958 and 1959, no appreciable defoliation was attributed to the looper at any location. Twenty collections containing the green-striped forest looper were made in 1960. Hosts were western hemlock and Douglas fir, but the majority of the collections were from hemlock. Larvae averaged 1.5 per collection from both hosts. As complete coverage of the district was not possible this year, this downward trend can not be considered a reliable indication of the population trend.

Western Cedar Bark Beetle, Phloesinus punctatus Lec.

The light outbreak of this bark beetle in the lower portion of the district in 1959 appears to have subsided. Very few new attacks were observed during the course of the survey in 1960.

Hemlock Looper, Lambdina fiscellaria lugubrosa (Hulst)

The hemlock looper remained at a low level in 1960. Seven hemlock samples averaged 1.7 larvae per collection.

Fall Webworm, Hyphantria cunea Harr.

A large outbreak of the fall webworm occurred in the district in 1960 on the Sechelt and Malaspina peninsulas. The preferred hosts was alder. The heaviest concentrations of webs was between Sechelt and Wilson Creek where various species of deciduous trees, including fruit trees, were infested. Twenty-five webs were counted on a single alder 1/4 mile south of Sechelt. Light defoliation was confined to fruit trees.

Western Tent Caterpillar, Malacosoma pluviale (Dyar)

The only tent caterpillar found in the district in 1960 was on Hardwicke Island where several webs were observed on alder and willow.

SPECIAL COLLECTIONS

Poplar and Willow Borer, Sternochetus lepathi (L.)

Several collections of this willow borer in the form of tree sections were made at various localities in the district this year for J. W. E. Harris Victoria, who is conducting development studies and incidence of attack.

Web Spinning Sawfly, Acantholyda sp.

Two specimens of this sawfly larvae were forwarded to Dr. D. C. Eidt, at Fredericton, N. B.

Ladybird Beetles

Two specimens of Chilocorus orbus Casey and three specimens of Mulsantina picta minor Casey were collected in five separate collections and forwarded to Dr. S. G. Smith at Sault Ste. Marie. Both of these species of beetles are very beneficial, feeding on plant nectars, exudate, and especially aphids.

MISCELLANEOUS INSECTS COLLECTED

North Vancouver District

Insect	Host	No. of collections	Remarks
Acleris senescens Zell.	W	1	Hardwicke Island
Acronicta grisea Wlk.	W	1	Porpoise Bay
Acronicata hesperida Sm.	H	1	Angus Creek
Adelges tsugae (Annand)	H	1	Malcolm Island
Allonomyma diana Hbn.	D	2	Okeover Inlet, Wildwood
Anthelia hyperborea Hulst	F	1	Duck Lake
Anomogyna mustelina Sm.	H, F	2	Phillips Arm, Chapman Creek
Buprestis aurulenta (L.)	S, H, F	3	Sechelt (emerging from a house)
Brchyrhinus ovatus Linn.	H	1	Carlson Creek
Caripeta divisata Wlk.	H	2	Sechelt, Carlson Creek
Celus californicus (Lec.)	D	1	Okeover Inlet
Ctenicera angusticollis Mann.	F	1	Helmcken Island
Ctenicera suckleyi Lec.	S, F	2	Hardwicke Island, Heydon Bay
Coccinella trifasciata Linn.	S	1	Heydon Bay
Cycloneda sanguinea Linn.	D, S, H	4	Sonora Island, Lausmann Creek, Egmont.
Dichelonyx backi Kby.	W	1	Gunboat Bay, Trout Lake
Dichelonyx fulgida Lec.	F	1	Trout Lake
Dyslobus granicollis Lec.	C	1	Madeira Park
Dyslobus verrucifer Csy.	H	3	Wilson Creek, Chapman Creek
Dyslobus decoratus Lec.	C	1	Rassmunsen Bay

MISCELLANEOUS INSECTS COLLECTED - continued

Insect	Host	No. of collections	Remarks
Eucordylea atrupictella Dietz.	F	1	Helmcken Island
Ectropis crepuscularia Schiff.	H	3	Cranberry Lake, Madeira Park, Westview.
Epirrita autumnata Gn.	H	3	Freda Creek, Hardwicke Island, Phillips Arm
Eupithecia unicolor Hulst	W, H, C, F	10	Helmcken Island, Phillips Arm, Rassmussen Bay, Chapman Creek, Madeira Park
Eupithecia annulata Hulst	F	1	Wilson Creek
Enypia venata Grt.	F, H	3	Sechelt Inlet, Salmon Inlet
Gabriola dyari Tayl.	S	1	Thurlow Island
Galerucella carbo Lec.	W, F, C	3	Chapman Creek
Halisidota argentata Pack.	F, H	5	Pender Harbour, Port Mellon, Sechelt, Madeira Park.
Helops pernitens Lec.	F	1	Gunboat Bay
Hylurgops rugipennis Mann.	F	1	Several larvae found in root collar of dying tree, Duck Lake.
Ipthimus serratus (Mann.)	F	1	Granite Lake
Neomyzaphis abietina Wlk.	S	1	Port Mellon
Neoalcis californiaria Pack.	S, F, H, C, D, W	15	Burnet Creek, Larsons Bay, Chapman Creek, Halfmoon Bay, Gunboat Bay, Rassmunsen Bay.
Nepytia a. nigrovenaria Pack.	S	1	Porpoise Bay.
Nyctobia limitaria Wlk.	W	2	Hardwicke Island, Trout Lake, Heydon Bay
Nemoria unilineria Tayl.	D	1	Chapman Creek

MISCELLANEOUS INSECTS - continued

Insect	Host	No. of collections	Remarks
Nymphalis antiopa Linn.	W	1	One web, Cranberry
Nadata g. oregeonensis Butl.	D	1	Burnet Creek.
Nemocestes horni Van D.	F, H, S	7	Hardwicke Island, Vancouver Bay, Deserted River, Malcolm Island, Lausmann Creek.
Nepytia phantasmaria Stkr.	H	3	Halfmoon Bay, Lausmann Creek.
Orgia a. badia Hy. Edw.	H	3	Carlson Creek, Sechelt Inlet, Porpoise Bay.
Pero morrisonarius Hy. Edw.	H	1	Narrows Inlet.
Psyllabora taedata Say.	Ma, H, F	6	Hardwicke Island, Phillips Arm, Loquilts Creek, Sonora Island.
Pemphus angusticollis (Mann.)		1	Stuart Island, ground.
Protoboarmia p. indictaria Wlk.	S	1	Cormorant Island .
Papillio rutulus Luc.	W	1	Wilson Creek.
Plectura spinicauda Mann.	W, Ma, Mb, H	6	Sechelt Inlet, Sonora Island, Malcolm Island Lausmann Creek, Chapman Creek.
Promylea lunigerella Rog.	W	1	Trout Lake.
Phellopsis porcata Lec.	D	1	Egmont.
Pissodes sitchensis Hopk.	S	1	Gunboat Bay.
Rheumaptera hasatata (Linn.)	D	1	Porpoise Bay .

MISCELLANEOUS INSECTS - continued

Insect	Hosts	No. of collections	Remarks
Stethreus 4-taberculata Mots.	F, C, H, Pl	6	Larsons Bay, Phillips Arm, Vancouver Bay, Deserted River.
Sciopithes obscurus Horn.	F, H, S	6	Gray Creek, Helmcken Island, Malcolm Island Stakawus Creek
Syphon cocinnus (Lec.)	H, S	2	Cormorant Island, Sonora Island.
Synaxis pallulata Hulst	F	2	Hardwicke Island, Duck Lake.
Scythropus californicus Horn.	F	1	Lang Bay.
Syngrapha a. interalia Ottl.	F, H, S	10	Helmcken Island Phillips Arm, Wilson Creek, Halfmoon Bay, Lausmann Creek.
Syngrapha selecta Wlk.	C	1	Chapman Creek.
Stenoporpia albescens Hulst	C	1	Halfmoon Bay.
Triphosa haesitata (Gn.)	cascara	1	Loquilts Creek.
Trichiosoma trangulum Kby.	W, D	2	Okeover Inlet, Hardwicke Island.
Vespamima sequoia Hy. Edw.	Pl	1	Porpoise Bay.

STATUS OF FOREST DISEASES

Important Diseases

Twig Canker of Pine

Further examination of lodgepole pine stands this year has shown an increased distribution of cankers caused by Atropellis piniphila (Wier) Lohman and Cash and Atropellis pinicola Zeller & Good. In many cases, either or both of these diseases were associated with damage caused by a pitch moth Vespamima sequoia (Hy. Edw.). Atropellis piniphila, being the more virulent, is the more damaging of the two. Samples of this disease were found in pine stands on Gambier and Hardwicke islands. One specimen was found on lodgepole pine at Duck Lake on the Sechelt peninsula. Although there was no tree mortality in each case there was some branch kill. All infections were considered light.

Heavy infections of Atropellis pinicola were found on lodgepole pine in the Porpoise Bay area and in a stand along the Powell River highway. In both of these areas heavy flagging was observed. A single infection of this disease was found at Gunboat Bay above Madeira Park, also on lodgepole pine.

Douglas fir Needle Cast

Considerable damage was caused by this serious foliage disease, Rhabdocline pseudotsugae Syd., to young Douglas fir around Madeira Park in 1960. Many of the young trees in this area had a very thin appearance, with the majority of these examined suffering up to 40 per cent defoliation. At one location two trees examined had lost approximately 80 per cent of their foliage. Infections by this disease were also found at Wilson Creek and Halfmoon Bay on the Sechelt peninsula. Comparatively heavy infections were also found at Lund and Westview on the Malaspina peninsula.

A Foliage Disease on Lodgepole Pine

An epiphytotic level of a foliage disease of lodgepole pine, as yet unidentified, appeared in several localities of the district in 1960, causing extensive damage mostly to the current growth, although in some cases 1959 foliage was similarly affected. Infected trees were quite conspicuous with the dead foliage giving them a reddish appearance. The most heavily infected areas were in lodgepole pine stands at Montague Point, Penber Harbour, three miles north of Wilson Creek, and on Hardwicke Island. Other areas of comparable infection occurred around Westview and Larsons Bay just south of Lund.

A Canker Disease on Hemlock

An unknown canker disease caused extensive damage and distortion to the stems in a stand of immature hemlock three miles north of North Lake along the Earl Cove, Egmont road. Approximately 60 per cent of the stems in this area were affected to some extent. Black sooty cankers completely girdled the trees. Several living trees were found with the stems completely covered with cankers. There was evidence of stunting and also some mortality. These severe cankerous swellings rendered many trees non-merchantable.

Hemlock Mistletoe

An extremely heavy infection by Arcethobium campylopodium Englm. caused severe stunting and discoloration of regeneration hemlock in the Mahood logging holdings near Stillwater. All young hemlock examined, ranging from seedlings to trees six inches d. b. h. over an extensive area were infected. Another considerable area of infection by this mistletoe, also on regeneration hemlock, was found in the British Columbia Forest Products holdings at Vancouver Bay in Jervis Inlet, but the young trees in that area did not seem to be suffering to the same extent.

Stem and Branch Canker

Infections caused by Didymosphaeria oregonensis Goodd. have appeared in several young alder stands at various localities throughout the North Vancouver District for the past two years. The largest area of infection observed occurred at Lausmann Creek in Princess Louisa Inlet. All alder examined here had at least one or more cankers. Other areas of comparable size and intensity were recorded at Roberts Creek and Gunboat Bay on the Sechelt peninsula. In all areas examined the trees showed no visible signs of damage aside from a slight swelling in the infected area and superficial lesions to the outer bark.

Willow Blight

Samples of a disease typical of willow blight, unidentified because of a lack of specific signs of the causal fungus, were made in three separate locations of the district. Three mature weeping willow at Alert Bay on Comorant Island had approximately 90 per cent of their foliage and branch tips affected. The leaves were turning black and the branches had encircling necrotic areas. There was also considerable tip kill. Light single infections of the same type of damage was found on Pacific willow on Channe Island in Cordero Channel, Port Mellon, and at Chapman Creek on the Sechelt peninsula.

Root Rot

A sample of root rot caused by Armillaria mellea (Vahl ex Fr.) Quél on Douglas fir was obtained in an area of regeneration Douglas fir at Larsons Bay on the Malaspina peninsula. At the same location a considerable number of young reddish colored trees, averaging four feet tall, were counted. Others showed early signs of discoloration.

Rust on Willow

The appearance of the rust Melampsora epitea Thuem. on willow was recorded in the North Vancouver District for the first time, Four samples were obtained in separate localities. At each location only one or two trees were affected but all were quite severe with approximately 80 per cent of their foliage being affected. All samples were obtained on the Malaspina peninsula at the following points; Lund, Larsons Bay, Westview and along the Mahood logging road at Stillwater on the Sechelt peninsula. no infections were observed on the alternate host, grand fir. Other alternate hosts were absent in these areas.

Canker on Sitka Spruce

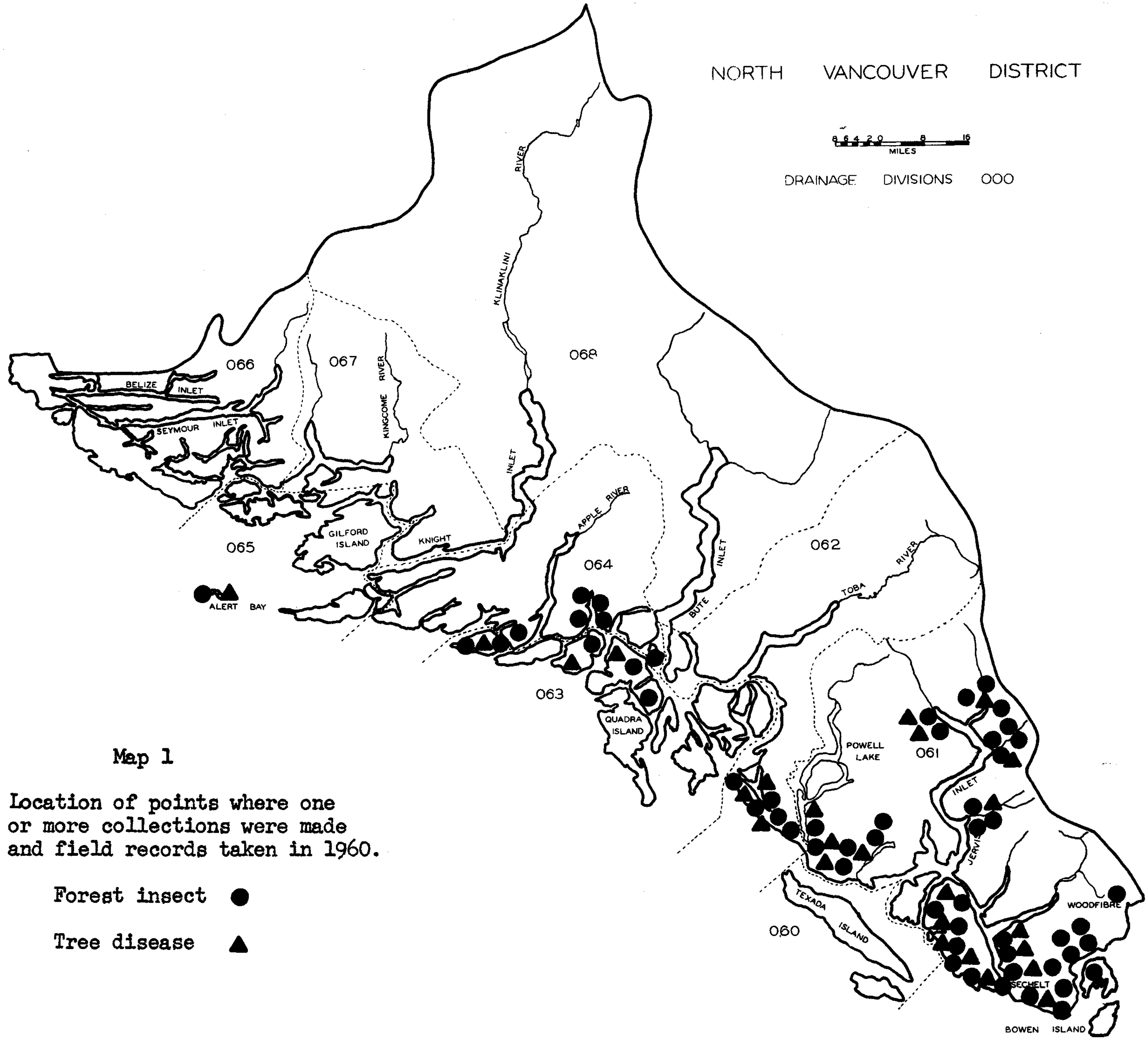
A new record of a canker of Sitka spruce caused by Retinocyclus olivaceus Fuckel was discovered this year on a mature tree on Hardwicke Island. Only a single infection was observed. The disease appeared as a large black canker on the undersurface of a lower branch.

Yellow Leaf Blister

Two heavy infections of yellow leaf blister, caused by Taphrina populi-salicis Mix were found on young cottonwood saplings at Stakawas and Lausmann creeks in Jervis Inlet. The trees examined in both areas had approximately 60 per cent of their foliage affected. No other infections by this disease were noticed in the district.

Other Noteworthy Diseases

Host	Organism	Locality	Remarks
Fir, Douglas	Caliciopsis pseudotsugae Fitz.	Helmcken Island	Branch canker.
	Dasyscyphus pseudotsugae Hahn	Helmcken Island	Branch canker.
Fir, grand	Peridermium pseudo-balsameum (Diet. & Holw.) Arth. & Kern	Malaspina peninsula	Heavy rust infections on needles of suppressed understory.
Hemlock, western	Caliciopsis sp.	Hardwicke Island	Branch canker.
	Haplosporella sp.	Hardwicke Island	Associated with tip dieback.
	Dimerosporium tsugae Dearn.	Lausmann Creek	Sooty mould causing needle drop.
Juniper, Rocky Mtn.	Gymnosporangium nidus-avis Thaxt.	Salmon Inlet	Rust broom causing deformation of branches.
Pine, lodgepole	Peridermium harknessii J. P. Moore	Larsons Bay	Causing rust galls on branches of young trees.
	Stereum sanguinolentum (Alb. & Schw. ex Fr.) Fr.	Hardwicke Island	Decay entered through rust gall.

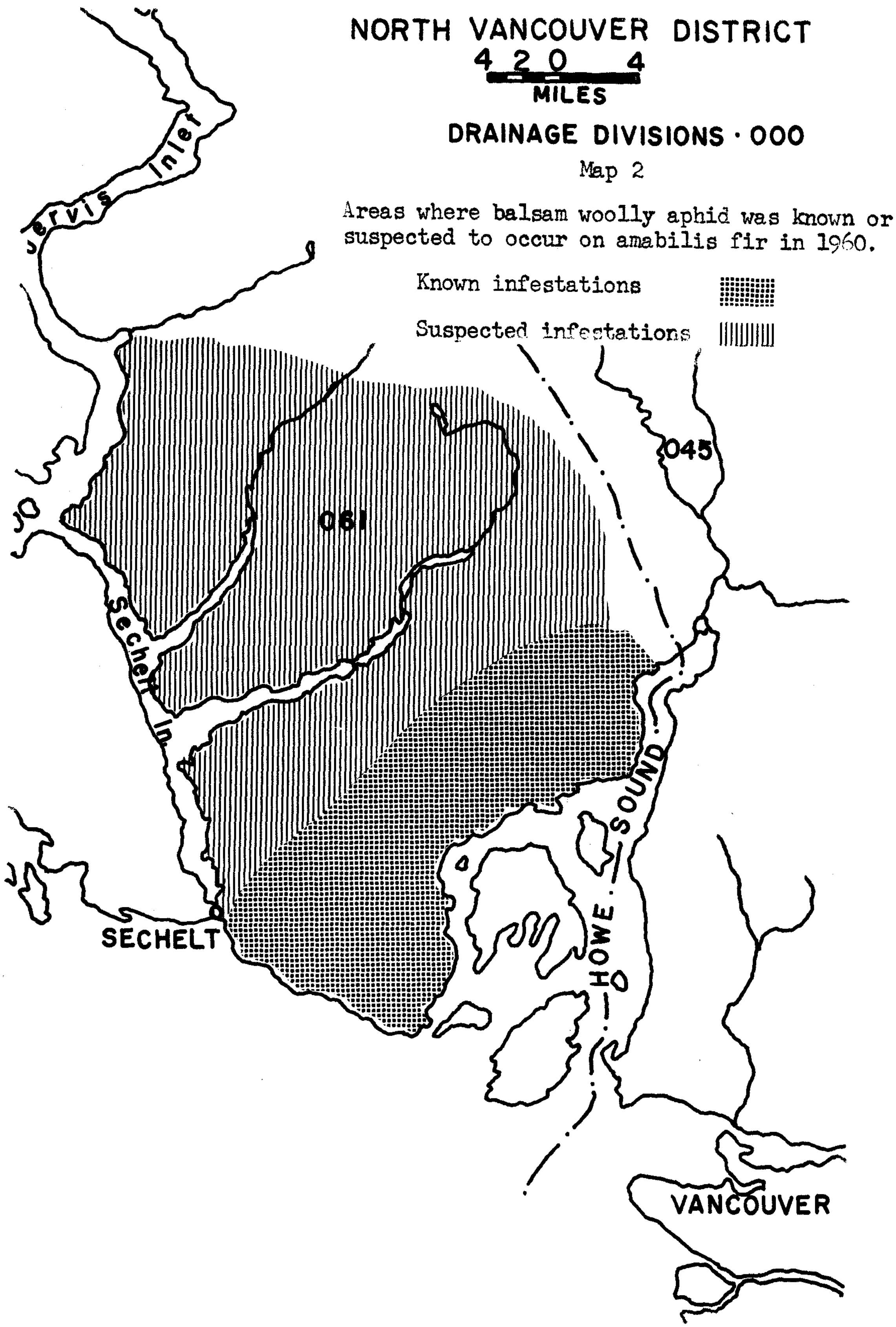


Map 1

Location of points where one or more collections were made and field records taken in 1960.

Forest insect ●

Tree disease ▲


NORTH VANCOUVER DISTRICT
4 2 0 4
MILES
DRAINAGE DIVISIONS · 000
Map 2
Areas where balsam woolly aphid was known or suspected to occur on amabilis fir in 1960.
Known infestations
Suspected infestations
Jervis Inlet
061
045
Sechelt In.
SECHELT
HOWE SOUND
VANCOUVER

ANNUAL REPORT OF FOREST BIOLOGY RANGERS

BRITISH COLUMBIA

1960

PRINCE RUPERT FOREST DISTRICT

FOREST BIOLOGY SURVEY

PRINCE RUPERT FOREST DISTRICT

1960

E. G. Harvey

INTRODUCTION

There were some changes in personnel in the Prince Rupert Forest District in 1960. The Forest Biology Ranger districts and rangers responsible for the survey of each were:

East Prince Rupert	-	E. G. Harvey
South Prince Rupert	-	D. Ruth
West Prince Rupert	-	N. E. Alexander

The northern area, accessible from the Alaska Highway, is included in the North Prince George Ranger District Report.

The 1960 field season was high-lighted by a number of insect infestations.

The two-year cycle spruce budworm infestation centred at Babine Lake increased in extent, but a much more pronounced spread occurred in the Prince George District to the north and east.

The black-headed budworm population decreased in the Queen Charlotte Islands, where a chemical control programme was carried out, but populations remain high on the coastal mainland.

A severe outbreak of the saddle-backed looper around Kitimat in association with the spruce budworm caused up to 100 per cent defoliation of some trees. About 1,800 acres were sprayed on August 1.

The forest tent caterpillar completely defoliated all deciduous trees over large areas in the vicinity of Hazelton. Spot infestations were prevalent in other parts of the district.

A tortricid caused severe defoliation to aspen in the Smithers area.

The aspen leaf miner remained abundant throughout the range of the host tree.

Bark beetle activity declined in 1960. Many beetle-killed trees were observed, but no fresh attacks were found.

The tree disease survey produced several new records of importance.

ANNUAL REPORT OF FOREST BIOLOGY RANGER

for

SOUTH PRINCE RUPERT DISTRICT

1960

FOREST BIOLOGY SURVEY

SOUTH PRINCE RUPERT DISTRICT

1960

D. S. Ruth

INTRODUCTION

The survey in the South Prince Rupert District commenced June 29 after the survey boat had completed some assigned work in the North Vancouver District. Ten days were spent in the West Prince Rupert District in July, during which time a total of 52 collections were made. Personnel engaged in the survey in addition to the Forest Biology Ranger were Cyril Sainsbury, operator of the M. V. Forest Biologist, and Michael Stuart, student assistant.

A total of 166 insect and 26 forest disease samples from the South Prince Rupert District were submitted to the Victoria Laboratory. Insect and disease collections by hosts are shown in Table 1. The location of forest insect and tree disease collections are shown on Map 1.

Table 1

Collections by Hosts

South Prince Rupert District - 1960

Coniferous hosts	Forest insects	Forest diseases	Broad-leaved hosts	Forest insects	Forest diseases
Cedar, western red	10		Alder, mountain	1	
Fir, Douglas	5	4	Alder, red	3	2
Hemlock, western	75	7	Alder, Sitka	1	
Pine, lodgepole	1	3	Birch spp.		1
Spruce, Sitka	60	5	Cottonwood, black	2	
Yew, western		2	Willow spp.	4	1
			Miscellaneous	4	1
			Total	15	5
Total	151	21	Grand Total	166	26

STATUS OF INSECTS

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

With the exception of drainage division 082, this insect was prevalent throughout the district in 1960. There was a marked increase in the larval population as indicated in Table 2. In 1958 only one larva was found, in drainage division 081. The location of collections is shown on Map 2. The largest number of larvae occurred in the Grenville Channel region where seven collections on western hemlock and Sitka spruce averaged 45.5 larvae each. One collection in this area contained 137 larvae. Defoliation ranged from 10 to 15 per cent on the current foliage of western hemlock.

In some sections of drainage division 081 and 082 the survey in 1960 was too late to detect black-headed budworm larvae.

Table 2

Summary of Black-headed Budworm Collections by Drainage Divisions

South Prince Rupert District, 1958 - 1960.

Drainage Division	Total no. of samples taken during larval period		No. of samples containing black-headed budworm		Average no. of larvae per sample	
	1959	1960	1959	1960	1959	1960
080	7	11	1	2	7.0	1.0
081	27	39	11	8	3.3	10.2
082	21	21	2	0	1.5	0.0
083	19	87	15	47	12.0	15.2
Total	74	158	29	57	7.9	14.0

The Green-striped Forest Looper, Melanolophia imitata Wlk.

The green-striped forest looper was found in all drainage divisions and was most prevalent on its preferred host, western hemlock, although some larvae were collected from Sitka spruce and western red cedar. Twenty-three collections containing looper averaged 1.5 larvae per sample. The 1960 population decreased considerably from previous years (Table 3). No defoliation was observed. Distribution of samples containing larvae is shown on Map 3.

Table 3

Summary of Green-striped Forest Looper Collections by Drainage Divisions

South Prince Rupert District, 1958 - 1960.

Drainage Division	Total no. of samples taken during larval period			No. of samples containing green-striped forest looper			Average no. of larvae per sample		
	1958	1959	1960	1958	1959	1960	1958	1959	1960
080	4	7	16	2	5	4	14.0	14.0	4.0
081	40	26	42	9	9	5	2.9	3.0	2.2
082	41	18	21	8	4	1	2.4	4.0	1.0
083*	-	19	86	-	8	13	-	3.0	1.9
Total	85	70	165	19	26	23	3.9	5.4	1.5

* Drainage division 083 was not sampled 1958

Western Hemlock Looper, Lambdina fiscellaria lugubrosa, (Hulst)

The hemlock looper decreased considerably from 1958 and 1959 as indicated in Table 4. Only 11 larvae were collected in five samples from western hemlock in various sections of the district.

Table 4

Summary of Hemlock Looper found by Drainage Divisions,

South Prince Rupert District, 1958 - 1960.

Drainage Division	Total no. of samples taken during larval period			No. of samples containing hemlock looper			Average no. of larvae per sample		
	1958	1959	1960	1958	1959	1960	1958	1959	1960
080	5	7	16	1	2	2	1.0	2.0	3.5
081	39	11	22	25	8	0	5.0	2.0	0.0
082	43	18	21	14	3	1	1.6	1.3	1.0
083	-	-	67	-	-	3	-	-	1.3
Total	87	36	126	40	13	7	3.9	2.0	2.0

Pine Root Weevil, Hylobius warreni, Wood

One adult was found perching on Sitka spruce, near Butedale. This is the first record of this insect in this section of the district.

Antique Tussock Moth, Orgyia antiqua badia (Hy. Edw.)

In 1959, 17 larvae were collected, thirteen of which came from drainage division 081 and the remainder from 083. This year 11 larvae were collected on western hemlock, Sitka spruce and western red cedar. Collections in 1960 were widely distributed throughout the district.

Spruce weevil, Pissodes sitchensis, Hopk.

One attack of spruce weevil was found near Bella Coola in a small stand of immature Sitka spruce. No other attacks were observed in other spruce stands examined.

Spruce Budworm, Choristoneura fumiferana (Clem.)

An appreciable increase in the spruce budworm population was noted when comparing the 1960 collections with those of the two previous years. In 1958 one larvae was found, and in 1959 seven. This year a total of 81 larvae were collected from Sitka spruce and western hemlock in 28 samples. Collections averaged 2.9 larvae each. The collections containing spruce budworm are shown in Map 3.

Geometrid, Hydromena irata, Sw.

This looper was present in all drainage divisions with the exception of 082. Most collections contained small numbers of this insect. However, on King Island in Jenny Inlet, 15 larvae were collected from a 3-tree beating sample of western hemlock. Thirty-two collections averaged 3.4 larvae per sample. This is the first year that this species has appeared in any appreciable numbers. The preferred hosts were Sitka spruce and western hemlock.

Spruce Gall Aphid, Adelges cooleyii, Gill.

A small number of galls caused by the spruce gall aphid were observed on the current twigs of Sitka spruce in Nascall Bay and Elcho Harbour on Dean Channel.

In the area around Bella Coola galls were prevalent on all spruce. Attacks varied from light to medium. The insect was also common on the alternate host, Douglas fir. A survey made in the Nusatsum Valley east of Bella Coola revealed heavy attacks of aphids on current foliage of Douglas fir reproduction ranging in size to 4 inches d. b. h. Twenty trees were examined all of which were heavily attacked.

Hemlock Aphid, Adelges tsugae, (Annand)

A request by the British Columbia Forest Service to examine western hemlock trees in and around the townsite of Bella Coola was carried out and it was found that a number of immature trees were infested with Adelges tsugae. These had numerous dead or dying branches which not only marred their appearance but seriously weakened the trees and could eventually cause their death if the attacks continued. A western hemlock hedge located in a private homesite approximately five miles east of Bella Coola was infested as well as some adjacent trees.

Sawflies, Neodiprion spp.

Forty-four collections averaging 20.1 larvae were made on Sitka spruce and forty-six collections averaging 19.6 larvae were made on western hemlock. Six collections on miscellaneous hosts averaged 3.1 larvae.

The heaviest population occurred at three locations in drainage division 083. In Khutz Inlet near Butedale 140 larvae were collected on Sitka spruce. At Camp Point on Grenville Channel 147 were found on western hemlock and in Douglas Channel near Clio Point 158 were collected on Sitka spruce. This is a definite increase in the sawfly population from previous years.

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

In a collection made 0.3 miles south of the Kitimat Dock 61 saddle-backed looper larvae were found on western hemlock and 58 on Sitka spruce. Defoliation ranged from 15 to 25 per cent. This area was adjacent to and south of the infestation at Kitimat in the West Prince Rupert District. Only two larvae were collected in a bay approximately three miles below the first collection point; both were dead and diseased. No defoliation was observed between the first and second areas. Fourteen more larvae were collected at widely separated points throughout the district.

In 1959, 51 larvae were found in three different locations in Draney Inlet, drainage division 080. The survey this year in Draney Inlet, was conducted after the larval period, but no defoliation was observed.

Spruce Sawflies, Pikonema spp.

Pikonema alaskensis, Roh., and P. dimmockii, Dresson, were common in most sections of the district on Sitka spruce. One hundred and eight P. dimmockii, were collected in 35 samples for an average of 3.1 larvae per collection. Sixty-seven P. alaskensis were collected in 20 samples for an average of 3.3 larvae per collection. This is a large increase in the population of the two Pikonema species from previous years. In 1959 four P. dimmockii and two P. alaskensis were collected at Elcho Harbour in Dean Channel. No records could be found which indicated the presence of these insects in collections made in 1958.

MISCELLANEOUS INSECTS

South Prince Rupert District - 1960.

Insect	Host	No. of collections	Remarks
Araeopidius monachus Lec.	S, C	3	Two collections in drainage 083 and one in 081. Four larvae collected.
Ampedus moerens Lec.	S, H	2	Three larvae collected in drainage 083.
Anthelia hyperborea Hulst	H, S	2	Collections made in Kishkosh Inlet and on Roderick Island.
Acanthelia hyperborea Hulst	H, S	2	One collection made in Hartley Bay another in Kynoch Inlet. Two larvae collected.
Acantholyda spp.	S	2	Collections made at the mouth of the Nascall River and near Bella Coola.
Byrrhidae sp.	H	1	Camp Point Grenville Channel, one larva collected.
Brachyrhinus ovatus Linn.	H	1	Cunningham Island.
Cephaloon sp.	H	1	Campbell Island near Bella Bella one larva collected.
Cyphon brevicollis (Lec.)	H	1	Denny Island, Bella Bella.
Caripeta divisata Wlk.	H, F, S	12	Three collections on hemlock and spruce made near Bella Coola contained 36 larvae.
Dendroctonus sp.	C	1	Butedale
Enypia venata Grt.	H	2	One larva found in drainage 081 another in 083.
Eupithecia spp.	C, H, S	12	Found in widely separated areas throughout the district.
Epirrita autumnata Gn.	H	1	Butedale, one larva found.

MISCELLANEOUS INSECTS - continued

Insect	Host	No. of collections	Remarks
Feralia comstocki Grt.	H	10	Collections averaged 1.4 larvae.
Gabriola dyari Tayl.	H, C	4	Five larvae collected in widely separated areas in the District.
Galerucella punctipennis Mann.	W	1	Kimsquit, Dean Channel.
Noctuid spp.	C, S, H, D	8	Collections averaged 1.5 larvae each.
Neoalcis californiaria Pack.	C, H	5	Collections averaged 4.1 larvae. Common in most parts of the district.
Nyctobia limitaria Wlk.	H, S	6	Most common in drainage 083. Collections averaged 2.1 larvae per sample.
Prothalpia holmbergi (Mann.)	H	1	Swindle Island, Finlayson Channel.
Plectura spinicauda Mann.	F, S, H, D	5	Common throughout the District; but in small numbers.
Pamphiliidae spp.	S, H	2	Klewnuggit Inlet and Roderick Island.
Pero behrensarius Pack.	S	1	Evans Inlet, King Island.
Pentatomidae sp.	F	1	Two larvae collected near Bella Coola.
Peltastica tuberculata Mann.	H	1	Bella Coola.
Pemphigus populi-transversus Riley	W	1	Light attack on willow near Bella Coola.
Rheumaptera hasatata (Linn.)	D	1	Kimsquit, one larva collected.
Sciopithes obscuris Horn.	H	3	All collections made in drainage 081. Collections averaged 2.0 per sample.

MISCELLANEOUS INSECTS - continued

Insect	Host	No. of collections	Remarks
Syngrapha a. interalia Ottl.	H, S	3	Larvae found at Namu, Butedale and Swindle islands.
Strethreus 4-taberculata Mots.	S	1	Khutze Inlet, one weevil collected .
Semiothisa spp.	H, S	18	Prevalent throughout the district; collections averaged 3.3 per sample.
Synaxis pallulata Hulst	S	1	Bay south west of Work Island one looper collected.
Zeiraphera diniana Gn.	S	3	Collections averaged 2.1 larvae per sample.

STATUS OF FOREST DISEASES

The overall disease condition in the South Prince Rupert District remained at a low endemic level. Twnety-six collections were made throughout the District and sent into the Victoria Laboratory for identification. Those diseases worthy of mention are in the following paragraphs.

Rust on Willow

The disease *Melampsora epitea* Thum., was found on the leaves of willow saplings near Kitimat causing light infection on approximately 18 per cent of the foliage. Willow stands examined in other sections of the district appeared to be free of this rust.

The coniferous host of the rust is hemlock. In May and June the young needles of hemlock are infected by basidio spores from telia of overwintered willow leaves. Approximately two weeks later, the needles begin to discolour and by late August the aecia-bearing needles have turned yellow and dropped off.

Sooty Mould

Dimerosporium tsugae Dearn., was found on western hemlock in three widely separated localities. Several immature trees at the mouth of the Nascall River were observed with up to 35 per cent of the foliage infected by this sooty mold. In each of the other two areas where this disease was observed only one tree was infected.

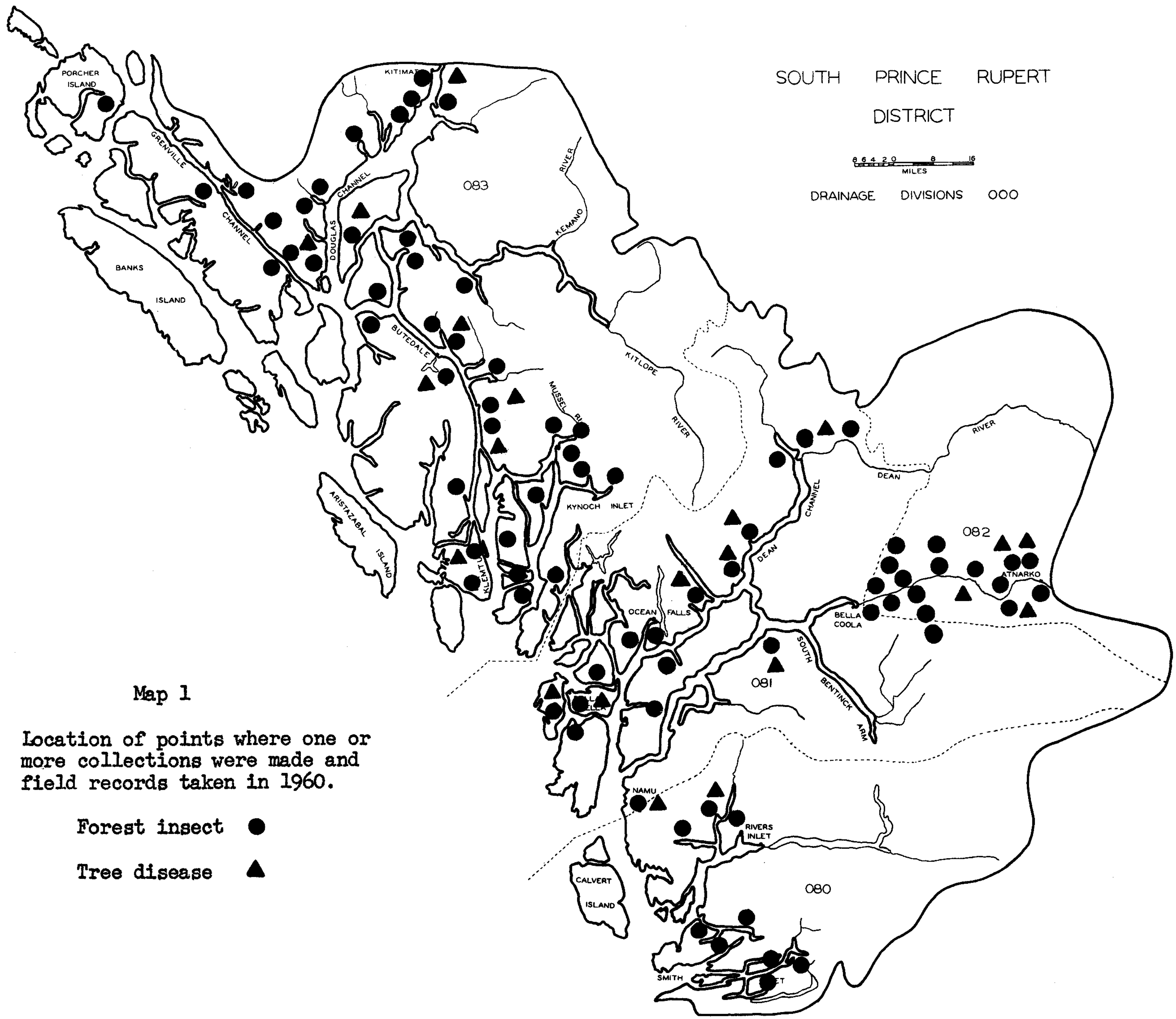
The sooty mold fungi often develops on the honeydew excreted by certain aphids and scale insects. It appears as a sooty growth or crust in isolated patches or may cover the entire needle. It usually appears on the undersurface of the needles. The fungus does not occur on needles of the current season. Although sooty leaves are unsightly and some interference with their physiological functions must result, there is no apparent injury to affected trees.

Douglas fir Needle Cast

Several small trees in a stand of Douglas fir were attacked by Phaeocryptopus gaeumannii (Rohde) Petr., fungus, thirty-four miles east of Bella Coola. Approximately 15 per cent of the foliage was affected. Samples of the needle cast were also found near the mouth of the Dean River. Here numerous trees were infected with up to 12 per cent of the foliage discoloured. In Burke Channel near the east end of King Island one Douglas fir was found diseased, but the attack was light.

Canker Disease of Red Alder

Didymosphaeria oregonensis Gooding, was found infecting an immature stand of red alder at Swanson's Bay near Butedale. The fungus causes a canker which appears as roughened bark around the main stems and branches, and was prevalent throughout the stand. Only small trees were infected. Apparently the canker ceased to enlarge after the bark became hard and thick. Although it may deform trees to some extent the damage is generally negligible. The disease is known to occur on Mountain, red, and Sitka alders.

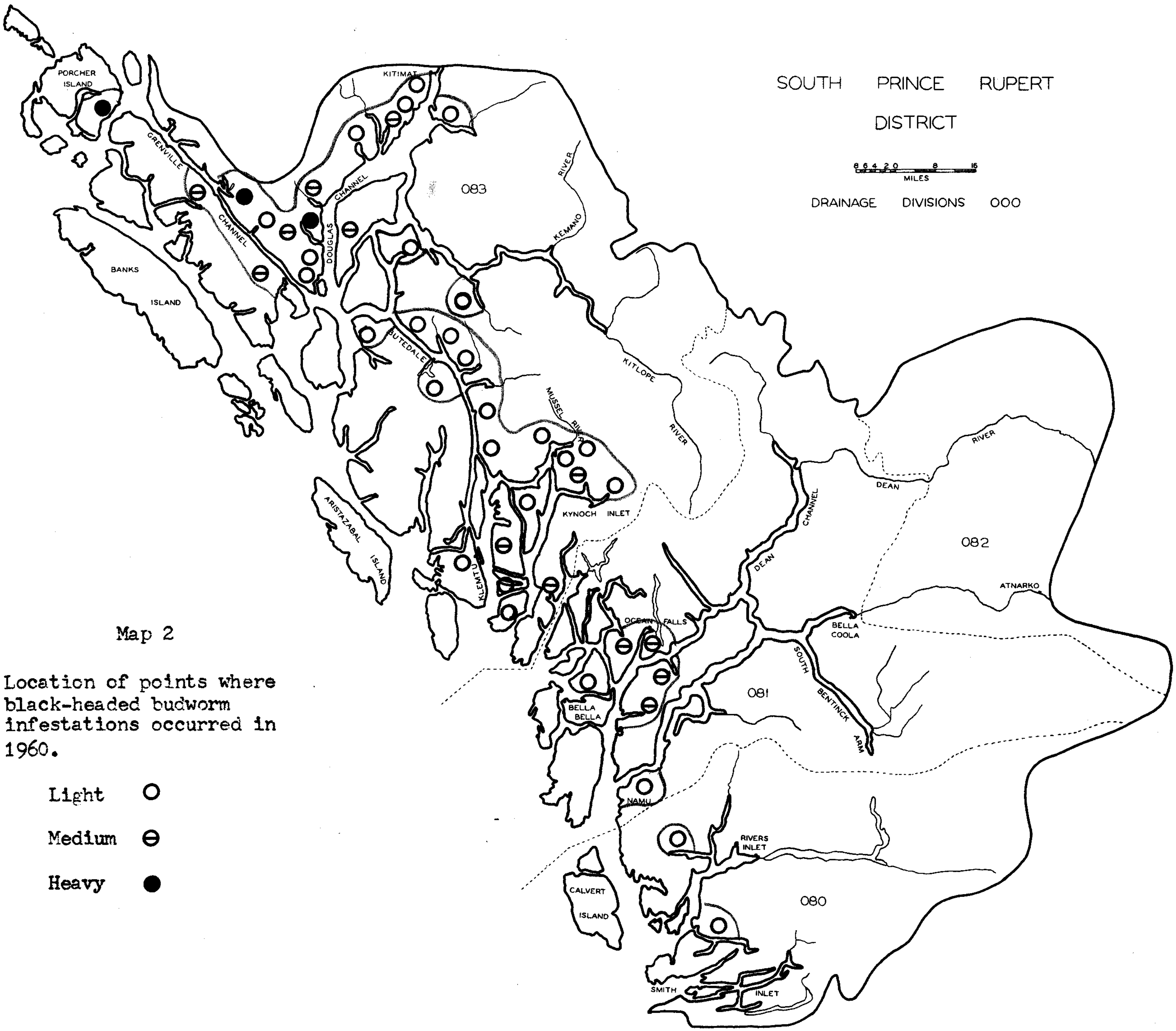


Map 1

Location of points where one or more collections were made and field records taken in 1960.

Forest insect ●

Tree disease ▲



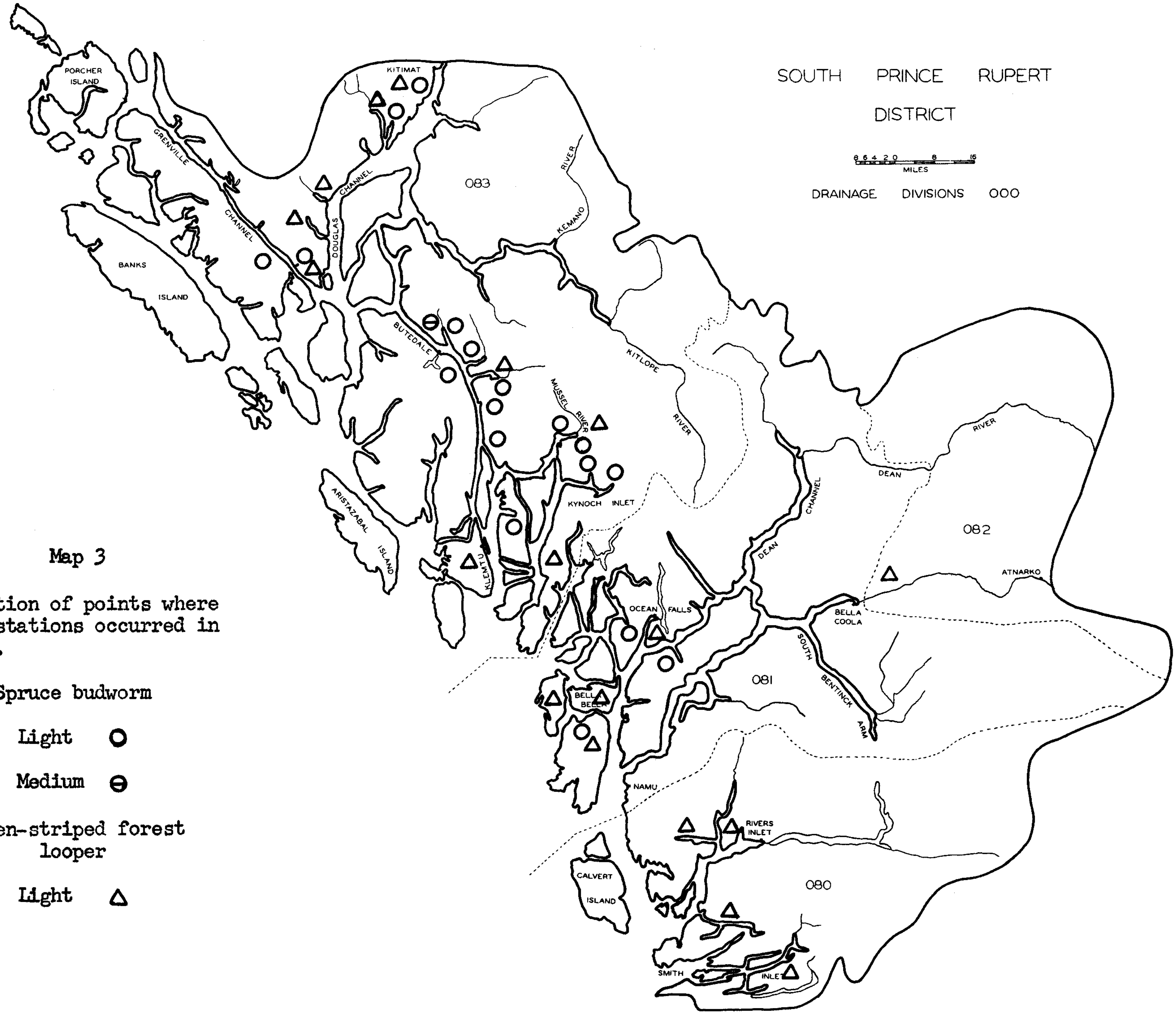
Map 2

Location of points where black-headed budworm infestations occurred in 1960.

Light ○

Medium ⊖

Heavy ●



Map 3

Location of points where infestations occurred in 1960.

Spruce budworm

Light ○

Medium ⊖

Green-striped forest looper

Light △

ANNUAL REPORT OF FOREST BIOLOGY RANGER

for

WEST PRINCE RUPERT DISTRICT

1960

FOREST BIOLOGY SURVEY

WEST PRINCE RUPERT DISTRICT

1960

N. E. Alexander

INTRODUCTION

The 1960 field season commenced on May 16 and terminated on September 27. A total of 354 insect samples and 68 forest disease samples were collected during this period. Collections, listed by hosts, are shown in Table 1. Points at which collections were made and records taken are shown in Maps 1 and 2.

There were no unusual disease conditions encountered in 1960.

Table 1

Collections by Hosts

West Prince Rupert District - 1960

Coniferous hosts	Forest insects	Forest diseases	Broad-leaved hosts	Forest insects	Forest diseases
Cedar, red	4	1	Alder, red	13	3
Cedar, yellow		1	Alder, Sitka	1	1
Fir, alpine	10	8	Aspen, trembling	9	2
Fir, amabilis	22	2	Birch	1	1
Fir, Douglas	1		Cottonwood, black	8	2
Hemlock, mountain	1		Maple, Douglas	1	1
Hemlock, western	166	10	Poplar spp.	3	5
Larch, European		1	Poplar, silver	1	
Pine, lodgepole	5	2	Willow	9	5
Spruce spp.	6		No host	7	
Spruce, Sitka	71	14	Miscellaneous	8	4
Spruce, white	7	5			
			Total	61	24
Total	293	44	Grand total	354	68

STATUS OF INSECTS

Black-headed Budworm, Acleris variana (Fern.)

The black-headed budworm populations declined in the Queen Charlotte Islands during 1960 and increased on the mainland coast of the district from Porcher Island north (Drainage Divisions 103 and 106) (Table 2). As these two areas are geographically distinct they will be discussed separately.

Queen Charlotte Islands

While the larval populations in the Queen Charlotte Islands remained at infestation levels, the collections were much smaller. As in previous years, collections on Graham Island were smaller than on Moresby. Budworm were found in more collections on Graham Island this year but the increase is not thought to be significant. On Moresby Island the largest larval collections in 1960 were in the areas of maximum defoliation in 1959, i. e. from Lagoon Inlet south (Map 4). There was no appreciable defoliation observed in this area during July.

Regular collections made by the spray assessment crew from early in July, 1960, would indicate that the major drop in the larval numbers occurred during July when the larvae were in their second to fourth instars. On June 10, "insects per 10 square feet of foliage" averaged 48. By July 4 this average had dropped to 37. After this date a rapid and constant decrease occurred, and on July 28 the average was down to four insects per 10 sq. ft. of foliage (Table 3). It is felt that this decrease in the population was caused by poor weather throughout the larval period. The larvae hatched but the hatch was not synchronized with the breaking of buds in the overstory. Continuing cool weather maintained this adverse condition.

Parasitism was relatively heavy in the larval population on the southern portion of the islands, as shown in Table 4. The parasites found were for the most part Asgogaster sp. (Hymenoptera: Brachonidae).

An egg survey of the southern islands, made during October, confirmed the population drop and indicated an even lower population in 1961 (Table 5) (Map 5).

Chemical control - Moresby Island

The spray project on Moresby Island commenced on July 17 and was completed by July 23. Spray was applied by a Grumman Avenger aircraft. Conditions were not optimum for the operation. Larval and bud development had not proceeded as expected and the weather was very unsettled. Control, uncorrected for natural mortality,[2] ranged from 70 to 100 per cent.

2/ J. M. Kinghorn, Preliminary Report on Black-headed Budworm Control Projects - Queen Charlotte Islands, 1960. (Unpub.)

Table 2

Summary of Black-headed Budworm Found by Drainage Division,

West Prince Rupert District, 1958 - 1960.

Drainage division	Total number of samples taken during larval period			Number of samples containing larvae			Average number of larvae per sample		
	1958	1959	1960	1958	1959	1960	1958	1959	1960
100	11*	24	30	6*	23	27	18.1*	275.8	94.9
101	15*	35	47	7*	16	30	3.0*	19.5	15.4
102	5	6	19	1	2	6	6.0	2.0	9.7
103	7	10	21	3	7	16	3.3	19.8	54.3
104	29	10	0	3	2*	0	3.0	2.0	0.0
105	16	9	1	0	2	0	0.0	1.0	0.0
106	12	28	26	2	8*	20	2.5	5.5	26.0
Totals	95	122	144	22	60	99	7.3	149.1	45.2

Drainages 100 and 101 - Queen Charlotte Islands.

* Includes pupae

Table 3

Black-headed Budworm Population Trend and Instar Development,

Queen Charlotte Islands, 1960. 1/

Date	Average number of insects per 10 square feet of foliage	Predominant stage of instar development
June 10	48	Eggs
June 16	35	1st instar
June 22	36	1st instar
June 28	33	2nd instar
July 4	37	2nd instar
July 10	20	3rd instar
July 16	19	3rd instar
July 22	9	3th instar
July 28	4	4th instar
August 3	3	4th instar
August 10	1	5th instar, pupae

1/ Basic Data from Chemical Control Project, J. M. Kinghorn, 1960

Table 4

Percentage Parasitism in the Black-headed Budworm,

Queen Charlotte Islands, 1959 and 1960.

Location	Percentage of larvae parasitized	
	1959	1960
Burnaby Island, Section Cove	24.2	76.9
Beresford Inlet	-	23.2
Sedgwick Bay, Lyell Island	-	33.3
Crescent Point	-	25.8
Tanu Island, west end	-	30.7
South side Talunkwan Island	-	35.8
Dana Inlet, west end	-	21.4
Thurston Harbour, Talunkwan Island	12.0	50.0
Trotter Bay	12.0	26.9
Traynor Creek, Louise Island	-	77.8
Carmichael Passage, Louise Island	-	54.7
Renner Point, Louise Island	-	54.2
Moresby Camp, T. L. 1218	-	61.2
Lagoon Inlet	13.2	

Table 5

Black-headed Budworm Egg Samples, Queen Charlotte Islands,

1959 and 1960.

	Location	Number of eggs per sample 1960	Average no. of eggs per 10" tip 1959	1960
1	Powvrico Bay, Lyell Island	2/15*	0.33	0.13
2	Beresford Inlet, Lyell Island	1/15	7.73	0.06
3	Rockfish Harbour, Louise Island	0/15	2.00	0.00
4	Lagoon Point, Moresby Island	1/15	3.40	0.06
5	Thurston Harbour, Talunkwan Island	0/15	1.27	0.00
6	Tanu Island	1/15	5.53	0.06
7	Dana Inlet, T.L. 1209, Moresby Island	0/15	-	0.00
8	Dana Inlet, Moresby Island	5/15	2.80	0.33
9	Ramsey Island	2/15	6.00	0.13
10	Maude Island	3/15	8.07	0.20
11	Alliford Bay, Moresby Island	0/15	17.83	0.00°
12	Copper River, Moresby Island	4/15	8.93	0.26°
13	Heather Lake, Moresby Island	0/15	4.53	0.00
14	South Bay, Moresby Island, P.L. 140	1/15	76.67	0.06°
15	Mosquito Lake, Blk. 1323	63/15	5.27	4.20
16	Moresby Camp, T.L. 1716	4/15	31.67	0.26°
17	South Bay, Skidegate mainline	2/15	2.40	0.13°
18	Peel Inlet, Moresby Island	1/15	0.60	0.06
19	Renner Point, Louise Island	4/15	3.53	0.26
20	Traynor Creek, Louise Island	0/15	13.07	0.00
21	Beljay Bay, Lyell Island	5/15	7.60	0.33
22	Takelly Cove, Lyell Island	0/15	1.20	0.00

* e. g. 2/15 - 2 eggs on 15 - 10" branch tips samples. ° sprayed area

Obviously, where untreated populations were undergoing catastrophic natural decline, the theoretical percentage control attributable to the spray was much less than indicated. Subsequent sampling indicated that the dosage of 1/4 lb. DDT per U. S. gallon per acre was effective. This dosage was used to test its effectiveness against the budworm and to lessen the hazard to fish. In all, some 31,500 acres were sprayed.

A very small scale spraying of Bacillus thuringiensis Berliner was done in the Skidegate Lake area. The assessment of the effectiveness of this spray was hindered by the lack of larvae on July 24 in the spray area, but it was definitely established that B.t. would kill budworm larvae, that it could kill with dosages practical for aerial application, and that it was not apparently toxic to fish.

Judging by the rapidly declining larval populations during 1960, the incidence of parasitism, the lack of defoliation, and the very low egg counts, it is expected that the budworm populations in drainages 100 and 101 will continue to decline in 1961 and present no serious problem to the forests.

Mainland Coast

The black-headed budworm showed a marked increase in numbers on the mainland coast in 1960. Ranger Supervisor R. L. Fiddick and Ranger D. Ruth operated the M. V. Forest Biologist in this area during July and some of this apparent increase can be attributed to the more opportune sampling time. Nevertheless, light defoliation observed in some locations confirmed the population increase. The average number of larvae per collection increased (Table 2) and the collections contained from one to 381 larvae each. This high collection was made at North Point, Observatory Inlet. Occurrences of larvae were well distributed (Map 3).

There was no egg survey undertaken in the area this year but it is not expected that weather conditions were any more favourable for budworm development on the coast than in the Charlottes and no violent increase in the population is anticipated in 1961.

Saddle-backed Looper, Ectropis crepuscularia Schiff.

In 1959 a considerable increase in the saddle-backed looper population was noted in coastal British Columbia, larvae being present in 162 collections. On May 17, 1960, a large flight of moths in the vicinity of Kitimat was reported by W. C. Lindstrom, B. C. Forest Service Ranger. These moths were subsequently identified as the saddle-backed looper. At the time it was estimated that the moths at rest covered trees and buildings in the area as heavily as five to the square foot. The area was put under observation, but as this insect has never caused serious damage to the coniferous stands in the past no special surveys were planned. The only previous records of large populations were at Hidden Lake (East Kamloops) in 1950, and in the North Thompson River Valley in 1951 - 1954. In the latter area hemlock was 60 to 100 per cent defoliated in 1953 but feeding subsided in 1954.

Unfortunately, no collections were made at Kitimat during July or early August in 1959 and no figures are available for comparison with this years. However, fume damage plots in the infestation areas were examined early in 1960 and only traces of 1959 insect feeding were found. Therefore it is assumed that any defoliation in 1959 was confined, for the most part, to the deciduous understory.

The 1960 moth flight commenced sometime prior to May 17 and continued until about June 15.

Large larval populations were present by the end of June, but a survey of the area was postponed until the end of July because of involvement with a black-headed budworm larval survey on the Queen Charlotte Islands. While the looper larvae were in their early instars (1st and 2nd) on July 2, it was estimated at the time that they had consumed 50 per cent of the current foliage on the hemlock and amabilis fir understory in the area around "Sand Hill" at Kitimat. Deciduous understory was also heavily fed upon.

Only the general life history of this species is known. The moths generally emerge in late May, mate and lay eggs. The light gray moth has a wingspan of about 1 1/4 inches. The general mottled and indistinct markings of this species makes identification difficult. The wings appear to have scalloped edges and many fine transverse lines, often poorly defined. The larvae hatch and feed on the deciduous understory and ground cover and commence feeding on the larger trees when this food supply is exhausted. The full-grown larvae are about 1 1/4 inches in length. The head is brownish, often mottled. The body is dark grey to brown, sometimes reddish in colour. The first three instars have a distinct inverted V marking on the dorsal side of the 2nd abdominal segment, but this marking becomes indistinct in the fourth instar and is often missing in the fifth. In August the larvae drop to the ground and pupate in the duff beneath the trees. The pupae are a reddish brown colour. The winter is passed in the pupal stage.

Extent and Intensity of Infestation

Unlike most of the insect infestations encountered by the Survey, there was no time to make accurate surveys of the extent of the outbreak before control measures were undertaken. Consequently, the major portion of the outbreak was mapped in September during the pupal survey. This work was fascilitated by the use of a helicopter and a very accurate appraisal of the areas affected was possible.

The outbreak extends from about two miles south of the smelter site to about three miles north of Kitimat station, and is entirely confined to the west side of the Kitimat River. Larvae were found in areas to the east of the river but there was no visible defoliation. Heavy feeding extends to an altitude of 1,500 feet up the mountainside, confining the westward spread with the exception of the Anderson and Moore creek valleys where the defoliation extends to the headwaters (Map 6). The total area is 14,000 acres.

With few exceptions the undergrowth, including devil's club, elderberry, and other deciduous bushes, was stripped. Most of the reproduction, regardless of species, was stripped. Defoliation was heaviest on the southern slope of

Sand Hill and the northern slopes of Anderson and Moore creek valleys. The feeding habits of this insect are well illustrated by Tables 6 and 11. Four of these plots were laid out several years ago to study the effects of fumes from the smelter on trees, and two were temporary plots established in 1960. Almost without exception defoliation was most severe on suppressed trees, and was lightest on the dominant trees. The feeding was also stratified to the extent that when defoliation was heavy in the upper third of the crown of intermediate trees, feeding was also heavy on the lower and mid-crown of the co-dominant and dominant trees.

The heaviest defoliation was recorded in Random Plot 1 on Sand Hill (Table 9). All suppressed and intermediate trees were completely defoliated, and 11 out of 19 dominant and co-dominant trees were 90 per cent or more defoliated. Defoliation in the other two plots on Sand Hill (Tables 8 and 10) was also heavy. Defoliation in parts of Anderson and Moore creek valleys was estimated at approximately this intensity, although the plot at the mouth of Anderson Creek (Table 7) did not show as much damage to the upper story trees.

Chemical Control

When the author and Dr. G. T. Silver, Survey Head, arrived at Kitimat on July 27, defoliation was severe and feeding was progressing rapidly. At a municipal meeting on July 29 it was decided to spray a portion of the outbreak if the control operation could be carried out by August 2. Plans to organize the project were successful, and 1,800 acres of mature timber were sprayed on August 1, 1960.

The insecticide, 1/2 lb. of DDT per gallon of fuel oil, was applied by a Grumann Avenger aircraft at the rate of 1 U. S. gallon per acre. From the standpoint of larval survival the spray operation could not be regarded as particularly successful. Because of the lack of men and time a complete study of the results was not possible. However, there are several possible explanations for the high larval survival. These are; insufficient amount of DDT, the advanced stage of the larvae at the time of spraying, and the insects habit of feeding from the ground cover up, thus gaining the protection of a relatively undisturbed upper crown. The assumption made is that the larvae were knocked down by the initial spray, but were able to crawl back up the trees and resume feeding. As feeding continued they were exposed to more DDT in the upper crown levels and gradually accumulated a lethal or sub-lethal dose of insecticide. This dosage caused the larvae to drop to the already heavily defoliated understory trees and finish their feeding there.

Although the data indicate that the control program did not result in heavy larval mortality the timber in the sprayed area appeared to be in better condition than the stands outside the sprayed area. It is therefore believed that the DDT did result in saving many trees which would otherwise have been severely defoliated and killed.

Pupal Sampling

This insect overwinters as a pupa and as spring egg laying only precedes larval feeding by about a month a method of determining the following year's potential population was required. After some rapid preliminary work in September the method adopted for field sampling was a 1-foot square duff sample taken at a point midway between the base of the tree and the perimeter of the crown on the east and west sides of each of three trees in each locality. The average number of pupae in the six samples was assumed to provide an estimate of the average pupal population for that area. Pupal samples and defoliation estimates were made in 32 localities and the results are tabulated in Table 12. With the exception of the sample point at Bowbyes Lake (26) the localities showing defoliation and the largest pupal counts were all within the infestation area as mapped from the air. The samples also show that only a very light population existed outside the area of heavy defoliation. This would account for the well defined boundaries of the outbreak. The average pupal population within the defined infestation area was 7.8 per square foot. There was no significant difference in the number of pupae inside and outside the area sprayed in 1960.

Natural Control Factors

Parasitism was very light in the 1960 infestation as shown in the following summary:

Number of larvae reared	-	869
Number of larvae died of parasites	-	10
Number of field collected pupae	-	1,402
Dusonia sp. parasite puparia collected in the field	-	96

The only identified parasite reared from the larvae was Dusona sp. This is believed to be a larval parasite and emerges when the host is in the last instar. The parasite larva spins a cocoon and overwinters in the duff. The 96 Dusona sp. recorded were found in the duff samples containing the 1,402 Ectropis pupae. Pupal parasitism is unknown as these parasites overwinter in the pupae and emerge in the spring.

Large numbers of birds were observed feeding on larvae during the infestation and some predator appeared to be searching for pupae in the duff, scratching holes around the base of trees and rocks etc. but it is not known what effect this predation will have on the over-all population.

The first indication of a virus disease was observed on August 1 when dead larvae were seen at Sand Hill. The number of dead larvae present in the field increased daily, and by August 3 large numbers of larvae apparently killed by virus were present at Moore Creek, Sand Hill, and Kitimat Station (Fig. 1). Dead larvae were forwarded to the Victoria Laboratory where the presence of a polyhedral virus was confirmed by Dr. O. N. Morris.

Pupae collected at Moore Creek in September were also examined by Dr. Morris who found 15 out of 52 examined infected with polyhedral virus. Except for one pupa the infections were light.

The sharp delineation of the infestation and the coinciding boundaries of the smelter fume cloud, lead to the belief that a favourable micro-climate is created by the fumes 3/. Thus, the conclusion is drawn that if the large moth flight remained in this area and laid their eggs there in 1960, there is more reason to believe that this will happen again in 1961 than there is reason to suspect that the outbreak will spread into the Kitimat River Valley.

Table 6

Ocular Estimate of Defoliation Caused by Saddle-backed Looper

in Fume Plot 1, Approximately One Mile North of Kitimat Station.

Kitimat, B. C. West Prince Rupert District. September, 1960.

Tree species	Crown class	No. trees	Av. D.B.H.	Average defoliation by crown levels (%) Top 1/3	mid 1/3	lower 1/3	Total	No. trees 100% defoliated	No. trees 70-99% defoliated
Hemlock	Dom.	3	32.5	0	3	12	5	0	0
	CoD.	4	17.8	1	9	16	10	0	0
	Int.	14	9.4	4	7	10	7	0	0
	Sup.	16	4.8	5	6	8	6	0	0
Balsam 1/	Dom.	7		0	4	6	5	0	0
	CoD.	4		0	3	4	3	0	0
	Int.	4		0	0	6	2	0	0
Cedar	CoD.	1	35.5	0	0	0	0	0	0
	Int.	1	14.6	0	0	0	0	0	0

1/ Balsam defoliation attributed to spruce budworm.

3/ G. T. Silver, The Saddle-backed looper, Ectropis crepuscularia Schiff., infestations at Kitimat B. C. 1960. (Unpublished report, Victoria, B. C.)

Table 7

Ocular Estimate of Defoliation Caused by Saddle-backed Looper

in Fume Plot 2. Anderson Creek, Kitimat, B. C.

West Prince Rupert District. September, 1960.

Tree species	Crown class	No. trees	Av. D.B.H.	Average defoliation by crown levels (%) Top 1/3	mid 1/3	lower 1/3	Total	No. trees 100% defoliated	No. trees 70-99% defoliated
Hemlock	Dom.	4		38	46	73	51	0	1
	CoD.	3		39	52	77	52	0	1
	Int.	5		81	81	81	81	3	1
	Sup.	4		100	100	100	100	4	0
	Dead	6		Dead July/59					
Balsam	Dom.	1	18.3	50	80	100	80	0	1
	CoD.	7		14	31	47	29	0	0
	Int.	5		81	92	92	91	2	2
	Sup.	11		100	100	100	100	11	0
Cedar	Dom.	1	25.5	0	0	10	3	0	0
	CoD.	3		0	2	13	4	0	0
	Int.	2		8	35	55	0	0	0
	Sup.	1	5.4	30	30	10	0	0	0
	Dead	1	24.4	Dead July/59					

Table 8

Ocular Estimate of Defoliation Caused by Saddle-backed Looper

in Fume Plot 3. Sand Hill, Kitimat, B. C.

West Prince Rupert District, September, 1960.

Tree species	Crown class	No. trees	Av. D.B.H.	Average defoliation by crown levels (%) Top 1/3	mid 1/3	lower 1/3	Total	No. trees 100% defoliated	No. trees 70-99% defoliated
Hemlock	Dom.	12		3	11	37	16	0	0
	CoD.	21		7	27	66	33	0	3
	Int.	42		-	-	-	60	7	14
	Sup.	46		-	-	-	93	30	12
Balsam	Dom.	3		17	45	57	45	0	1
	CoD.	3		77	83	93	83	0	2
	Int.	1		15	15	20	15	0	0
	Sup.	4		-	-	-	81	1	2
Cedar	Int.	1	4.1	100	100	100	100	1	
Lodgepole pine	Dom.	1	14.6	0	0	0	0	-	-

Table 9

Ocular Estimate of Defoliation Caused by Saddle-backed Looper

in Random Plot 1, Sand Hill, Kitimat, B. C.

West Prince Rupert District. September, 1960.

Tree species	Crown class	No. trees	Av. D.B.H.	Average defoliation by crown levels (%) Top 1/3	mid 1/3	lower 1/3	Total	No. trees 100% defoliated	No. trees 70-99% defoliated
Hemlock	S + Int.	11		99	100	100	100	10	1 (98)
	D + CoD.	19		63	86	97	85	2	14
Balsam	Sup.	3		100	100	100	100	3	0

Table 10

Ocular Estimate of Defoliation Caused by Saddle-backed Looper
in Random Plot 2. Sand Hill, Kitimat, B. C.
West Prince Rupert District. September, 1960.

Tree species	Crown class	No. trees	Av. D.B.H.	Average defoliation by crown levels (%) Top 1/3	mid 1/3	lower 1/3	Total	No. trees 100% defoliated	No. trees 70-99% defoliated
Hemlock	D + CoD.	12		26	53	83	54	0	5
	S + Int.	18		97	99	100	98	13	5
Balsam	D + CoD.	3		15	18	30	20	0	0
	S + Int.	14		98	98	100	98	11	3
Cedar	S	1	3	-	-	-	80	0	-
	Dom.	2	20	-	-	-	0	-	-

Table 11

Ocular Estimate of Defoliation Caused by Saddle-backed Looper in Fume Plot 4, 200 Yards West of Goose Creek R. R. Crossing. Kitimat, B. C. West Prince Rupert District. September, 1960.

Tree species	Crown class	No. trees	Av. D.B.H.	Average defoliation by crown levels (%) Top 1/3	mid 1/3	lower 1/3	Total	No. trees 100% defoliated	No. trees 70-99% defoliated
Hemlock	CoD.	4		9	25	43	26	0	0
	Int.	6		11	31	35	32	0	1
Balsam	Dom.	10		5	10	10	10 1/	0	0
	CoD.	8		7	8	13	10	0	0
	Int.	1	17.5	5	5	10	8	0	0

1/ All defoliation on balsam attributed to spruce budworm.

Table 12

Location of Sample Points and Average Number of Saddle-backed Looper Pupae per Square Foot of Duff at Each Locality.

West Prince Rupert District. Kitimat, 1960.

Sample number	Locality	Defoliation in per cent			Average no. pupae per sq. ft.
		overstory	understory	ground cover	
1.	Kitimat Arm Bl. 89	25	40	70	4.3
2.	Moore Creek	70	95	100	12.1
3.	Anderson Creek (Fume Plot)	50	100	100	12.3
4.	Anderson Creek (Spray stations 1 - 10)	50	100	100	4.3
5.	W. of Kitimat River Bl. 6053	70	100	100	16.2
6.	Sand Hill	70	100	100	11.9
7.	W. of Kitimat Station	30	70	100	10.3
8.	Radley Park	0	0	Tr	6.0
9.	Goose Lake - south end	50	-	-	14.5
10.	Claque Mtn. trail, 800'	50	100	100	5.0
11.	Claque Mtn. trail, 1,500'	50	50	100	3.7
12.	Block 6071	25	50	80	0.2
13.	3 mi. N. Kitimat Station and 1,000' west of railway	5	15	20	0.5
14.	3 mi. N. Kitimat Station	5	15	20	0.5
15.	Bl. 6016 Kitimat River	0	0	0	0
16.	Bl. 6046	0	0	10	0.8
17.	Bl. 307	0	0	0	0
18.	Bl. 6013	0	0	0	0
19.	Bl. 6021	0	0	0	0
20.	Bl. 308 Minette Bay	0	0	0	0

Table 12 - continued

Sample number	Locality	Defoliation in per cent overstory	understory	ground cover	Average no. pupae per sq. ft.
21.	S. of Hirsch Creek Bridge Bl. 6154	0		0	0
22.	2 mi. N. Hirsch Creek Bl. 6187	0	0	0	0
23.	Bl. 6103-W. of Kitimat River	5	5	5	0.5
24.	Bl. 6113	10	10	10	0
25.	Claque Mtn. trail 2,100'	0	0	0	0*
26.	Boybyes Lake	10	25	25	6.3
27.	Little Wedeene River, S. E. corner Bl. 6132	0	0	0	0
28.	Wedeene River, L6149	0	0	0	0
29.	Little Wedeen River, TL 12105	5	0	0	0.2
30.	Terrace Hwy. Bl. 6210	0	0	0	0
31.	Wedeene River, TL 12108	0	0	0	0
32.	Wedeene River 2 mi. N. of Raley Creek	0	0	0	0
33.	Wedeene River	0	0	0	0
34.	Terrace Hwy.-4.2 mi. S of Hot Springs	0	0	0	0

* Larvae present and still feeding

Summary

The saddle-backed looper, Ectropis crepuscularia Schiff. increased to severe outbreak proportions at Kitimat in 1960. The outbreak was contained in a well defined area 14,000 acres in extent. Within this area the greater proportion of all deciduous and coniferous understory and ground cover was completely defoliated, and defoliation of the overstory hemlock was severe in several localities. Some tree mortality is expected at Sand Hill and in the Anderson and Moore Creek valleys.

About 1,800 acres were sprayed on August 1 with 1/2 lb. DDT per gallon applied at the rate of one gallon per acre. The deposit recovered was low, indicating that very little spray penetrated the canopy to the understory. From the standpoint of larval mortality the operation was not satisfactory, but observations indicate that a considerable amount of foliage was saved.

Pupal counts made in September, 1960, indicate that a heavy moth flight may develop in 1961. It is probable that the insects may remain in the same localized area defined by the presence of the fume cloud. Barring unforeseen factors another heavy larval population is anticipated. If this should occur chemical control would be necessary to prevent intensive defoliation and tree mortality.

Spruce Budworm, Choristoneura fumiferana (Clem.)

The spruce budworm occurred more frequently within the district this year and a flight over previously unsurveyed areas of Drainage Divisions 102 and 104 revealed that heavy defoliation of Sitka spruce and amabilis fir was present from Kitimat north into the Big and Little Wedeene and neighbouring valleys. In these areas spruce and balsam lost up to 80 per cent of their current year's foliage. Light defoliation was recorded throughout the Kitimat Valley from the Skeena River south to Kitimat.

During the helicopter survey of the saddle-backed looper infestation at Kitimat, foliage samples were taken in a number of locations and examined for budworm eggs. No eggs were found although defoliation was visible from the air and from the ground. These egg sample points are show on Map 6 (Ectropis). Defoliation estimates at these points and at three plots in the infestation area are shown below:

3 Anderson Creek fume plot	- 30 per cent current defoliation
7 West of Kitimat Station	- 80 per cent current defoliation
28 Wedeene River, Blk. 6149	- 20 per cent current defoliation
29 Little Wedeene R.,TL 12105	- 50 per cent current defoliation
32 Wedeene R., 2 mi. north of Raley Creek	- 20 per cent current defoliation
33 Wedeene River	- 80 per cent current defoliation

Nalbeela Creek Plot (D.D.102) - 12 per cent current defoliation

Hermann Lake Plot (D.D. 104) - 50 per cent current defoliation

Dasque Creek Plot (D.D. 104) - 20 per cent current defoliation

Although not certain, this is believed to be the 1-year-cycle spruce budworm. The trend of the spruce budworm population in this district since 1958 is shown in Table 13.

Table 13

Trend of Spruce Budworm Populations in the West Prince Rupert District, 1958 to 1960.

Year	Number of collections containing budworm	Average number of larvae per collection	Range of larvae per collection
1958	2	1.0	1
1959	11	1.8	1 - 5
1960	35	7.2	1 - 149

Western Hemlock Looper, <u>Lambdina fiscellaria lugubrosa</u> (Hulst)

The hemlock looper continued to occur in the West Prince Rupert District in 1960 but populations were very light. No larvae of this insect were collected in the Queen Charlotte Islands.

There have been no instances of damaging hemlock looper populations within this district. Since 1954 the highest average number of larvae per collections has been 7.9 (Table 14). This is considered a very light population.

Antique Tussock Moth, <u>Orgyia antiqua badia</u> (Hy. Ed.)

In 1960 the antique tussock moth occurred in eight collections which averaged 5.0 larvae each. This compares with averages of 3.9 in eight in 1959, 1.2 in ten in 1958, 1.0 in five in 1957, and none collected in 1956.

This insect was observed at Kitimat this year, late in the saddle-backed looper infestation, but the larvae were faring poorly as the loopers had cleaned off all the deciduous cover which normally hosts the tussock moth in this area and the understory conifers were also devoid of foliage.

Table 14

Population Fluctuation of the Hemlock Looper in the

West Prince Rupert District, 1954 to 1960.

Year	Number of collections containing larvae	Average number of larvae per collection
1954	84	7.9
1955	65	4.9
1956	6	1.0
1957	2	1.0
1958	7	1.7
1959	9	1.2
1960	6	1.1

Yellow-lined Forest Looper, Nyctobia limitaria Wlk.

As shown in Table 15, the collections containing this insect remained fairly constant this year. Thirty-six collections on hemlock, Sitka spruce, and amabilis fir averaged 3.6 larvae each. The first occurrence was on July 5 and the last larvae were taken on August 8. Collections were widely scattered throughout the district.

Table 15

Yellow-lined Forest Looper Collections in the

West Prince Rupert District, 1958 to 1960.

Year	Number of collections containing yellow-lined forest loopers	Average number of larvae per collection
1958	NA*	1.8
1959	22	3.0
1960	36	3.6

* not available

Green-striped Forest Looper, Melanolophia imitata Wlk.

The green-striped forest looper population within the West Prince Rupert District remained at approximately the same level as in 1959 (Table 16). Collections were widely distributed throughout the district and there were no areas of high populations.

Table 16

Population Variation of Melanolophia imitata Wlk. in the West Prince Rupert District, 1956 to 1960.

Year	Number of collections containing green-striped forest loopers	Average number of larvae per collection
1956	7	1.1
1957	3	1.0
1958	7	2.0
1959	33	2.8
1960	28	3.0

Spruce Gall Aphid, Adelges cooleyii Gill.

Spruce gall aphids were collected at several points and from several hosts in the West Prince Rupert Ranger District during 1960. Locations of these collections are shown in Table 17. The occurrence of this insect in this area is of some interest because of the limited distribution of the alternate host tree, Douglas fir. The only known occurrence of Douglas fir on the Queen Charlotte Islands is a small group of four trees remaining from a 1929 planting on Maude Island, Skidegate Inlet. Two attempts were made this year to locate these remaining trees but were unsuccessful. There was no sign of Adelges attack on the nearby spruce.

At Marie Lake on Graham Island (Branch 30, Juskatla), spruce seedlings only two or three inches high were heavily attacked.

On the mainland, the closest known stands of Douglas fir occurring near the West Prince Rupert District are at Chief Menzies Bay (southwest of Kemano) and at the southeast end of Babine Lake. In addition to this there are several trees under 50 years of age planted in Terrace and a number of recent plantations in the Kitsumgallum Lake area.

There were no occurrences of this insect noted on the immediate mainland coast this year.

Table 17

Spruce Gall Aphid Collection Points and Intensity of Infestation,

West Prince Rupert District, 1960.

Collection No.	Location	Drainage	Host	Infestation* incidence	Infestation* intensity
W.P.R. 2	Terrace	104	Fd	2 trees	Heavy
W.P.R. 3	Terrace	104	S	Light	Light
W.P.R. 13	Talus Creek, Hwy. 16	104	S	Light	Light
W.P.R. 67	Andimaul Mountain Lookout	105	S	Light	Light
W.P.R. 78	Cedar River	104	S	Light	Light
W.P.R. 85	Lava Flow, Nass River	106	S	Light	Heavy
W.P.R. 103	Cedarvale Ferry	105	S	Light	Light
W.P.R. 206	"Sand Hill", Kitimat	102	S	Light	Light
	<u>Queen Charlotte Islands</u>				
W.P.R. 168	Juskatla	101	S	Light	Medium
W.P.R. 170	Juskatla	101	S	Light	Light
W.P.R. 171	Marie Lake	101	S	Medium	Medium
W.P.R. 201	Skidegate Lake, P.L. 116	100	S	Light	Light

* Light 1 - 25% of trees (incidence) or twigs (intensity) infested.

Medium 25 - 75%, Heavy 75 - 100%.

All percentages estimated.

The insect stages present in the various collections was also of interest. Collection W.P.R. 2, from Douglas fir, contained only "cotton tuft" nymphs while the collections from Sitka spruce had both the "gall" and "tuft" stages of the insect present on the same twig. Usually the "tuft" was found immediately beside the gall on the tree side of the twig.

Sitka Spruce Weevil, Pissodes sitchensis Hopk.

The Sitka spruce weevil was recorded throughout the mainland portion of the district this year. Top, or leader-killed trees were noted at Ginlulack Creek (Nass River), Dragon Lake, Kalum Lake, Kitimat River, Exstew River, Terrace, Cedarvale, Skeena Crossing, Kitwanga, and points between. The heaviest attacks were on the margins of old fields near Remo. An outstanding record was established near the Kitimat River where the leader of an 80 year old, 100 foot tree was attacked and killed. It had previously been attacked at 60 feet but had re-established its leader, leaving the characteristic crook in the stem. This high attack is very uncommon for the Sitka spruce weevil but is not uncommon in this specific area.

Aspen Leaf-miner, Phyllocnistis populiella Chamb.

The aspen leaf-miner infestation continued in 1960. Infested areas were more scattered than in previous years but the incidence and intensity of infestation remained high in those areas affected (Table 18). In most areas the trees were also stripped of their foliage by the forest tent caterpillar.

Table 18

Percentage of Leaves Mined by the Aspen Leaf-miner,

West Prince Rupert District, 1958 - 1960.

Location	Drainage division	Percentage of leaves infested		
		1958	1959	1960
Kitwanga	105	88	86	87
Skeena Crossing	105	87	80	85
Lakelse Road	104	64	40	0
Kitwanga Lake	105	94	40	96
Flint Creek	105	84	98	60
Cedarvale - Woodcock Road	105	-	-	77

Green Spruce Looper, *Semiothisa granitata* (Guen.)

The green spruce looper decreased in numbers and occurrence in the district during 1960. Twelve collections averaged 3.2 larvae each compared to a 1959 average of 11.1 larvae in 27 collections. However, there were not as many collections made in 1960 during the larval period of this insect. In 1958 twenty-seven samples averaged 3.3 larvae, and in 1957 three collections contained four larvae.

Grey Forest Looper, *Caripeta divisata* Wlk.

Fifteen 3-tree beating samples contained an average of 7.5 larvae each in 1960. In common with the other "fall" insects, these numbers were affected in 1960 by the fewer collections made during the larval period. In 1959 twenty-four collections averaged 12.2 larvae, and in 1958 thirty collections averaged 5.6 larvae.

On June 23, a moth flight was observed in the vicinity of Dragon Lake (D. D. 106). Moths were observed in day flight from the Tseax River (Lava beds) east to the end of the road at Dragon Lake. There were no large larval collections in this area later in the season and there were no signs of defoliation.

Western Tent Caterpillar, *Malacosoma pluviale* (Dyar)

The western tent caterpillar infestation at Terrace (D. D. 104) collapsed in 1960. Tents were very few and far between. The number of tents on one side of the road in three areas of observation is shown in Table 19.

Table 19

Number of Western Tent Caterpillar Tents per Mile on one Side of Road.

West Prince Rupert District, 1958 - 1960.

Area	Hosts in all areas	Number of tents		
		1958	1959	1960
West Kalum Road	Red alder, birch,	65	6	0
Remo Road	cottonwood, willow,	527	500	0
Lakelse Lake Road	and shrubs.	1,209	2,300	10

Spruce Sawflies, Pikonema spp.

The spruce sawflies, *Pikonema alaskensis* Roh., and *Pikonema dimmockii* Dresson, were again common throughout the district in 1960. Forty-one collections averaged 6.0 larvae each. The average number of larvae per collection from 1959 to 1956 was 5.0, 2.0, 1.0, and 1.0 respectively.

Forest Tent Caterpillar, *Malacosoma disstria* Hbn.

As predicted in 1959, the forest tent caterpillar populations in D. D. 105 showed a marked increase in 1960. Heavy feeding was again confined to that part of the district east of Woodcock but defoliation was more extensive than in previous years.

Large numbers of eggs were present on the aspen within this area in the spring (Figure 2) and counts made at the same localities in the fall indicate that heavy defoliation can be expected in 1961 (Table 20). No tree mortality was observed.

Table 20

Forest Tent Caterpillar Egg Mass Counts, West Prince Rupert District,

Spring and Fall, 1960.

Location	Number of trees examined	Number of egg masses on three trees	
		June	September
Juniper Creek	3	132	353
Kitwanga - Kispiox Road	3	330	300
Kitwanga Lake Road	3	441	135

Spruce Terminal Damage, Queen Charlotte Islands

In 1960 it was observed that on the Queen Charlotte Islands terminal damage to Sitka spruce reproduction was relatively heavy. Observations indicated that the damage was widespread and present throughout much of Moresby and Graham islands, but was most prevalent in the Skidegate Inlet - Cumshewa Inlet area, and the south-east portion of Graham Island. Examinations in the field failed to reveal any agency or agencies consistently associated with the damage, but a record was made of the symptoms. Although some terminals were killed by insects, the greater amount of damage was due to the failure of the terminal buds to flush and develop, resulting in multiple leaders, forked stems, and deformed trees.

The occurrence of leader damage was tallied in four areas in August. All spruce trees three feet and over on random strips were classified by height classes of 3 - 6, 7 - 10, and 11+ feet. Trees were tallied as healthy or damaged, and leader damage was dated by counting the branch whorls. When the results of these tallies pointed out the potential importance of the situation four permanent plots were established. Damage was dated back to 1957, but earlier damage was recorded. The incidence of lateral damage was recorded on these plots.

The terminal damage in 1960 was of three types:

1. Tip of leader turned red and bent over, resulting in multiple leaders.

2. Terminal sweeping or bent over almost at right angles. It is uncertain if this type of apparent injury is permanent.

3. Terminal bud killed before leader growth starts, resulting in multiple leaders.

In type 1 damage there was usually defoliation present, but this alone was not considered heavy enough to kill the tips. No insect specimens were found so the cause of death is undetermined. This type was not common.

No insects were found associated with the sweeping or bent terminals (type 2). There some defoliation on these terminals, but this did not appear to be the cause of the deformity.

The greatest proportion of damage (type 3) resulted from the death of the terminal bud, apparently before growth started in the spring. A considerable number of buds were examined and dissected, but death could not be attributed to any one factor. Some buds were mined, apparently by a lepidopterous larva. The center of the bud was destroyed and contained frass. A dead larva was found in one bud but identification was impossible. Another bud contained a small mine which penetrated from the tip to the center. The mine or gallery was very small and could have been caused by a small beetle. Some buds had no evidence of insect damage, but a large proportion of the apparently unharmed buds contained mycelial strands in a cavity in the center of the bud. These were cultured and the fungus identified as _Cephalosporium_ sp. which belongs to Fungi imperfecti, Class Moniliales. It is not known if this fungus is capable of killing buds, or developed after the buds were dead.

Terminal buds were collected in October and examined in the hope of finding insects or disease in the overwintering stages. No insects were found in about 40 terminals examined from October to December. A fungus was found in some buds, but it is not believed to be _Cephalosporium_ sp. As these terminals were collected in October at random the results of the examinations are in no way an indication of terminal damage which may occur in 1961.

During the examination of spruce trees it was observed that a large number of lateral branches were attacked and killed. This damage was definitely associated with insects, although no specimens were obtained. Many of the branch tips examined were killed by mining insects. In one typical branch a gallery started about 1/4 inch below the base of the bud, spiralled counter clockwise for half the circumference of the twig for

3/8 inch, and then entered deeper into the branch tip between the bark surface and the pith. The tip was killed. Some lateral tips were apparently killed by heavy defoliation, but no insect has been definitely associated with the damage.

Extent and Intensity of Damage

The results of the four random tallies are shown in Table 21. The number of trees affected in the four areas averaged 44.1 per cent. The lowest incidence of damage, 16.7 per cent, was at Skidegate Lake, and the heaviest was at Sandspit where over 70 per cent of the trees were damaged.

The number of trees damaged by years indicates a gradual but continuous increase since 1953. In that year one damaged leader was recorded, one in 1954, and the number increased from eight in 1955 to 199 in 1960. The damage was heaviest in the last three years.

There was not a great deal of variation in 1960 damage associated with height. Twenty-three per cent of the 366 trees under six feet tall were damaged, 31 per cent of the 208 trees from seven to 10 feet tall, and 17 per cent of the 294 trees over 11 feet tall. The maximum height of current damage was less than 30 feet.

An average of 67 per cent of the trees in the four permanent plots were damaged (Table 22). The trend of annual damage so obvious in the tallies was not as clearly defined in the plots. The incidence of damage increased slowly from 44 in 1957 to 78 in 1959, but decreased to only 29 in 1960.

The sums of both tallies and plots are shown below:

	Year of damage					Total
	1960	1959	1958	1957	Earlier	no. trees
Plots	29	78	56	44	51	224
Tallies	199	165	77	18	22	868
Total	228	243	133	62	73	1,092

The incidence of damage in the permanent plots appeared to level off and even drop off a little in 1960. It remains to be seen if the trend will continue in 1961.

The number of trees suffering lateral damage in 1960 was very high (Table 22). These attacks, while killing the branch tips, should not effect tree form or growth to any extent unless they become much heavier.

Table 21

Summary of Sitka Spruce Terminal Damage. Random Tallies, Moresby Island, August, 1960.

Height Class	Tally no. 1/	Healthy trees	Year of damage							Total no. trees damaged	Total no. terminals damaged
			1960	1959	1958	1957	1956	1955	1954		
3-6 feet	1	54	12	6	11	0	0	0	0	29	29
	2	47	38	36	8	0	0	0	0	75	82
	3	42	1	0	1	0	1	0	0	2	3
	4	66	34	28	7	1	0	0	0	51	70
	Total	209	85	70	27	1	1	0	0	157	184
7-10 feet	1	11	8	4	5	2	0	0	0	19	19
	2	13	30	30	12	3	3	1	1	52	80
	3	34	2	2	1	0	0	1	0	6	6
	4	37	24	12	7	1	0	1	0	36	45
	Total	95	64	48	25	6	3	3	1	113	150
11-25 feet	1	13	8	3	3	3	2	0	0	13	19
	2	6	18	17	7	3	3	1	0	30	49
	3	128	14	11	6	1	1	4	0	33	37
	4	34	10	16	9	4	2	0	0	36	41
	Total	181	50	47	25	11	8	5	0	113 2/	147
All trees	1	78	28	13	19	5	2	0	0	61	67
	2	66	86	83	27	6	6	2	1	157	211
	3	204	17	13	8	1	2	5	0	41	46
	4	137	68	56	23	6	2	1	0	123	156
	Total	485	199	165	77	18	12	8	1	383 2/	481

1/ Location of tally strips: 1. Alliford Bay - Sandspit Road PL 135 2. Sandspit L307. 3. North side of Skidegate Lake at bridge. 4. Copper Bay Road.

2/ Total includes 1 tree attacked 1953.

Table 22

Summary of Sitka Spruce Terminal Damage. Queen Charlotte Islands, 1960.

		Plot 1	Plot 2	Plot 3	Plot 4	Total
No. trees with terminal damage	1960	5	18	5	1	29
	1959	19	35	7	17	78
	1958	18	18	7	13	56
	1957	19	14	8	3	44
	Earlier	15	13	20	3	51
No. trees undamaged		16	23	12	22	73
No. trees with lateral damage	1960	53	24	72	39	188
	Earlier	53	17	72	37	179
Total no. trees		58	49	77	40	224
Height of trees	Av.	10	6	8	9	
	Range	3-25	3-9	3-15	4-24	

Location of plots:

1. Near East Narrows on Moresby Island
2. Sandspit - 1.5 miles from Northern Pulpwood Store on road behind store.
3. Skidegate Lake - 1.6 miles from Skidegate Lake bridge on road towards Copper Bay.
4. North side of Maude Island.

MISCELLANEOUS INSECTS COLLECTED

West Prince Rupert District

Name	Host	No. of collections	Remarks
Acantholyda sp.	S, Sw, Ba, H, B	16	Web-spinning sawflies. No economic importance.
Anomogina mostelina Sm.	Sw, Ba, H	3	Cutworm, defoliator.
Anthelia hyperborea Hulst	H, S	6	A defoliating looper of no importance.
Biston cognataria Gn.	H, W	2	Defoliating looper. A few present at Kitimat defoliating willow.
Campea perlata Gn.	A, B	3	All collections in D. D. 105.
Deuteronomos magnarius Gn.	D	1	Looper.
Enypia venata Grt.	B, Ba, H, S	15	Loopers. Found often in ones and twos.
Enypia packardata Tayl.	H, Sw, S	10	Loopers. Found often in ones and twos.
Epirrita autumnata (Gn.)	H, S. Ba, Sw	32	Looper, of no economic importance.
Epirrita pulchraria Tayl.	H, Sw, Ba	4	Looper, of no economic importance.
Eucordylea atrupictella Dietz.	H	1	Budworm.
Eupithecia spp.	H, Sw, Ba, S	36	Common looper. Scattered occurrence, no large numbers found.
Feralia comstockii Grt.	H, S	3	Cutworm. Of common occurrence. No importance.
Gabriola dyari Tayl.	H, Sw, S	18	Looper.
Halisidota m. angulifera Wlk.	W, D	4	Defoliating caterpillar. Has fed heavily on the deciduous cover near Kitimat in past years but was down in numbers in 1960.

MISCELLANEOUS INSECTS - continued

Name	Hosts	Number of collections	Remarks
Hemaris t. cimbiciformis Steph.	H	1	Hawkmoth, defoliator.
Hemichroa crocea (Fourc.)	D, W	5	Sawfly, defoliator. Presently infesting small patches of alder on Moresby Island.
Hydriomena irata Swett.	H, S, B	8	Looper.
Hydriomena manzanita Tayl.	H, S	2	Looper.
Lithocolletis populiella Cham.	A	1	Leaf blotch miner.
Neodiprion spp.	H, B, Ba, S, Sw	72	Sawflies, defoliators. Often found in large numbers most years but no serious defoliation attributed to them. Fewer found in 1960.
Neoalcis californiaria Pack	H, S	1	Looper.
Neomyzaphis abietina Wlk.	S	2	Spruce aphid. Infests spruce on Charlottes. Occasional trees weakened.
Panthea portlandia Grt.	H	2	Defoliating caterpillar.
Parorgyia styx B. & McD.	Ba	1	Defoliating caterpillar.
Phenocaspis pinifoliae (Fitch)	Pl	3	Scale insect. Common in D. D. 104 and 105.
Promylea lunigerella Rog.	Sw	1	Budworm.
Protoboarmia p. indicataria Wlk.	B	1	Looper.
Smerinthus cerisyi Kby.	W	2	Hawkmoth.
Stenoporpia albescens Hulst.	H	1	Looper.
Synaxis pallulata Hulst	H, Ba	3	Looper.

MISCELLANEOUS INSECTS - continued

Name	Hosts	Number of collections	Remarks
Syngrapha a. interalia Ottl.	H, S, B	14	Cutworm, defoliator. Consistent occurrence of this genus in early collections.
Syngrapha r. nargentia Ottl.	H, S. Ba, Cot	6	Cutworm, defoliator. Consistent occurrence of this genus in early collections.
Syngrapha selecta Wlk.	H, S	3	Cutworm, defoliator. Consistent occurrence of this genus in early collections.
Venusia pearsalli Dyar	A	1	Looper.
Zeiraphera diniana Gn.	H, S	12	Budworm.

STATUS OF FOREST DISEASES

Forest disease conditions in the West Prince Rupert District showed little significant change in 1960. There were no new records or reports of economically important disease problems. Several conditions of interest and potential importance are mentioned in the following text.

Important Diseases

Effects of Fluorine Fumes on Forest Trees - Kitimat

For the last few years a study has been underway to determine the effects of industrial fume emissions from the Kitimat smelter on the surrounding forest. Plots were laid out in the immediate vicinity of the smelter and at varying distances up the Kitimat River valley as far north as the boundary of Drainage Division 102. Annual examinations of plots were made and records taken of the visible decline of the trees and other plant life.

Observational records definitely indicate that trees and plants in the vicinity of the smelter were adversely affected. The first symptom of decline was the absence of undergrowth in the area. Tree mortality gradually increased, not in any clearly definable amount but obviously more than in adjacent stands which were not in the lee of the smelter. This deterioration becomes less pronounced as the distance from the smelter increases and ceases to be discernible, at this time, from Blk. 6052 north. There is no sign of similar stand deterioration to the east of the Kitimat River mouth.

During the 1960 summer season a very heavy infestation of the saddle-backed looper, Ectropis crepuscularia Schiff., severely defoliated hemlock and balsam trees and other plants within the area covered by the smoke from the smelter. A complete report on this infestation is found under the heading Ectropis in the Status of Insects section. This heavy defoliation is certain to hasten stand deterioration in the area affected. The plots established within this infestation have been most useful for assessment of insect damage and unless very heavy damage results from the insect feeding they will continue to be useful in their original role.

Nectria sp., Infection of Red Alder

A condition has been noted in small patches of alder along the Skeena River west of Terrace in which the trees are totally or partially killed. The areas are small, possibly an acre or less in each case. The primary damage seems to be caused by a cambium-feeding insect. Nectria and possibly some other fungi invade the wounds caused by the insect. The resulting lesions frequently lead to the death of the tree. Work is underway to clarify this situation.

Exotic Plantations.

Exotic plantations have recently been established in the district and systematic observations were started this year on those registered with the laboratory.

The principal problem observed was the infection of Populus spp. by Cytospora sp., a canker forming fungus. This fungus is not considered to be a primary parasite but is capable of infecting weakened trees. As such it serves as an indicator of other adverse factors affecting the host.

In one area, at the mouth of the Exstew River, where a high percentage of the planted stems exhibited signs of Cytospora sp., the trees were subject to severe and prolonged flooding. There was also a marked infection by the root rot fungus Armillaria mellea (Vahl ex Fr.) Quél.

At Terrace, another area which was heavily infected by Cytospora, the affected native cottonwood had been weakened in 1959 by a very severe infection of leaf rust, Melampsora occidentalis Jacks. Without similar predisposition to attack, it is felt that Cytospora is not a serious disease agent.

A new British Columbia record for the occurrence of Cytospora sp. on Populus X canadensis 'Robusta Issendorf' was established at the Exstew River.

A summary of disease conditions in exotic plantations appears in Table 23.

Table 23

Exotic Plantation Examination, West Prince Rupert District - 1960

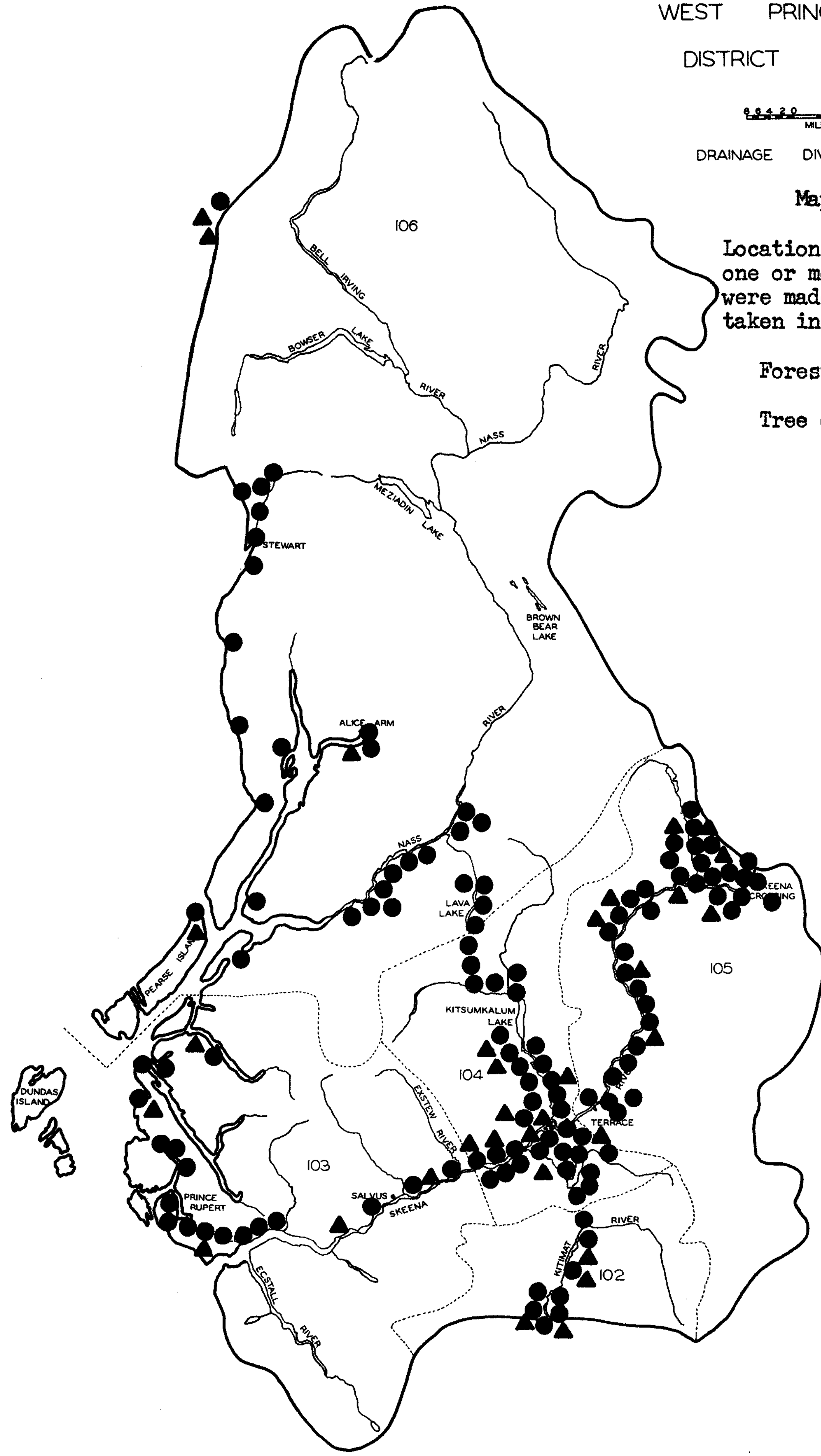
Plantation No.	Location	Species composition	Remarks
XP - 73	Maude Island (D. D. 100)	Douglas fir	3 trees, no survivors found
XP - 125	Erlandsen Creek (D.D. 104)	Douglas fir (coast)	Poor survival. Leader bending. Possibly snow damage.
XP - 126	Nelson River (D.D. 104)	Douglas fir (coast)	Fair survival.
XP - 127	Erlandsen Creek (D.D. 104)	Douglas fir (interior)	Survival good, but many bent and multiple leaders.
XP - 129	Erlandsen Creek (D.D. 104)	European larch	Heavy tip and leader withering. Possibly frost.
XP - 133	Exstew River (D.D. 103)	Hybrid poplars	Many diebacks in this plantation. Also root rot.
XP - 148	Nelson River (D. D. 104)	Ponderosa pine	Poor survival.

OTHER NOTEWORTHY DISEASES

Host	Organism	Locality	Remarks
Alder, red	*Didymosphaeria oregonensis* Goodding	Alger Creek, D.D. 307	Stem canker.
Aspen, trembling	*Pollaccia radiosa* (Lib.) Bald. & Cif.	Cedarvale, D. D. 105	Velvety red-green leaf fungus. Often causes heavy defoliation of aspen .
Cottonwood, black	*Taphrina populi-salicis* Mix	Jedway, D. D. 100	Yellow leaf blister. Similar to peach-leaf curl.
Fir, amabilis	*Peridermium holwayi* Syd.	Bobquinn Lake, D. D. 307	Needle rust.
Hemlock, western	*Dimerosporium tsugae* Dearn.	Ningunsaw River, D. D. 307	Needle cast.
	Echinodontium tinctorum Ellis & Everh.	Kitwanga, D. D. 105	Decay fungus. Causes heavy losses in this district.
Pine, lodgepole	*Peridermium harknessii* J. P. Moore	Port Simpson, D. D. 103	Stem rust, causes cankers.
Spruce, Sitka	*Retinocyclus abietus* (Crouan) Groves & Wells	Kitimat River D. D. 102	Black branch cankers.
Willow	*Melampsora epitea* Thuem.	Kitwanga, D. D. 105	Yellow leaf rust. Principal coniferous host in this region is alpine fir.

WEST PRINCE RUPERT

DISTRICT (MAINLAND)

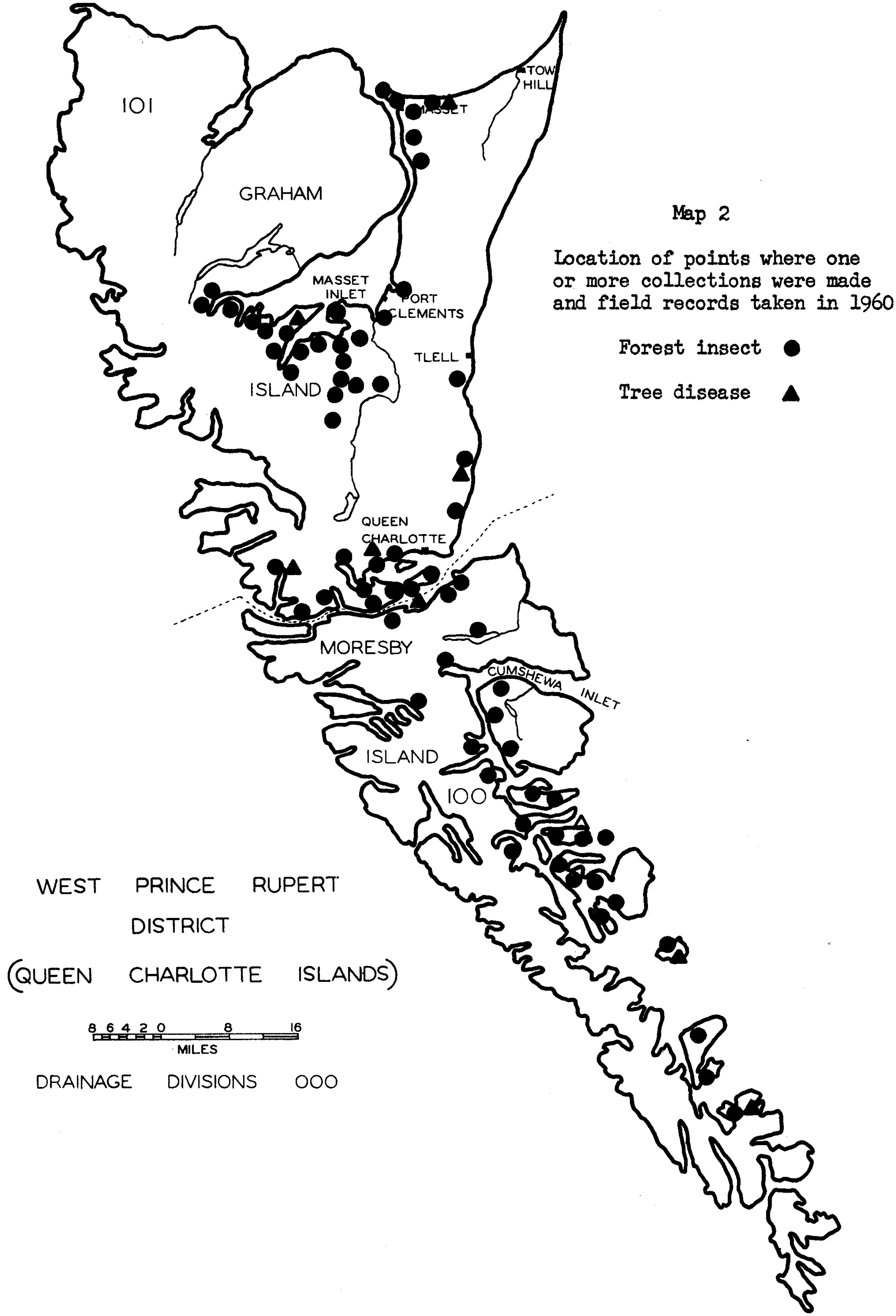


Map 1

Location of points where one or more collections were made and field records taken in 1960.

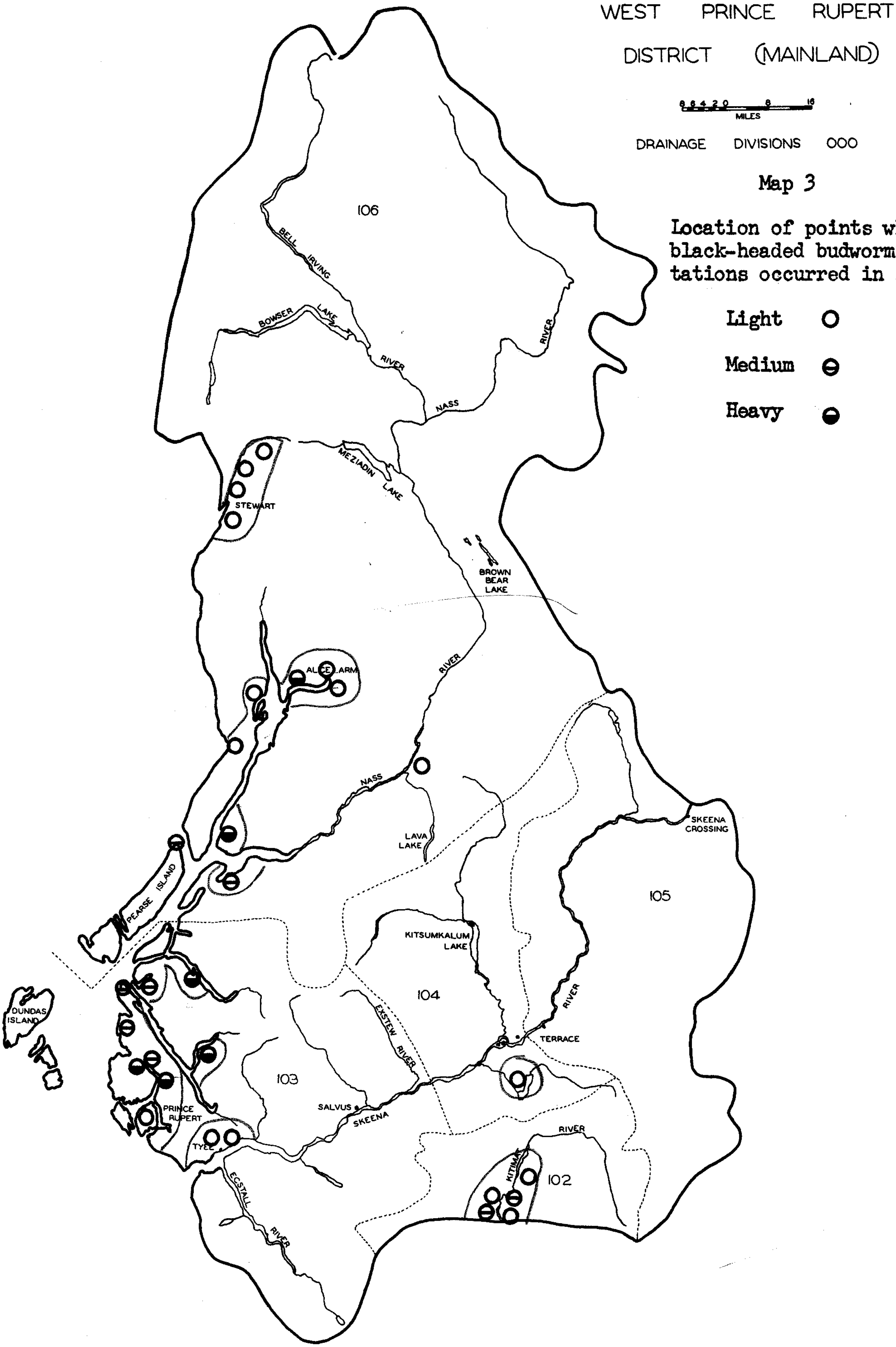
Forest insect ●

Tree disease ▲



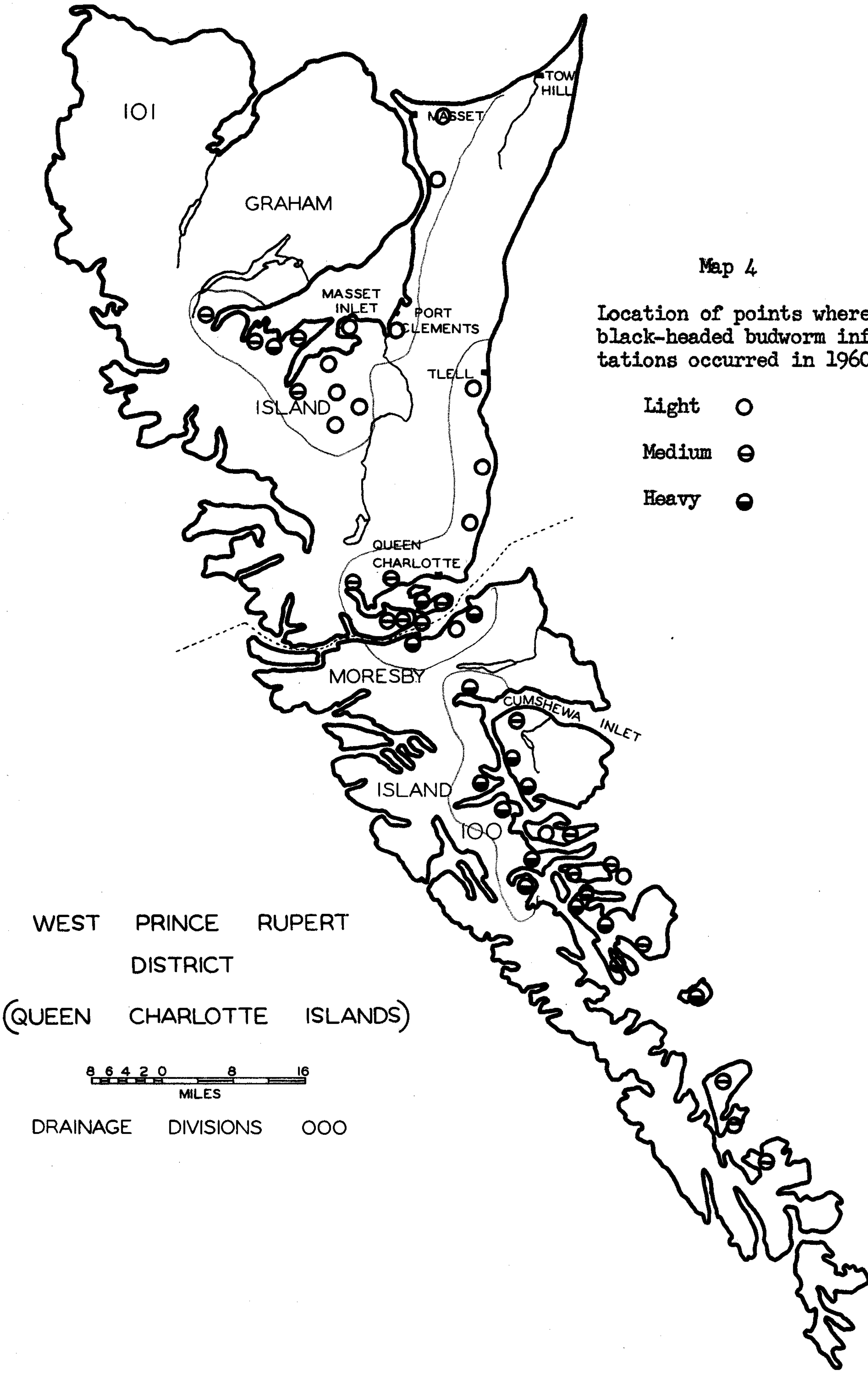
Map 2

Location of points where one or more collections were made and field records taken in 1960



Map 3

Location of points where black-headed budworm infestations occurred in 1960.



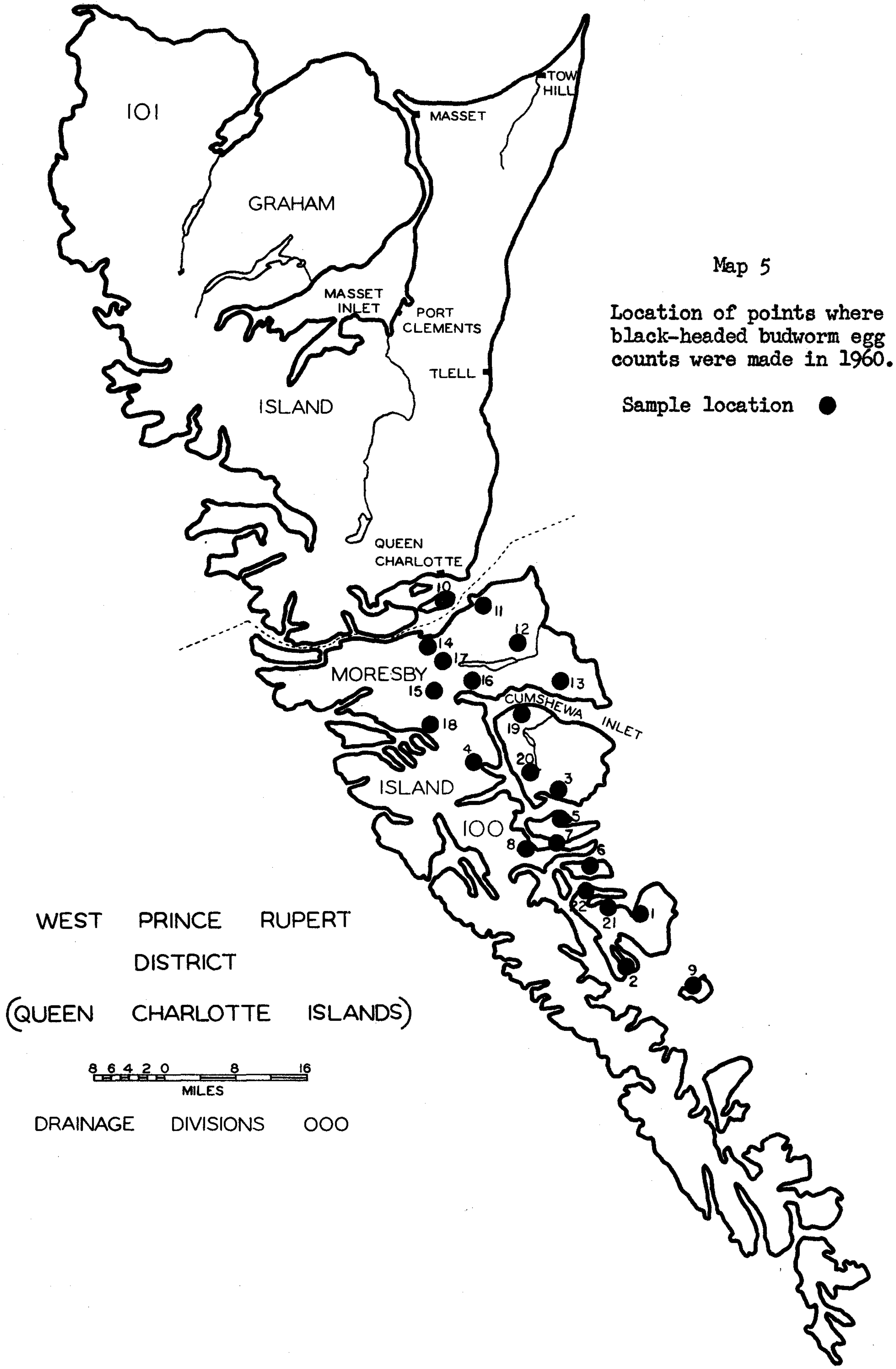
Map 4

Location of points where black-headed budworm infestations occurred in 1960.

Light O

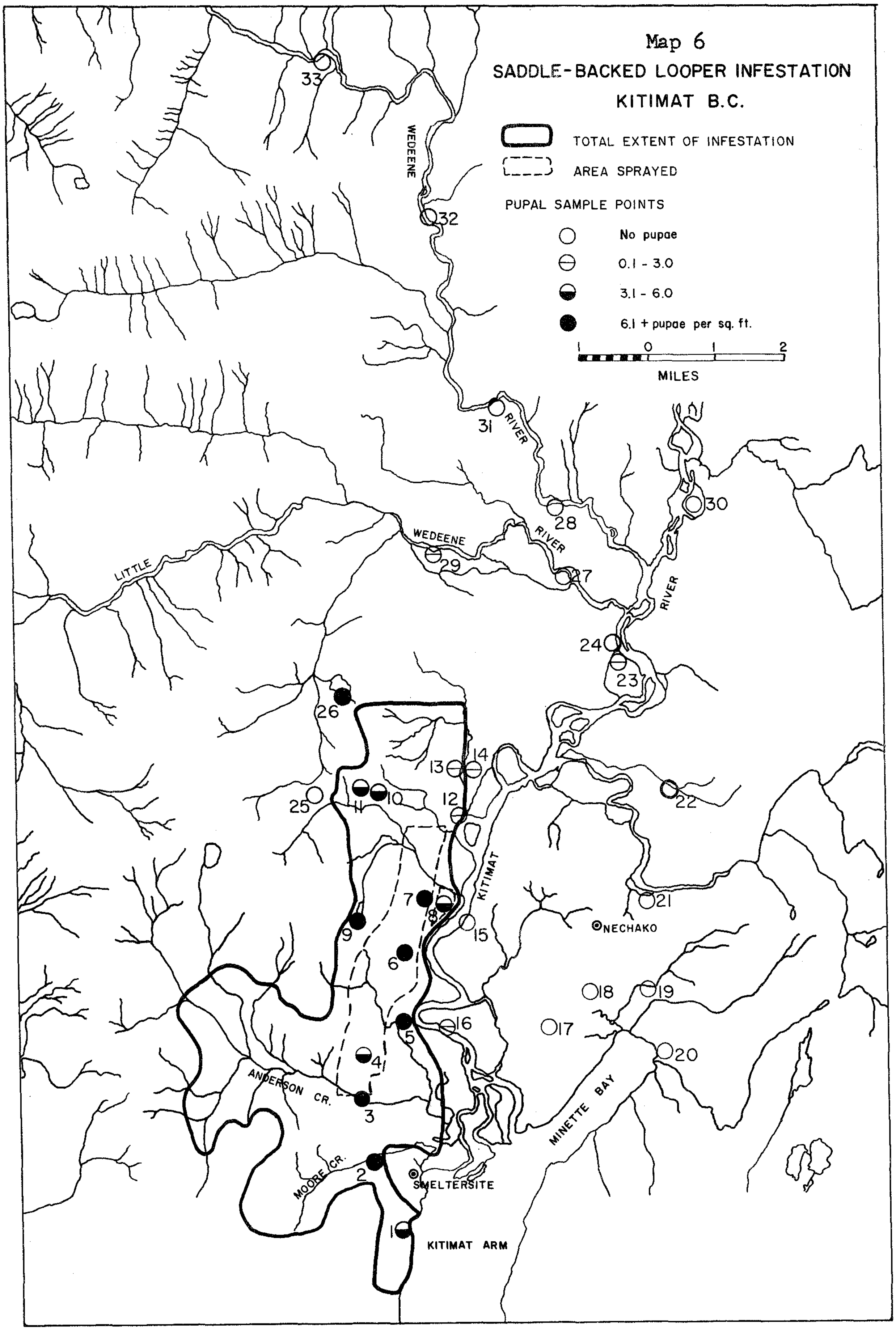
Medium ⊖

Heavy ◒



Map 5

Location of points where black-headed budworm egg counts were made in 1960.



Map 6
SADDLE-BACKED LOOPER INFESTATION
KITIMAT B.C.
TOTAL EXTENT OF INFESTATION
AREA SPRAYED
PUPAL SAMPLE POINTS
No pupae
0.1 - 3.0
3.1 - 6.0
6.1 + pupae per sq. ft.
1 0 1 2
MILES
WEDEENE
RIVER
LITTLE
WEDEENE
RIVER
RIVER
KITIMAT
NECHAKO
ANDERSON CR.
MOORE CR.
SMELTERSITE
KITIMAT ARM
MINETTE BAY
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
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18
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22
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28
29
30
31
32
33

WEST PRINCE RUPERT DISTRICT (MAINLAND)

8 6 4 2 0 8 16
MILES

DRAINAGE DIVISIONS 000

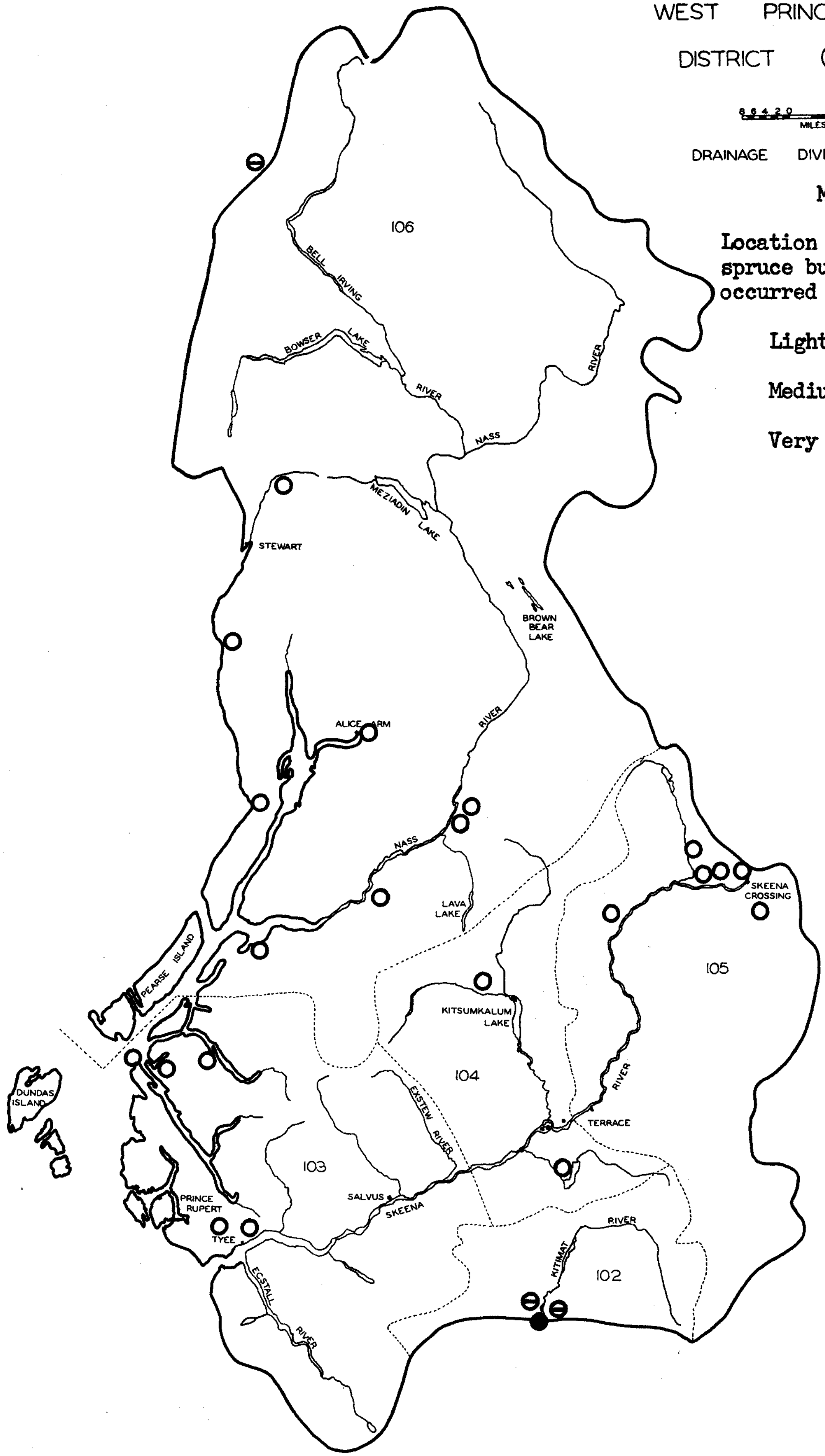
Map 7

Location of points where spruce budworm infestations occurred in 1960.

Light ○

Medium ⊖

Very heavy ●



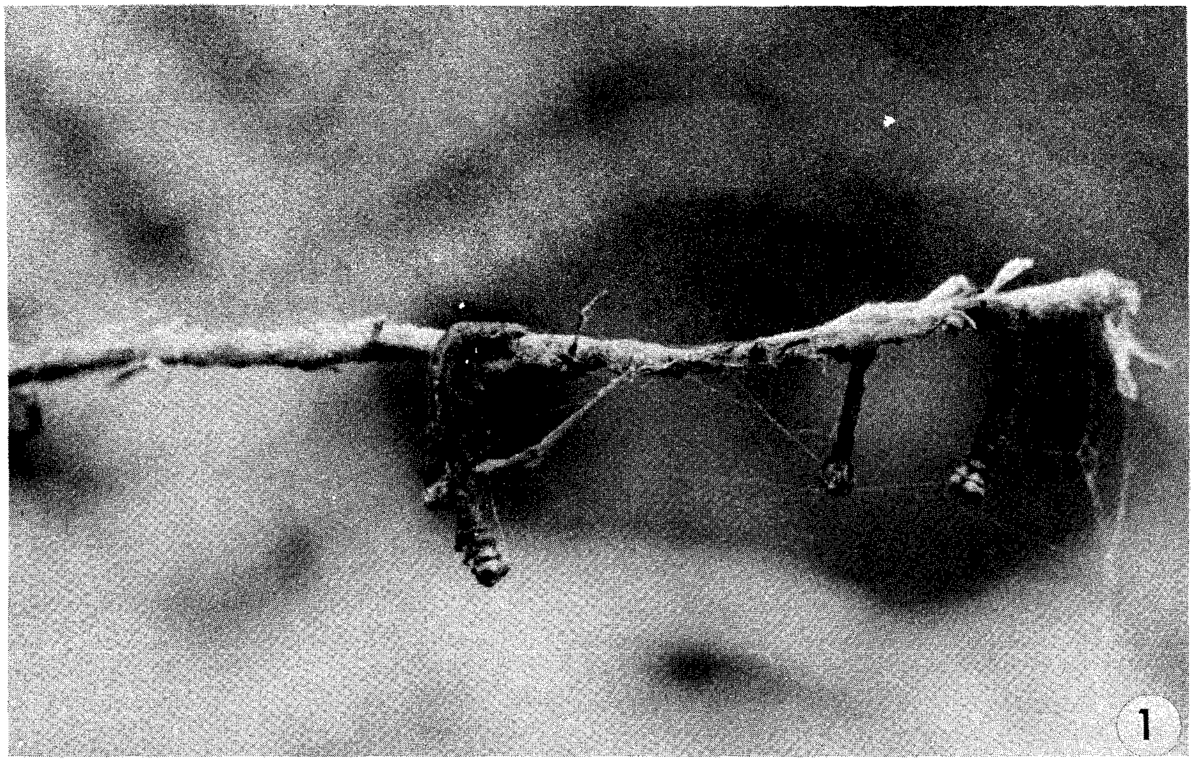


Figure 1. Larvae of the saddle-backed looper, killed by a polyhedral virus disease. Kitimat B.C., West Prince Rupert District. August 1960 N.E. Alexander

Figure 2. Forest tent caterpillar egg masses on trembling aspen. Kitwanga B.C., West Prince Rupert District, June 1960 N.E. Alexander

ANNUAL REPORT OF FOREST BIOLOGY RANGER

for

EAST PRINCE RUPERT DISTRICT

60
19~~59~~

FOREST BIOLOGY SURVEY

EAST PRINCE RUPERT DISTRICT

1960

E. G. Harvey

INTRODUCTION

Field work in the East Prince Rupert District started near the end of May in 1960. The fine weather in April turned wet and cold in May, delaying insect activity. The field season closed with the coming of cold weather at the end of September. A total of 169 forest insect and 61 forest disease collections was made. These are shown, by hosts, in Table 1. The locations of sample points are shown in Map 1.

Table 1

Collections by Hosts

East Prince Rupert District - 1960

Coniferous hosts	Forest insects	Forest diseases	Broad-leaved hosts	Forest insects	Forest diseases
Douglas fir	2		Alder, red	1	
Fir, alpine	40*	17	Alder, Sitka	3	1
Fir, amabilis	1	2	Aspen, trembling	15	6
Hemlock, western	4		Birch	1	1
Juniper		2	Chokecherry		1
Larch	1		Cottonwood, black		4
Pine, lodgepole	21	9	Hazelnut	1	
Pine, ponderosa		1	Hawthorn		1
Pine, whitebark	1	2	Saskatoon		1
Spruce, black	1	1	Willow	1	1
Spruce, Sitka	13		Miscellaneous	2	1
Spruce, white	53	10	No host	8	
			Total	32	17
Total	137	44	Grand Total	169	61

* Includes 13 egg samples from combined alpine fir and white spruce; or alpine fir, white spruce and lodgepole pine.

STATUS OF INSECTS

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

This was the second, or heavy feeding year, of the two-year-cycle spruce budworm. As the defoliation is comparatively light in the first year of the cycle, aerial mapping was not carried out in 1959. The increase in extent of the infestation was therefore not realized until this summer, when the area from the Bulkley River to the Parsnip River, and from Germansen Landing to Francois Lake was surveyed from the air.

Extent of Infestation

Although it is believed that this infestation started near the north end of Babine Lake in the East Prince Rupert District, by far the greater area of defoliation now lies to the east and north of the lake, in the Prince George District. (See West Prince George District report). The area of visible defoliation in the East Prince Rupert District increased to 2,770 square miles, a 2-fold increase compared to the 1,300 square miles recorded in 1958. This defoliation was classed as light, medium, and heavy, with respective areas of 2,085, 500, and 1,085 square miles. Collections of up to 100 larvae each were found up to 10 miles from the perimeter of the areas shown on the map as suffering light defoliation, indicating that the infestation may continue to spread. Smaller numbers of larvae, one to 10 per collection, were also found in samples throughout the district as shown in Map 2.

Method Survey

Larval sampling started at the end of May. The larvae apparently emerged from winter hibernation after the warm weather in April before the buds were open. Cold weather in May retarded the opening of buds until early in June. During the early survey most of the larvae were found mining the buds. Larvae from ten 18-inch branch tips at each sample point or plot constituted a collection. In many of the areas three-tree beating collections were also made, particularly outside the visibly defoliated areas (Table 2). Egg counts were made in the late summer, also using the 18-inch branch tips as a sample unit. Defoliation estimates were made during the egg survey.

Population Trend

Larval populations of the two-year-cycle spruce budworm can only be compared for years of the same stage of development. Therefore larval numbers of 1960 must be compared with the 1958 numbers to obtain the population trend. From 1958 to 1960 the number of larvae per square foot of foliage increased from an average of 8.8 to 18.2 (Table 3). The corresponding number of egg masses taken when these larvae had completed their cycle decreased from 5.1 masses per square foot of foliage to 2.0 (Table 4). Parasitism was very light and no diseased larvae were found so the decrease could not be attributed to these natural control factors. Dead and shrivelled larvae were common on the foliage, so starvation could be a controlling factor.

Table 2

List of Three-tree Beating Sample Points Where Above Normal Numbers of Spruce Budworm Larvae Were Collected. East Prince Rupert District. 1960.

Location	Host Ba	Sw	Pw b
Smithers Landing	200+	8	
Fulton Lake	-	155	
Hatchery Arm	200+	200+	
Hagan Arm	150	64	
Wright Bay	-	14	
Taltapin Lake - west end	-	60	
Topley Landing	200+	83	
Babine Lake, opposite Silver Island	-	17	
Babine Portage	-	9	
Smithers Landing Road - (3,500 ft.)	200+	-	
Cronin Mt. (5,000 ft.)	170	-	28
Southbank	-	6	
Kiskegas (Skeena River)	5	7	

Table 3

Comparison of Spruce Budworm Larval Counts

per Square Foot of foliage.

East Prince Rupert District. 1958 - 1960.

Location	Larvae per sq. ft. of foliage 1958		1960	
	Hosts			
	Ba	Sw	Ba	Sw
5 mi. Nilkitkwa River trail	14.1	13.1	9.9	6.3
1/4 mi. Nilkitkwa River trail	1.3	.3	8.5	6.3
Suskwa River trail	-	-	6.5	3.9
Opp. McKendrick Island	5.5	-	11.1	-
N. end of Chapman Lake	13.5	8.5	87.5	25.7
Gronin Mine junction	6.0	-	-	-
Cronin Mine road	23.8	23.2	34.6	35.0
Doris Lake	3.3	11.5	-	-
Smithers Landing	14.6	10.0	-	-
Hatchery Arm, Babine Lake	6.2	5.3	-	-
Pinkut Lake	-	6.1	-	10.6
Taltapin Lake - east end	1.5	4.5	7.7	-
Walcott Station	-	-	-	0.6
Averages	8.5	9.2	23.7	12.6
Average - all hosts	8.8		18.2	

Table 4

Comparison of Spruce Budworm Egg Counts

per Square Foot of Foliage.

East Prince Rupert District. 1958 - 1960.

Location	Egg Masses per sq. ft. of foliage 1958			1960		
	Hosts					
	Ba	Sw	Pl	Ba	Sw	Pl
5 mi. Nilkitkwa River trail	11.9	14.7		2.2	0.0	
1/4 mi. Nilkitkwa River trail	3.9	1.7	13.7	1.0	.8	
Suskwa River trail	.9	1.0	7.1	1.6	1.5	2.8
Opp. McKendrick Island	4.3			2.8		
North end of Chapman Lake	5.7	5.5		.2	1.3	
Cronin Mine Road	3.3	3.5		2.3	.5	
Doris Lake	8.0	14.0	7.6	.4	.6	
Smithers Landing	3.3	1.3		.7	.2	
Fulton Lake		7.5	8.1		.4	
Hatchery Arm	.9	2.5		2.6	3.0	
Hagan Arm	2.5		3.0	.7	8.9	2.2
Pinkut Lake		2.4	1.0		.9	5.3
Taltapin Lake	1.8		1.7	1.5	.6	3.7
West side of Chapman Lake	6.0			.1		
Walcott				.3	.3	
Cronin Mine Junction	3.8			.4		
Wright Bay					.1	
Averages	4.3	5.4	6.0	1.2	1.4	3.5
Average - all hosts	5.1			2. 0		

Stand Condition

Stands in the areas of repeated heavy defoliation are in poor condition. Some mortality has appeared which may be due to the budworm, as no sign of beetle attack is present. Several years of consecutive bud-kill in many areas has resulted in a condition where some trees have produced no new foliage for up to five years. Top kill is common on both alpine fir and white spruce. The understory trees, from seedlings up to 20 or 30 feet in height, have suffered severely. Many have been killed and many others have lost up to 90 per cent of their foliage. The Cronin Mine road - Chapman Lake area, and the Nilkitkwa River Valley have suffered the heaviest damage, and tree mortality is noticeable in the latter area.

Summary

The decrease in egg counts could indicate a decline in the infestation level in the Babine Lake region. Defoliation and bud-mining are expected to be generally lighter in 1961, with the exception of localized areas where the number of eggs present, although less than in 1958, is still high enough to produce heavy larval populations. If the population continues to decrease as expected mortality of overstory trees should not be heavy. Scattered tree mortality may occur in the Chapman Lake - Cronin Mine Road and in the Nilkitkwa River Valley regions.

Bark Beetles, *Dendroctonus* spp.

The infestations of *Dendroctonus* spp. bark beetles, which showed signs of declining in 1959, have disappeared. Many dead trees remain from the old attacks, but no fresh attacks could be found on either pine or spruce trees.

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

Only three black-headed budworm larvae were found at widely separated points in the district.

Forest Tent Caterpillar, *Malacosoma disstria* Hbn.

The infestation in the Hazelton area, which extends from Kitwanga in the West Prince Rupert District to the Bulkley Canyon in the East Prince Rupert District, increased in intensity in 1960. Deciduous trees and bushes were completely stripped of foliage over large areas, and the roads were literally covered with larvae looking for new feeding places. Egg counts made in the fall indicate the population will remain at a high level in 1961, with up to 170 egg masses taken from the crown of one aspen tree of six inches diameter.

Counts of over 100 egg masses per tree crown taken from aspen of a similar size on the north-east side of the Bulkley River indicate that the small infestation at Moricetown may be spreading. In 1960 about 10 square miles were heavily infested. A few infested trees were also found at Forestdale . This could be the start of another small outbreak.

The Green Velvet Looper, Epirrita autumnata Harr.

This looper was found in only seven collections. Sixty-five of the 70 larvae found were in three collections. One from the Smithers Landing road contained 28, one from Tahtsa Lake 25, and one from Nadina Lake 12 larvae.

Aspen Leaf-miner, Phyllocnistis populiella Chamb.

The aspen leaf-miner was again prevalent throughout the range of the host tree. Some black cottonwood leaves were also attacked wherever this tree appeared, but aspen was the preferred host.

An Aspen Leaf Roller, Tortricid sp.

An infestation of the aspen leaf roller extended from Telkwa to several miles north of Smithers. Aspen within this area were almost completely defoliated by mid-summer.

Spruce Gall Aphid, Adelges coolyii (Gill.)

A special survey was made in 1960 to find the extent of the area infested by this insect. All infested trees were found in the south-eastern portions of the District (drainages 120 and 122, Table 4), in or near the growing range of the alternate host tree, Douglas fir.

A Ladybird Beetle, Chilocorus tricyclus

Several collections of this ladybird were sent to Dr. S. G. Smith of Sault Ste. Marie. They were found in numbers, 20 to 30 per collection, on a small clump of scale-infested aspen near Houston.

Table 4

Spruce Gall Aphid Collection Points and Intensity

of Infestation, East Prince Rupert. 1960.

Collection no.	Location	Drainage	Intensity
EPR - 15	Pendleton Bay	122	Heavy
30	Babine Lake opp. Silver Island	122	Light
32	Babine Portage	122	Heavy
40	Endako	120	Heavy
42	Southbank	120	Medium
45	Ootsa Lake	120	Light
48	Nadina River	120	Light
55	Smithers	122	Heavy
78	Moricetown	122	Light
79	Priestly	120	Heavy
81	Nithi River	120	Heavy
82	Francois Lake - Endako	120	Heavy
86	Euchu Lake	120	Heavy
91	Redfern Rapids	120	Heavy

MISCELLANEOUS INSECTS

East Prince Rupert. 1960

Name of Insect	Hosts	No. of collections	Remarks
Clemensia albata Pack.	Ba	1	Defoliator. Hazelton
Enypia venata Grt.	Sw	1	Defoliator. Hazelton
Ectropis crepuscularia Schiff.	Ba, H, Bi	3	3 larvae on birch at Kispiox
Eucordylea atrupictella Dietz.	Sw	1	Defoliator. Priestly
Feralia comstocki Grt.	Sw, H	2	Endako, Hazelton
Feralia jocosa Gn.	Sw, Ba	2	Ootsa Lake, Kispiox
Gabriola dyaria Tayl.	Sw	1	Hazelton
Hydriomena r. columbiata Tayl.	D. Sitka	1	Smithers
Hydriomena irata Swett.	D. Sitka	1	Nilkitkwa River
Hemichroa crocea (Fourc.)	D. Sitka	1	7 larvae at Smithers
Malacosoma pluviale Dyar	A	1	1 colony at Smithers
Nyctobia limitaria Wlk.	Sw	1	Houston
Orgia a. badia (Hy. Ed.)	Ba	1	Kispiox
Pikonema alaskensis (Roh.)	Sw, S	9	Widely distributed, small numbers
Pikonema dimmockii (Cress.)	Sw, S, Sb, Ba	13	No large collections. Widespread.
Pheosia rimosa Pack.	A, D. Sitka	2	Smithers, Hazelton
Protoboarmia p. indicatario Wlk.	Sw	2	Kispiox
Smerinthus cerisyi Kby.	A	1	Hazelton
Syngrapha r. nargenta Ottol	Sw	1	Nilkitkwa River
Syngrapha a. interalia Ottol	Sw	1	Nadina River

MISCELLANEOUS INSECTS - continued

Name of Insect	Hosts	No. of collections	Remarks
Syngrapha selecta Wlk.	Ba	2	Nadina River.
Trichiosoma triangulum Kby.	D Sitka	1	11 larvae at Smithers
Venusia pearsalli Dyar	Sw	1	Nadina Lake
Zenobia pleonectusa Grt.	Sw	1	Southbank
Zeiraphera diniana Gn.	Ba	1	Tahtsa Lake
Zale d. largera Sm.	Pl	1	Smithers

STATUS OF FOREST DISEASES

Important Diseases

Introduced Rust on Ponderosa Pine Seedlings

A rust disease of pine seedlings, collected on samples of ponderosa pine taken from a seed bed of the British Columbia Forest Service at Telkwa, was found to be caused by Melampsora pinitorqua Rostr., a rust probably imported from Europe. Most of the seedlings in the bed were heavily infected and on the advice of the Victoria laboratory were subsequently destroyed. This is the first record of this rust on ponderosa pine and the first record of its occurrence in North America.

A Parasite on Dwarf Mistletoe

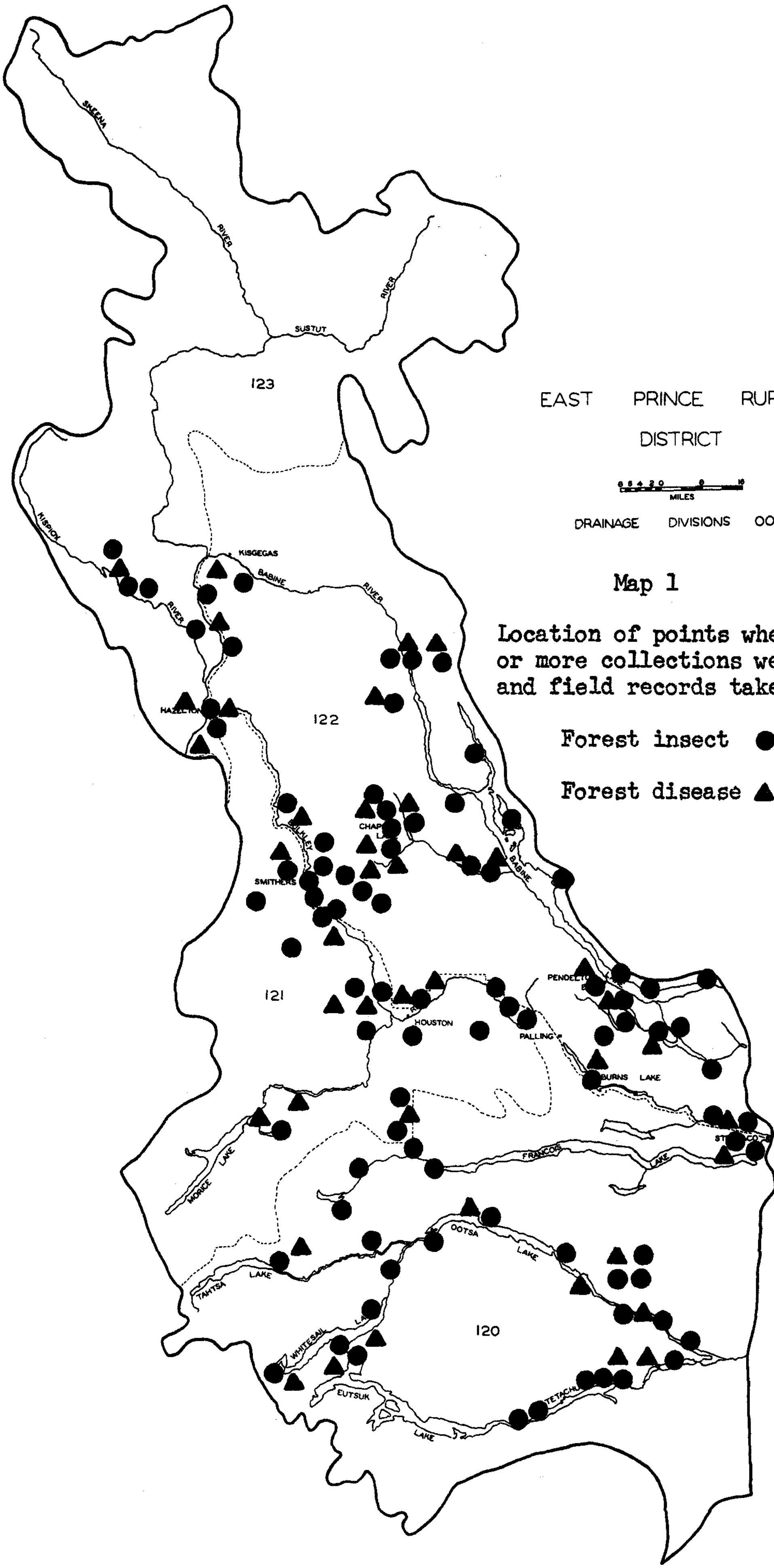
A fungus parasite, Wallrothiella arcuthobii (Peck.) Sacc., was found on dwarf mistletoe collected at Euchu Lake in Tweedsmuir Park. This is an important, but not common, parasite which prevents dwarf mistletoe from producing seed.

Ink Spot of Aspen

The ink spot of aspen Sclerotium sp., was found in outbreak levels in Tweedsmuir Park where several hundred acres near Euchu Lake were defoliated. This fungus was first reported in British Columbia in 1950, under the name Ciborinia seaveri Groves & Bowrm., when it caused heavy defoliation to aspen in the Smithers area.

OTHER NOTEWORTHY DISEASES

Host	Organism	Locality	Remarks
Birch	Poria obliqua (Pers.) Karst.	Kispiox	White rot fungus rare in B. C.
Fir, alpine	Peridermium holwayi Syd.	Cronin Mine Pendleton Bay Tahtsa Lake	Needle rust, common in these areas.
	Melampsorella caryophyllacearum Schroet.	Smithers McBride Lake	Broom rust. Brooms are large but scarce.
	Pucciniastrum epilobii Otth.	Eutsuk Portage	Needle rust. Common in area.
Pine, lodgepole	Peridermium stalactiforme Arth. & Kern.	Wistaria	Stem rust. Many trees in area infected.
Pine, lodgepole	Peridermium harknessii J. P. Moore	Cheslatta Lake	Rust gall. Common throughout host range.
	Coleosporium asterum (Diet.) Syd.	Wisteria Euchu Lake	Needle rust. Light infection on a few trees in each area.
	Cronartium comandrae Peck.	Wisteria	Stem rust. Common in area.
	Arceuthobium americanum Nutt.	Euchu Lake Morice Lake Pinkut Lake	Dwarf mistletoe. Plentiful in these three areas.
Pine, white bark	Dasyscyphus fuscosanguineus Rehm.	Cronin Mine	New host and distribution record.
Spruce, white black	Peridermium coloradense (Diet.) Arth. & Kern.	Hazelton Burns Lake Telegraph Creek	Broom rust. Common throughout host range.
Spruce, white	Chrysomyxa weirii Jacks.	Owen Lake	Needle rust. Heavy infection on a few trees.



EAST PRINCE RUPERT

DISTRICT

MILES

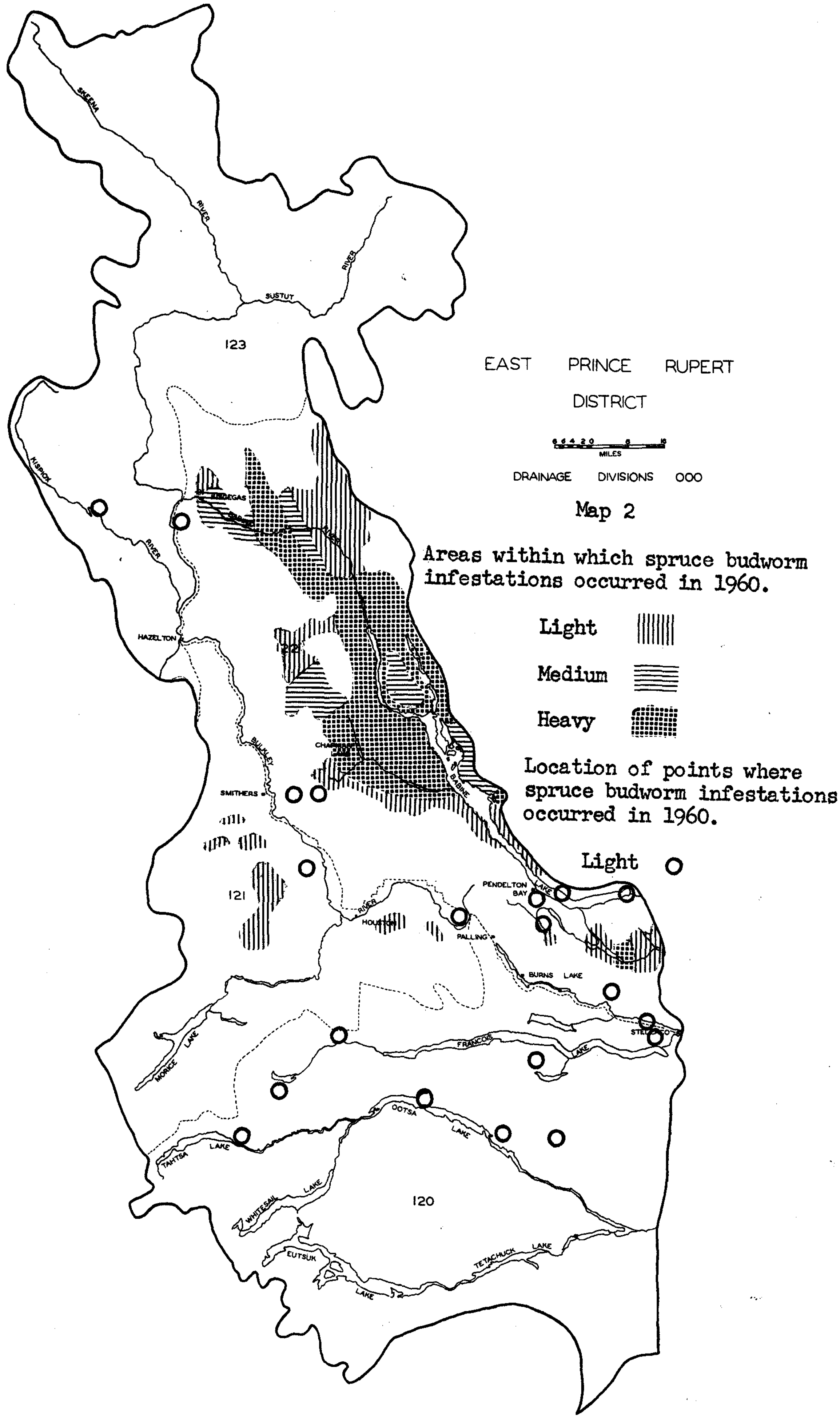
DRAINAGE DIVISIONS 000

Map 1

Location of points where one or more collections were made and field records taken in 1960.

Forest insect ●

Forest disease ▲



EAST PRINCE RUPERT
DISTRICT
MILES
DRAINAGE DIVISIONS 000
Map 2
Areas within which spruce budworm infestations occurred in 1960.
Light
Medium
Heavy
Location of points where spruce budworm infestations occurred in 1960.
Light
SKEENA
RIVER
SUSTUT
RIVER
123
KISPIOX
RIVER
HAZELTON
BULKLEY
SMITHERS
122
121
RIVER
HOUSTON
PALLING
PENDELTON BAY
LAKE
BABINE
BURNS LAKE
FRANCOIS
LAKE
MORICE LAKE
OOTSA
LAKE
TAHTSA LAKE
WHITESAIL LAKE
120
EUTSUK
LAKE
TETACHUCK LAKE

ANNUAL REPORT OF FOREST BIOLOGY RANGERS

BRITISH COLUMBIA

1960

KAMLOOPS FOREST DISTRICT

FOREST BIOLOGY SURVEY

KAMLOOPS FOREST DISTRICT

1960

B. A. Sugden

INTRODUCTION

Forest Biology rangers assigned to the Kamloops Forest District in 1960 were: W. E. Bitz, West Kamloops Forest Biology Ranger District; C. B. Cottrell, Central Kamloops; and B. A. Sugden, East Kamloops.

Field work began in the District in April and continued until mid-November. Cold wet weather during the late spring and early summer slowed the activity of many of the forest insects.

Rangers from Central and East Kamloops and from South and West Prince George assisted with the work on the Douglas-fir beetle damage appraisal strips in the West Kamloops District.

The Douglas-fir beetle remained the most important pest of merchantable Douglas-fir trees in the District. A decline in population has been predicted in some regions for 1960, however, outbreaks of Douglas-fir beetle may be expected in 1961.

Damage by the mountain pine, western pine and Engelmann spruce beetles was comparatively low throughout most of the District.

Populations of western hemlock looper, spruce budworm, black-headed budworm and Douglas-fir tussock moth remained low in 1960.

Many of the infestations of satin moth on black cottonwood and trembling aspen have subsided. Although several outbreaks were recorded in 1960, the population of this species has declined.

Infestations of aspen leaf-miner remained active. Damage was generally severe during 1960.

A needle disease infecting ponderosa pine caused injury to many stands in West, Central and East Kamloops districts.

ANNUAL REPORT OF FOREST BIOLOGY RANGER

for

WEST KAMLOOPS DISTRICT

1960

FOREST BIOLOGY SURVEY

WEST KAMLOOPS DISTRICT

1960

W. E. Bitz

INTRODUCTION

Forest Insect Survey field work began April 11 with field examinations of overwintering broods of Douglas-fir beetle. Subsequent field trips were made to examine foliage-colour-change plots of beetle-killed Douglas-fir trees. A total of 10 hours flying time was used on tree Damage Appraisal.

Regular survey work extended from May 20 to October 30. During the field season 301 forest insect collections and seven forest disease collections were obtained. Table 1 shows the collections by host. Map 1 shows the distribution of collections and field records.

Table 1

Collections by Hosts,

West Kamloops District, 1960

Coniferous hosts	Forest insects	Forest diseases	Broad-leaved hosts	Forest insects	Forest diseases
Cedar, western red	10	0	Alder sp.	3	-
Douglas fir	103	3	Aspen, trembling	16	2
Fir, alpine	1	1	Birch spp.	7	-
Hemlock, western	6	1	Cherry, choke	1	
Juniper, common	2	-	Cottonwood, black	3	-
Pine, lodgepole	48	-	Poplar, Lombardy	2	-
Pine, ponderosa	21	-	Willow spp.	28	-
Spruce, Engelmann	41	-	Miscellaneous	9	
			Total	69	2
Total	232	4	Grand total	301	7

STATUS OF INSECTS

Douglas-fir Beetle, *Dendroctonus pseudotsugae* Hopk.

The status of the Douglas-fir beetle in 1960 was determined entirely by the Damage Appraisal Survey. Four flights were made, extending the aerial survey over some of the southern parts of the District for the first time.

The strip plots established in 1959, when the winter damage plots were discontinued, were cruised again for current beetle attacks.

Foliage color change studies on beetle-killed trees, begun in 1957, were continued. Two new plots of currently-attacked trees were established to ensure an adequate supply of material for observation. However a number of plots established in past years have been logged or otherwise destroyed causing some disruption in foliage colour change comparisons.

The pattern of beetle attack varied from the usual in 1960, due to the protracted cold, wet weather during the spring and early summer. Beetle emergence and subsequent flight was spread over a relatively long period, reducing the density of attack considerably.

The annual examination of wintering beetle broods, before the spring flight, was made for the fifth consecutive year.

TREE DAMAGE APPRAISAL SURVEY

Douglas-fir tree mortality attributed to the Douglas-fir beetle reached its highest level in history in the West Kamloops District. The Damage Appraisal showed a total of 28,973 red tops compared to a previous high of 15,590 counted in 1959.

Tree mortality is determined annually by a count of all Douglas-fir trees bearing red foliage; these are presumed to have been killed during the three-year period preceding the year of survey. Five overlapping three-year periods have been covered to date taking into account the years from 1953 to 1959 inclusive. Table 2 shows the number of trees killed and volume in cubic feet for each of the five three-year periods. Map 2 shows the distribution of trees killed during the 1957-1959 period.

Table 2

Number of Douglas-fir Trees killed by Douglas-fir Beetles by Three-year Periods as Determined in 1956 to 1960 Inclusive, West Kamloops District

Three-year period	Year of survey	No. of trees killed	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

Volume figures were developed from the British Columbia Forest Service Site-class Table. The figures are based on measurements taken from numerous samples of beetle-killed trees throughout the District. Volumes ranged from 18 cu. ft. per tree in a logged-over area near Clinton to 130 cu. ft. per tree in an undisturbed stand in the same general area. Average volume per tree in the Lac la Hache area was 65 cu. ft. while the average in the Clinton area was 70 cu. ft. Volume estimates in Table 2 are based on these figures. Table 3 lists the main localities where sample measurements were taken, and the estimated volume at each point.

Table 3

Sample Measurements of Beetle-killed Douglas-fir Trees, West Kamloops District, 1960

Location	No. of trees measured	Av. d.b.h.	Volume per tree (cu. ft.)
Lac la Hache	25	20.8	62
Williams Lake	25	21.7	68
Place Lake	25	22.0	68
Soda Creek	25	20.0	50
Clinton Hill	10	30.0	130
Clinton (Sulphur Lake)	10	13.5	18
Clinton North	10	20.7	55
59 Mile House	6	23.0	75

As indicated in Table 2 the 1960 tally is approximately double the previous high which was recorded in 1959. Of particular interest are the areas near Cache Creek and Clinton in the southern parts of the District, the Chilcotin region occupying the northwestern sections and the Joes Lake-Springhouse area in Williams Lake Ranger District. Tree mortality in the two former areas indicated an increase of 350 per cent and 250 per cent respectively over the 1959 appraisal figures. It must be emphasized however that at Cache Creek, part of this increase is due to extended aerial coverage of areas previously surveyed only by roads. The increase is about double in this area.

In the Chilcotin the increase is due almost entirely to 1959 attack following extension of logging to new areas north and west of Riske Creek. A spectacular increase was noted at Riske Creek where 500 red tops were counted in an area containing only a few scattered groups of beetle-killed trees in previous years. Widely separated groups can now be seen from Williams Lake to Tatlayoko Lake, about 200 miles to the west. The other region of heavy attack, the Joes Lake-Springhouse area has been the scene of extensive bark beetle damage for at least five years. While the biggest increase is at Joes Lake a noticeable increase was general for over 35 miles northward toward Williams Lake. Table 4 shows Damage Appraisal counts and percentage increase over 1959 in the three aforementioned areas.

Table 4

Percentage Increase over 1959 Level, of Douglas-fir Beetle Attack at Three Localities, West Kamloops District, 1960

Location	No. of red tops		Percentage increase
	1959	1960	
Cache Creek - Clinton	952	4283	350
Joes Lake - Springhouse	2850	4620	62
Riske Creek	444	1540	250

In the Lillooet region the only serious bark beetle infestation is along the north shore of Anderson Lake. In 1958 over 260 red tops were counted here. Since this was the first bark beetle infestation in this area it is assumed to be the result of brood development in slash from a power line right-of-way clearing in 1957. This has expanded to 487 red tops in 1960. Beetle activity was seen for the first time on nearby Seton Lake when a group of 10 red tops were found by aerial survey. Although logging has been in progress at this location for at least five years this was the first sign of Douglas-fir beetle infestation.

Currently attacked trees were found on the south side of Bridge River near its confluence with the Fraser. This follows the first signs of logging in this area. Increased attack in 1961 is anticipated here as well as at Seton and Anderson lakes. Over the remainder of the District, red-topped Douglas-fir trees were prevalent, indicating a high level of 1959 attack.

STRIP PLOTS

The strip plots established in the Lac la Hache area in 1959, when the winter damage plots were discontinued, were cruised again in 1960 to determine current beetle attack. One plot was destroyed by logging; of the remaining five only two contained currently attacked trees.

A total of five green infested trees was found compared to 36 in 1959. On the basis of this cruise a greatly reduced attack can be expected in 1961. Table 4 shows the depletion of trees per acre for 1959 and 1960.

Table 4

Number of Douglas-fir Trees per Acre Killed in 1959 and 1960 by Douglas-fir Beetles on Strip Plots, West Kamloops

	1959	1960
No. acres cruised	288	240
No. trees killed per acre	0.13	0.02

This reduced attack was evident in other parts of the District as difficulty was experienced in finding freshly attacked trees for foliage colour change studies.

WINTER MORTALITY OF BEETLE BROODS

This was the fifth consecutive year of examinations to determine mortality in beetle broods due to winter conditions. In mid-April, three trees from each of three locations between Williams Lake and 100 Mile House were selected for examination. Sections of bark six inches by 24 inches were inspected at each cardinal compass point at 10-foot intervals along the stem.

Average mortality of 6001 teneral adults was 33.5 per cent. This is almost a three-fold increase over the 1959 winter mortality of 11.7 per cent. Variations between trees ranged from 17.7 per cent on a single tree at 100 Mile House to 76.9 per cent on one tree at Williams Lake. Table 5 shows the annual brood mortality figures for various locations from 1956 to 1960 inclusive.

Table 5

Percentage Mortality of Wintering Douglas-fir Beetle Broods, West Kamloops District, 1956 to 1960

Location	1956	1957	1958	1959	1960
Place Lake	-	51.6	12.9	-	-
Lac la Hache	93.4	23.9	8.2	18.3	27.2
Enterprise	-	-	-	5.2	-
100 Mile House	-	-	-	-	40.3
Williams Lake	67.0	-	-	-	31.6
Average	85.0	37.7	10.5	11.7	33.5

FOLIAGE COLOUR CHANGE

A number of plots have been established annually since 1957 to study colour changes on foliage of beetle-killed trees. The original plots at Williams Lake and Lac la Hache still retained traces of red foliage in 1960, the fourth year after attack. Inspection of these plots showed that 38 per cent of the plot trees at Williams Lake retained traces of red while at Lac la Hache 60 per cent of the trees still had a red tinge. The original plots at Clinton were completely grey showing no sign of foliage three full years after attack.

Additional plots were established in 1958 in the same areas but only those in the Clinton area survived logging operations. These plots showed no traces of red foliage two complete seasons after attack. This accelerated discoloration and subsequent needle drop was considered to be due to the protracted hot dry period in the spring and summer of 1958. The attacked trees began fading one month after attack and the majority turned red by July. By September most of the 1958 attack was indistinguishable from the previous year's. Inspections in the Lac la Hache area revealed a similar accelerated discoloring; foliage loss varied from 20 to 60 per cent about 15 months after attack. Logging activities destroyed the plot at this time but other observations indicated a complete loss of foliage on many of the trees two complete seasons after attack. Three plots were established in 1960, two at Cache Creek and one near Clinton. Due to another unusual season, the reverse of the 1958 season, the 1960 season was abnormally cold and wet till mid-summer. This resulted in disseminated beetle attacks unlike the peak density attacks characteristic of the spring flight. Freshly attacked trees or groups of trees were difficult to find and those located showed a confused pattern of attack and subsequent lack of conformity in foliage colour changes. Only a small percentage of attacked trees indicated a color change by September.

Observations made during the past four years indicate beetle-killed Douglas-fir trees will retain some discolored foliage for at least three years from the time of attack. The only divergence from this standard to date occurred as a result of the extremely hot dry period in 1958. This weather did not seem to have any unusual effect on trees already red from the previous year's attack.

In general the studies have shown a more rapid discoloration and foliage loss on trees in the Clinton area and southward than elsewhere in the District. One other observation worthy of mention is that the abnormally hot dry season in 1958 did not accelerate the needle drop on trees killed the previous year, while, as mentioned earlier, it had the effect of greatly accelerating colour changes on trees attacked the same year.

Forecast

Due to cold and wet early season weather, the customary spring beetle flight failed to materialize. Beetle emergence and flight was over a longer period. This resulted in numerous lightly or partially attacked trees which were able to pitch out or otherwise survive the attack. Successfully attacked trees were difficult to find compared with previous years. These facts, combined with a three-fold increase in mortality of wintering beetle broods, indicate a light infestation in 1960 over most of the District. An exception is anticipated in the Lillooet area as mentioned in the section under Damage Appraisal.

Aspen Leaf Miner, Phyllocnistis populiella Cham.

A general increase in density of attack was found in 1960 following a lessening of activity in 1959. Areas of 100 per cent infestation were again prevalent except in the Chilcotin area. In this region the attack varied from four to 73 per cent of foliage affected. Table 6 lists some representative locations and percentage of foliage affected throughout the District.

Table 6

Percentage of Aspen Leaves Infested, West Kamloops District, 1959 and 1960

Location	Percentage of leaves infested	
	1959	1960
Lytton	37	63
Lillooet	26	47
Venables Valley	72	100
Clinton	40	45
100 Mile House	100	100
Lac la House	23	65
Horsefly	100	100
Quesnel Lake	64	100
Tatla Lake	60	54
Alexis Creek	7	4
McLeese Lake	85	100
Williams Lake	24	28

Four plots established in 1959 were re-examined this year. Sampling was done by examining the leaves of two apical 12-inch branches from each of five trees per plot. Table 7 shows the number of leaf surfaces containing mines and the number of adults produced per leaf surface for 1959 and 1960.

Table 7

Percentage of Aspen Leaf Surfaces Mined and Adult Leaf-miner Emergence per Leaf Surface, West Kamloops District, 1959 and 1960

Location	Percentage leaf surfaces with mines		No. adults produced per leaf surface	
	1959	1960	1959	1960
Cache Creek	21	21	0.01	0.06
Clinton	24	17	0.02	0.01
Williams Lake	16	16	0.03	0.02
Soda Creek	58	68	0.03	0.21

In addition to the leaf counts, 100 cocoons were examined at sampling points and the percentage mortality from various causes was recorded. Table 8 shows the mortality rate compared with 1959.

Table 8

Percentage Mortality of Leaf-miners in Cocoons by Parasites and Other Causes, West Kamloops District, 1960

Location	Percentage mortality in cocoon stage			
	Parasites		Other Causes	
	1959	1960	1959	1960
Cache Creek	19	22	65	47
Clinton	14	16	64	38
Williams Lake	0	19	69	51
Soda Creek	4	39	68	34

Spruce Budworm, _Choristoneura fumiferana_ (Clem.)

No trace of this species was found in 1960 in the area of previous infestation at Lillooet. Seven random sampling plots have been established at representative points throughout the former infestation area. Inspection at these plots indicated a resumption of normal twig growth at all points despite severe defoliation for at least three years. No adventitious budding was seen on Seton Lake. Five acres had some top kill and medium adventitious budding.

In other sections of the District only one or two larvae per collection were collected from the preferred host, Douglas fir. These were mainly in the Clinton and Ashcroft areas. Occasional specimens were recovered from lodgepole pine and Engelmann spruce in the Chilcotin and Williams Lake areas.

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

Only two larvae were found this season at widely separated points. The hosts were Douglas fir and Engelmann spruce.

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

Only one larva of this species was found in 1960. It was collected from its preferred host, Douglas fir, at the site of a former spot infestation near Lillooet.

Pine Needle Fascicle Miner, *Zelleria haimbachi* Busck

A lessening of activity in both 1959 and 1960 has reduced the numbers of this miner to a very low level. Only traces of activity were found this year compared with a high point in 1958 when 72 per cent of ponderosa pine terminals were damaged near Spences Bridge.

Black Pine Leaf Scale, *Nuculaspis californica* (Cole.)

The small infestation on ponderosa pine at Botanie Creek near Lytton was reduced in intensity and extent in 1960. Although it has been severe for at least five years on ponderosa pine regeneration, no tree mortality has occurred to date.

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

No larvae were found in the Quesnel Lake region. In 1959 an average of three larvae per collection was obtained in 13 standard beating collections from western hemlock in this area.

Single specimens were obtained in standard collections from Douglas fir in the Ashcroft and Clinton areas.

False Hemlock Looper, *Nepytia canosaria* Wlk.?

This species was found in only three collections. The host was Douglas fir in the Ashcroft area and near Lillooet.

Saddle-backed Looper, Ectropis crepuscularia Schiff.

No larvae of this species were found in the Quesnel Lake area. An average of 3.5 larvae per collection were obtained from western red cedar in association with western hemlock loopers in this region in 1959.

A Leaf Roller on Birch, Allononyma vicarialis Zell.

This species was seen for the first time in this District when severely infested birch trees were examined at Oregon Jack Creek and north of Cache Creek in the Ashcroft Ranger District. The infestation was similar in size and intensity at both locations, affecting about 60 per cent of the foliage over about five acres.

Douglas-fir Needle-miners, Contarinia spp.

Light populations of Contarinia constricta Condr. and C. pseudotsugae Condr. were present throughout the range of Douglas fir in this District. C. cuniculator Condr., common in other areas, was not found in the West Kamloops District.

A Poplar Leaf Beetle, Pachybrachys probably liebecki Fall.

The first record of this leaf beetle in the West Kamloops District was obtained at Spences Bridge in the last week in May. It was defoliating mainly regeneration growth of both Lombardy poplar and black cottonwood. A few of the smaller trees were almost completely defoliated at this date. The infestation extended a few miles south and east of Spences Bridge into the Central Kamloops District.

OTHER NOTEWORTHY INSECTS

Insect	Host	Number of collections	Remarks
Achytonix praeacuta Sm.	F	2	Decrease
Caripeta angustiorata Wlk.	Pl	3	"
C. divisata Wlk.	F	3	"
Dioryctria pseudotsugella Munroe	F	13	Increase
Eupithecia annulata Hlst.	F	7	Decrease

Insect	Host	Number of collections	Remarks
E. filmata Pears.	F	4	Decrease
Feralia spp.	F	6	"
Griselda radicana Wlshm.	F	15	Increase
Hyphantria cunea Drury.	A, C	Nil	Decrease
Incisalia eryphon Bdv.	Pl	Nil	"
Melanolophia imitata Wlk.	F	7	"
Neodiprion sp.	Se	2	"
Neodiprion sp.	F	6	"
Neodiprion Sp.	Py	2	"
Nyctobia limitaria Wlk.	F	2	"
Panthea sp.	Pl	1	"
Pero behrensarius Pack.	F	3	"
Pikonema alaskensis Roh.	Se	3	"
P. dimmockii Cress.	Se	3	"
Semiothisa granitata Gn.	F	4	"
Zale duplicata Sm.	Pl	2	"

It will be noted that with only three exceptions all species decreased in numbers from the 1959 level. This is considered representative of general insect conditions in the West Kamloops District in 1960.

STATUS OF FOREST DISEASES

Important Diseases

Die-back of Douglas fir

Scattered top killing and flagging of branches in the Lillooet area affecting over 700 trees in 1958 was attributed to *Cytospora* sp., a weakly parasitic fungus. The three sites of attack were on dry, rocky slopes constituting poor growing environment. It is apparent that the affected trees were predisposed to attack by a prolonged hot and extremely dry period. Examination of the affected areas in 1960 showed no expansion of damage since the original occurrence in 1958. A study plot was established at Pavilion Lake on one of the damaged sites. Twenty healthy trees were tagged and crown condition and any unusual growing conditions noted, to follow the development of this fungus.

Drought Damage to Ponderosa Pine

Examination of ponderosa pine on the one-quarter-acre drought-damage plot established in 1958 near Clinton, was made in September. Assessment of tree mortality can now be made since all trees still living at the time of inspection had put out new growth and appeared to be recovering. Twenty-five trees representing 66 per cent of the total have died since 1958. This is an increase of only nine per cent over 1959 when 57 per cent of the stems were dead by September. Of the trees killed the first year, all suffered initial discoloration of over 80 per cent.

All trees dying in the year following drought damage sustained initial foliage discoloration of from 50 to 80 per cent. The trees surviving and apparently recovering had nearly all suffered less than 50 per cent initial discoloration. Average d.b.h. for surviving trees was 8.3 inches compared with 4.7 inches d.b.h. for dead stems.

The most significant information obtained from this plot study indicates that ponderosa pines in this region cannot tolerate drought injury resulting in more than 50 per cent discoloration. Susceptibility to drought appears to decrease as d.b.h. increases.

A Needle Cast of Ponderosa Pine

Infection of Elytroderma deformans (Weir) Darker was again prevalent throughout the range of ponderosa pine in the District. A diminishing intensity of infection was noted in some of the areas most severely affected by drought in 1958 but drought damage may have been confused with needle cast at that time. In other sections of ponderosa pine type, evidence of increased activity appeared to be general. Two permanent sample plots were established to follow the trend of infection. In the plot near Clinton 51 per cent of terminals contained some degree of infection while at Hat Creek 24 per cent of terminals were affected.

Exotic Plantations

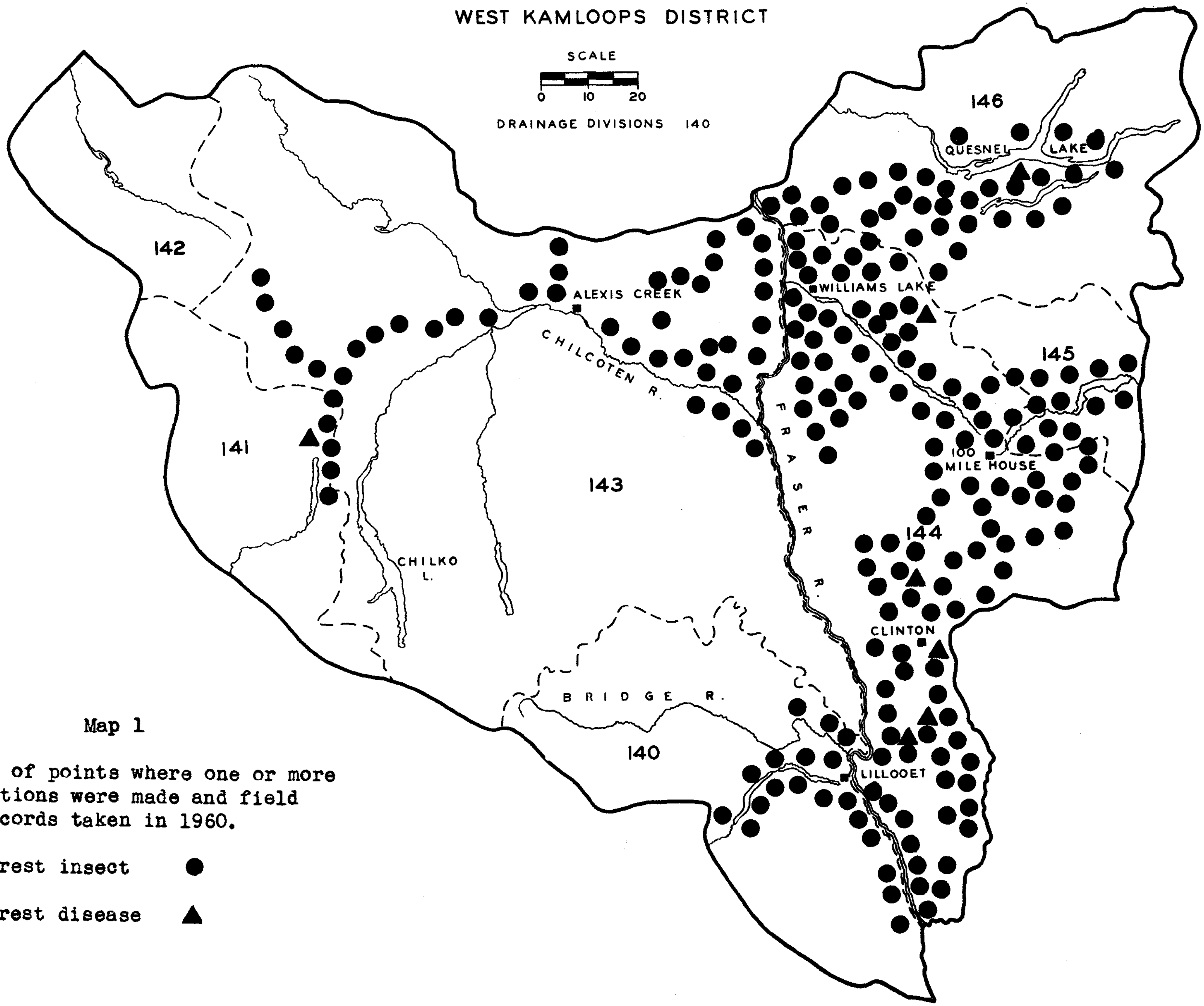
The annual examination of seedlings in the exotic plantations near Clinton was made in September. Only two of the original eight plots contained surviving seedlings. These were XP 113 consisting of Scots pine and XP 114 containing red pine. Five additional seedlings of each species died in 1960 reducing the survival rate to 27 per cent for Scots pine and 13 per cent for red pine.

Table 9 shows the original number of seedlings of each species and the survival for 1959 and 1960.

Table 10

Summary of Disease Conditions on Exotic Plantations at Clinton, 1959 and 1960

Plot No.	Tree species	No. seedlings planted 1957	No. seedlings surviving 1959	1960	Percentage killed by drought 1959	1960
XP 113	Scots pine	95	31	26	67	73
XP 114	Red pine	95	22	17	76	87
XP 112	Scots pine	250	0	0	-	-
XP 115	Pinaster pine	12	0	0	-	-
XP 120	Japanese black pine	15	0	0	-	-
XP 121	Japanese red pine	15	0	0	-	-
XP 116	European larch	50	0	0	-	-
XP 119	European larch	100	0	0	-	-

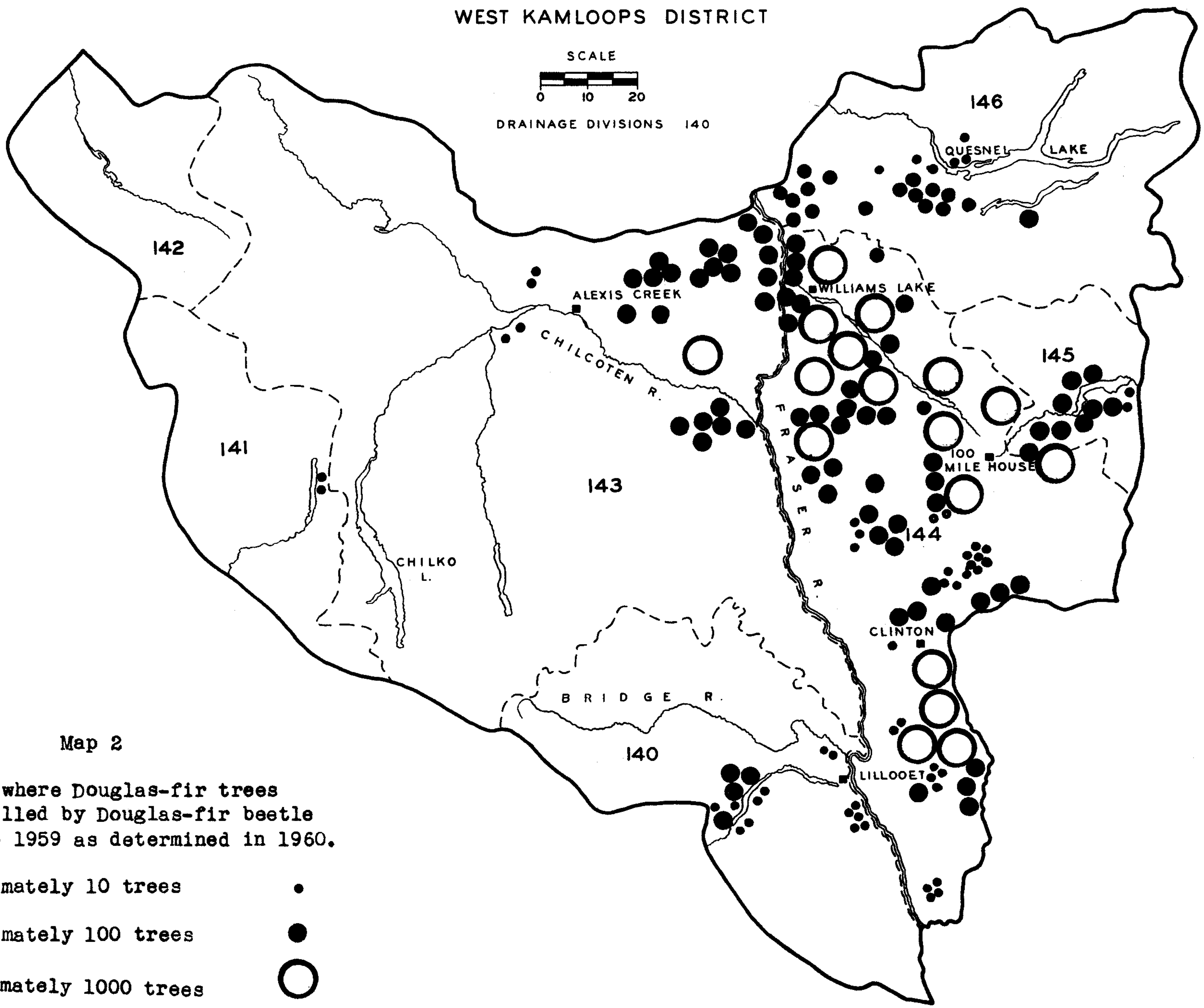


Map 1

Location of points where one or more collections were made and field records taken in 1960.

Forest insect ●

Forest disease ▲



Map 2

Points where Douglas-fir trees have been killed by Douglas-fir beetle from 1957 to 1959 as determined in 1960.

Approximately 10 trees •

Approximately 100 trees ●

Approximately 1000 trees ○

ANNUAL REPORT OF FOREST BIOLOGY RANGER

for

CENTRAL KAMLOOPS DISTRICT

1960

FOREST BIOLOGY SURVEY

CENTRAL KAMLOOPS DISTRICT

1960

C. B. Cottrell

INTRODUCTION

Field work in the Central Kamloops Forest Biology Ranger District began on April 8 and ended on November 4, During the summer a sampling station was established near a weather recording station, 22 miles north-west of Kamloops, maintained by B. C. Interior Sawmills Ltd. Throughout the field season 310 insect and 18 forest disease collections were taken. Table 1 shows the collections by hosts. Map 1 shows the locations where one or more collections were made and field records taken in 1960.

Table 1

Collections by Hosts

Central Kamloops District - 1960

Coniferous hosts	Forest insects	Forest diseases	Broad-leaved hosts	Forest insects	Forest diseases
Cedar, western red	3	-	Alder, mountain	6	-
Douglas fir	80	2	Aspen, trembling	30	-
Fir, alpine	10	-	Birch, western white	6	1
Hemlock, western	18	-	Cherry, choke	4	1
Juniper, Rocky Mountain	12	-	Cottonwood, black	9	1
			Maple, Douglas	3	-
Pine, lodgepole	22	1	Willow spp.	9	9
Pine, ponderosa	43	1	Miscellaneous	18	-
Spruce, Engelmann	37	2			
			Total	85	12
Total	225	6	Grand total	310	18

STATUS OF INSECTS

Douglas-fir Beetle, Dendroctonus pseudotsugae Hopk.

The 1960 Douglas-fir beetle attack appears to have been light. At

Paul Lake, 90 trees which were lightly attacked in 1959, were attacked again in 1960 and killed. Five Douglas firs were attacked at McConnell Lake and three at Goose Lake.

At Goose Lake, one of the attacked trees was 44 inches d.b.h. and its bark was from five to seven inches thick. This is the largest, thickest-barked Douglas fir known to have been attacked by the beetle in this District.

In July 1960, red-topped Douglas-fir trees apparently killed during 1957-59 were counted, (See Map 2). The loss of 432,770 cubic feet, shown in Table 2, was computed by multiplying the number of dead trees by the estimated volume for beetle-killed Interior Douglas-fir in each district. Volume estimates were based on the measurements of 25 trees in each area.

Table 2

Douglas-fir Trees Killed by the Douglas-fir Beetle in the Period 1957 to 1959, as Determined in 1960, Central Kamloops District

Locality	Number of dead trees	Average volume per tree (cubic feet)	Estimated volume of timber (cubic feet)
Arrowstone Hills	358	90	32,220
Tranquille Forest Reserve	1113	100	111,300
Niskonlith Forest Reserve	977	80	78,160
Long Lake Forest Reserve	272	40	10,880
Highland Valley	1245	90	112,050
Monte Hills	416	50	20,800
Salmon Lake Region	370	80	29,600
Kane Valley	472	80	37,760
Total	5223		432,770

Engelmann Spruce Beetle, Dendroctonus engelmanni Hopk.

A moderate population of beetles was found in numerous log decks along Jamieson Creek. Logs near Sock Lake contained a light population. No attacks were found in standing Engelmann spruce in the District.

Mountain Pine Beetle, Dendroctonus monticolae Hopk.

Only 22 attacked white pine were observed in the North Thompson Valley from Blue River to Gosnell, and 25 trees on Barton Creek, northwest of Adams Lake. There has been a continual decline of this beetle in the Central Kamloops District since 1951.

Western Hemlock Looper, Lambdina fiscellaria lugubrosa (Hulst)

In 1960 there was an increase in the number of larvae collected from western hemlock in the North Thompson Valley. In 1957 the average number of larvae taken was 0.2 per three-tree beating collection; in 1958, 0.6; in 1959, 1.8; and in 1960 an average of 4.0.

Previous to 1957, larvae were numerous throughout the cedar-hemlock stands between Blue River and Albreda, but since then, larvae have mostly been found near Pyramid in an area approximately three miles long.

Spruce Budworm, Choristoneura fumiferana (Clem.)

Larval populations of the one-year-cycle spruce budworm remained at a low level in the Montane Forest Region of the Central Kamloops District. During the larval feeding period in 1960, 49 Douglas-fir collections were made which contained an average of 0.2 larvae. In the same period in 1959, 33 Douglas-fir collections also averaged 0.2 larvae. The average number of larvae per Engelmann spruce collection was 0.2 in 1960 compared with 0.3 in 1959.

Two-year-cycle spruce budworm moderately defoliated the branch tips of mature alpine fir along the upper valley of Jamieson Creek.

Black-headed Budworm, Acleris variana (Fern.)

Larvae were scarce in collections from Douglas fir, alpine fir, Engelmann spruce and western hemlock throughout the District.

Saddle-backed Looper, Ectropis crepuscularia Schiff.

Eighty per cent of western hemlock collections from Clearwater to Clemina contained from one to five larvae of the saddle-backed looper. Heavy defoliation occurred in this area from 1950 to 1952; since then few larvae were found until 1960.

Sawflies on Coniferous Hosts, Neodiprion spp.

The infestations on lodgepole pine at Squilax and on ponderosa pine at Deadman River have collapsed. Only a few colonies were found at each site.

Sawfly larvae were frequently found in standard three-tree beating samples from six coniferous hosts in the District. The percentage of collections containing larvae and the average number of larvae in collections containing larvae are shown in Table 3 for the years 1958, 1959, and 1960.

Table 3

Three-tree Beating Collections of Neodiprion spp. from Six Coniferous Hosts, Central Kamloops District, in 1958, 1959, and 1960

Host	No. of collections during larval period			Percentage of collections with larvae			Av. no. of larvae per positive collection		
	1958	1959	1960	1958	1959	1960	1958	1959	1960
Douglas fir	62	53	65	60	64	52	11	9	5
Engelmann spruce	26	23	22	50	70	48	9	6	7
Western hemlock	10	4	7	70	100	86	10	24	40
Ponderosa pine	11	14	21	55	57	33	7	5	2
Lodgepole pine	15	21	17	40	67	35	5	13	13
Alpine fir	5	9	7	20	22	0	1	3	0

Satin Moth, Stilpnotia salicis (L.)

Satin moth larvae defoliated trembling aspens in three groves at Knutsford. One grove was 90 per cent defoliated, while most of the trees in two other groves were dead from repeated attacks.

West of Stump Lake, 15 groves of aspen were moderately to heavily defoliated.

Few larvae were found at Pritchard. Most of the 200 mature black cottonwoods, which have been attacked for four successive years, have suffered severe top-kill.

Aspen Leaf-miner, Phyllocnistis populiella Chamb.

The populations of aspen leaf-miners remained at a high level throughout the District. Leaf-miner counts were made at seven locations. The leaves from two 12-inch branches from each of five trees were taken, averaging more than 400 leaves per sample. The number of infested leaf surfaces and the number of adults produced per leaf surface are shown in Table 4.

At each location 100 cocoons were randomly selected and examined for pupal mortality. The percentage of cocoons which were parasitized or died from other causes is shown in Table 5.

Table 4

Percentage of Aspen Leaf Surfaces Mined and Number of Aspen Leaf-miner Adults Produced per Leaf Surface, Central Kamloops District, 1959 and 1960

Location	Percentage of leaf surfaces with mines		Number of adults produced per leaf surface	
	1959	1960	1959	1960
Paul Creek	22	56	0.06	0.30
Deadman River	87	73	0.31	0.37
Cache Creek	59	47	0.30	0.21
Campbell Range	50	20	0.27	0.10
Robbins Range	82	81	0.55	0.45
Fall Creek	70	91	0.38	0.46
Coldwater River	50	81	0.25	0.60

Table 5

Percentage Mortality of Aspen Leaf-miners in Cocoons in 100-cocoon Samples, Central Kamloops District, 1959 and 1960

Location	Percentage mortality in cocoon stage			
	Parasitized		Other causes	
	1959	1960	1959	1960
Paul Creek	9	0	2	9
Deadman River	26	18	0	9
Cache Creek	22	21	1	1
Campbell Range	10	25	2	9
Robbins Range	19	22	3	0
Fall Creek	0	32	2	4
Coldwater River	18	25	3	4

Spotless Fall Webworm, *Hyphantria* cunea Drury

There was an increase in larval webs on choke cherry and black cottonwood in the western part of the District from Spences Bridge to Merritt and in the Fraser Canyon. As shown in Table 6, 293 webs on various hosts were counted from a moving vehicle for seven miles near Spences Bridge, compared with 179 in 1959.

There were fewer larvae in the eastern portion of the District from Savona to Chase. At Savona, as shown in Table 7, 103 webs were counted in a three-mile "strip count", compared with 278 in 1959 and 809 in 1958.

Table 6

Spotless Fall Webworm Strip Counts, Spences Bridge to Seven Miles Southeast along the Nicola River, Central Kamloops District, August 10, 1960

Host	No. of webs per mile							Average per mile
	Mile 0-1	1-2	2-3	3-4	4-5	5-6	6-7	
Black cottonwood	88	8	32	15	15	5	19	26.0
Choke cherry	52	1	1	8	10	9	5	12.3
Saskatoon	6	-	9	-	4	-	2	3.0
Willow	-	-	-	-	2	-	2	0.6
1960 totals	146	9	42	23	31	14	28	41.9
1959 totals	72	23	16	17	23	13	15	25.6

Table 7

Spotless Fall Webworm Strip Counts, Savona Cut-off from East to West, Central Kamloops District, August 10, 1960

Host	No. of webs per mile			Average per mile
	Mile 0-1	1-2	2-3	
Choke cherry	43	4	3	16.7
Black cottonwood	14	3	6	7.7
Manitoba maple	-	10	-	3.3
Apple	-	10	-	3.3
Lombardy poplar	4	1	-	1.7
Trembling aspen	3	2	-	1.7
1960 totals	64	30	9	34.3
1959 totals	178	41	19	69.3
1958 totals	524	135	150	269.7

Forest Tent Caterpillar, *Malacosoma disstria* Hbn.

The 750-acre infestation on trembling aspen at Barton Creek, northwest of Adams Lake, has collapsed. A few larvae only were collected near the perimeter of the infested area. No larvae were taken in random beating samples in the District.

Western Tent Caterpillar, *Malacosoma pluviale* Dyar

Occasional tents were observed on choke cherry at Chase, and on wild rose at Knutsford.

Western Winter Moth, *Erannis vancouverensis* (Hulst)

The infestation on mountain alder and willow at Agate Bay collapsed in 1960. Only nine larvae were collected in a 10-acre area where up to 50 per cent defoliation occurred in 1959.

Douglas-fir Needle-miners, *Contarinia* spp.

A light to moderate population of *Contarinia pseudotsugae* Condr. was present throughout most of the range of Douglas fir in the District. The heaviest populations were in the North Thompson Valley. A light population of *C. constricta* Condr. was fairly common over most of the District. A light population of *C. cuniculator* Condr. was found at Squilax only.

Pine Needle Scale, *Phenacaspis pinifoliae* (Fitch)

There was a large increase in the number of ponderosa pines attacked by the pine needle scale near Lower Nicola. In 1959, a few scattered immature trees were affected, while in 1960, almost every pine was lightly attacked for three miles along the Mamette Lake road north of Lower Nicola. Small, light infestations were noted at Nicola, Savona and Kamloops. On June 2, hundreds of adults of a ladybird beetle, *Chilocorus tricyclus* Smith, were present on the trees.

A light attack persisted on lodgepole pine north of Barriere.

Jack Pine Needle Miner, *Zelleria haimbachi* Busck

Although not quite as numerous as in 1959, larvae were frequently found on the branch tips of ponderosa pine throughout its range in the District. One hundred tips were examined at four locations and the following percentages of infested tips were recorded: Martel, 16; Dot, 33; Savona, 24; Robbins Range, 21; and Barnhartvale, seven per cent.

An Ambrosia Beetle, Trypodendron sp.

Infested Engelmann spruce logs were found at two locations west of the North Thompson River; along Jamieson Creek, 25 miles north of Kamloops and Grizzly Lake, 16 miles west of Clearwater. At each site several hundred logs were attacked. The number of attacks ranged from 10 to 20 per square foot.

Poplar Borer, Saperda calcarata Say

The poplar borer heavily attacked trembling aspen in the Thompson and Nicola river valleys. The attacks were restricted to trees in open-growing groves at elevations of less than 3000 feet. In September, 12 plots were established in the District. At each site the percentage of aspens attacked and the number of attacks per tree were recorded, as shown in Table 8.

Table 8

Trembling Aspen Attacked by the Poplar Borer,
Central Kamloops District, September, 1960

Location	Elev. (feet)	No. trees examined	Percentage trees infested	Av. d.b.h. infested trees (inches)	Av. no. attacks per tree
Kamloops	1200	29	67	6.6	9.9
Cache Creek	1400	48	54	7.8	6.0
Clapperton	1500	15	73	4.8	9.4
Nicola	2100	49	41	5.8	4.3
Nicola Lake	2100	8	38	9.3	3.5
Quilchena	2100	30	0	-	0
Coldwater Valley	2200	67	61	6.3	4.3
Stump Lake	2500	72	8	8.0	2.5
Knutsford	2600	90	50	5.5	5.8
Campbell Range	3400	100	0	-	0
Aspen Grove	3800	60	0	-	0
Merritt (south)	3900	40	0	-	0

Cottonwood Crown Borer, _Aegeria tibialis_ Harris

Carolina poplars on the property of a Kamloops auto court were severely attacked by the cottonwood crown borer. By early September, larvae had entirely girdled the root collars of 19 out of 20 trees which were 10 years old and from six to eight inches d.b.h. All trees bordered a paved driveway and a few roots from each had been removed to prevent damage to the pavement. This may have attracted the borers which are found in black cottonwood and trembling aspen in the surrounding forest.

Sequoia Pitch Moth, _Vespamima sequoiae_ (Hy. Edw.)

Sequoia pitch moth larvae continued to damage immature lodgepole pine at McLure. Near Clearwater, 18 lodgepole pines, six inches d.b.h., were freshly attacked.

A Ponderosa Pine Cone Borer, _Dioryctria auranticella_ (Grote)

Fifty mature ponderosa pine cones were examined for borers at each of five locations in the District. The average percentage of infested cones in 1960 was 18.4, less than half the 1959 average of 37.2. The ponderosa pine cone crop was light in 1960. Table 9 shows the percentage of cones infested at five localities sampled.

Table 9

Percentage of Ponderosa Pine Cones Infested by _Dioryctria auranticella_ (Grote) in 50-cone Samples, Central Kamloops District, 1959 and 1960

Location	Percentage infested	
	1959	1960
Little Shuswap Lake	18	0
Savona	94	28
Mamette Lake	16	22
Nicola	36	36
Merritt	22	6
Average	37.2	18.4

A Sawfly, Xyela sp.

Samples taken in 1960 indicated a general decrease in _Xyela_ sawfly populations throughout the District. An average of 320 staminate flowers of ponderosa pine were examined at each of seven locations during May and June. Table 10 shows the percentage of flowers infested in 1957, 1958, 1959 and 1960.

Table 10

Percentage of Ponderosa Pine Staminate Flowers Infested by *Xyela* sp., Central Kamloops District, 1957 to 1960

Location	Percentage infested			
	1957	1958	1959	1960
Heffley	8	83	73	77
Barnhartvale	14	23	21	10
Nicola	37	35	40	18
Merritt	8	14	18	9
Savona	55	84	79	65
Kamloops	37	17	20	2
Lytton	-	40	31	7
Average	27	39	38	25

Ugly-nest caterpillar, *Archips cerasivoranus* (Fitch)

Ugly-nest caterpillars caused less damage in 1960 than in the past five years. The only area where severe defoliation occurred was at Birch Island where chokecherry along one mile of road-side was attacked.

A Leaf Roller, *Archips rosanus* Linn.

For several miles along the Fraser River, south of Lytton, approximately 35 per cent of the leaves of chokecherry, saskatoon and hazel had been rolled by late May. There was a heavy infestation in this area in 1957, when almost 100 per cent of the leaves of 11 broad-leaved trees and shrubs had been rolled. Larvae were scarce in 1958 and 1959. In 1960, gelechiid larvae were frequently found in conjunction with the leaf roller.

Alder Flea Beetle, *Altica ambiens* (Lec.)

A small infestation occurred in the Sinmax Creek Valley, 14 miles west of Agate Bay. By June 18, 20 large mountain alders were 30 per cent defoliated.

A Leaf Beetle, *Pachybrachys* sp., poss. *liebecki* Fall.

Immature black cottonwoods for three miles along the Nicola River Valley southeast of Spences Bridge were from five to ten per cent defoliated at the end of May. This was the first known infestation in the District.

Sage-brush Sheep-moth, *Pseudohazis hera pica* Wlk.

Larvae were commonly found on sagebrush, *Artemisia tridentata* Nutt., north of Kamloops and along the north side of Kamloops Lake westward to Deadman River. No defoliation could be attributed to this caterpillar, as much of the sagebrush was heavily defoliated by larvae of a leaf-beetle, *Trirhabda pilosa* Blake. The sheep-moth was seldom collected in the interior of British Columbia before 1959.

OTHER NOTEWORTHY INSECTS

Insect	Host	Number of collections	Remarks
Abagrotis mirabilis Grt.	Js	3	rare
Achytonix praeacuta Sm.	F	7	found singly
Caripeta divisata (Wlk.)	H	5	N. Thompson Valley only
Dioryctria pseudotsugella Munroe	F	5	Thompson Valley only
D. reniculella (Grote)	Se	1	decrease
Enypia moillieti Blkmre.	F	2	decrease
Epirrita autumnata Harr.	Se	1	decrease
Eucordylea atrupictella Dietz.	F, Se, Pl	7	plentiful at McGillivray
Eupithecia annulata Hlst.	F, Se	6	decrease
E. luteata bifasciata (Dyar)	F	3	decrease
E. niphadophilata Dyar	Js	3	increase
Feralia comstocki Grt.	F, H	5	increase
F. jocosa Gn.	F, H	6	increase

Insect	Host	Number of collections	Remarks
Gabriola dyari Tayl.	F, H	5	decrease
Griselda radicana Wlshm.	F, Se, Js	22	common
Hypagyrtis piniata Pack.	F, Se	3	decrease
Lithophane lepida Lint.	Js	1	rare
Melanolophia imitata Wlk.	F, Se	5	decrease
Nepytia canosaria Wlk.?	F	4	decrease
Pero behrensarius Pack.	F	3	decrease
Pikonema alaskensis (Roh.)	Se	5	decrease
P. dimmockii (Crese.)	Se	7	decrease
Protoboarmia p. indicataria Wlk.	F, Pl	6	decrease
Semiothisa adonis B. & McD.	Pl	2	decrease
S. granitata Gn.	F, Se, H	7	numerous at Pyramid
S. setonana B. & McD.	Js	1	decrease
Stenoporpia satisfacta B. & McD.	F	1	decrease
Synaxis jubararia Hlst.	F, Se, H	9	increase
Xylomyges hiemalis Grt.	F	1	decrease
Zale duplicata largera Sm.	Pl	2	decrease
Zeiraphera fortunana Kft.	Se	1	decrease

STATUS OF FOREST DISEASES

Important Diseases

Needle Cast on Ponderosa Pine

Damage to the foliage of ponderosa pine caused by the needle cast, Elytroderma deformans (Weir) Darker, was generally lighter throughout the District than in previous years. For an indication of the extent of past damage, two plots were established in June, 1960. In co-operation with Mr. A. Foster, Forest Pathology Laboratory, quarter-acre plots were set up at Lower Nicola and Kamloops, two heavily infected areas. At Lower Nicola, the foliage infection ranged from 10 to 80 per cent and averaged 53 per cent on 33 trees examined. Of the 33 pines, 80 per cent had brooms or deformed branches. At Kamloops, where 71 trees were examined, foliage infection ranged from 0 to 100 per cent and averaged 52 per cent, and 45 per cent of the trees had brooms. Table 11 shows the number of trees in each infection category.

Table 11

Extent of Needle Cast Damage to Ponderosa Pine in
Two Plots, Central Kamloops District, 1960

Estimated percentage foliage infection exclusive of 1960 growth	No. of trees	
	Lower Nicola	Kamloops
0	0	1
10	1	7
20	2	7
30	2	6
40	6	11
50	5	6
60	4	7
70	4	4
80	5	4
90	1	8
100	3	10
Total	33	71

A Leaf Cast on Black Cottonwood

A green fungus was found on the leaves of black cottonwood in a 10-acre stand of mature trees along Sinmax Creek. By early June, most of the leaves had discoloured and fallen off. The cause of the infection has not yet been determined.

Injury to Babylon Weeping Willow

During June and July it was noted that many Babylon weeping willows, *Salix babylonica* L., in the Central Kamloops District were in poor condition. The leaves of some trees turned yellow and fell off during July, while bark cracks appeared around dead areas of cambium. The cause of the injury may have been a combination of a disease pathogen on the bark and severe frosts in November 1959. Wisconsin weeping willow, *Salix blanda* Anders, was not affected.

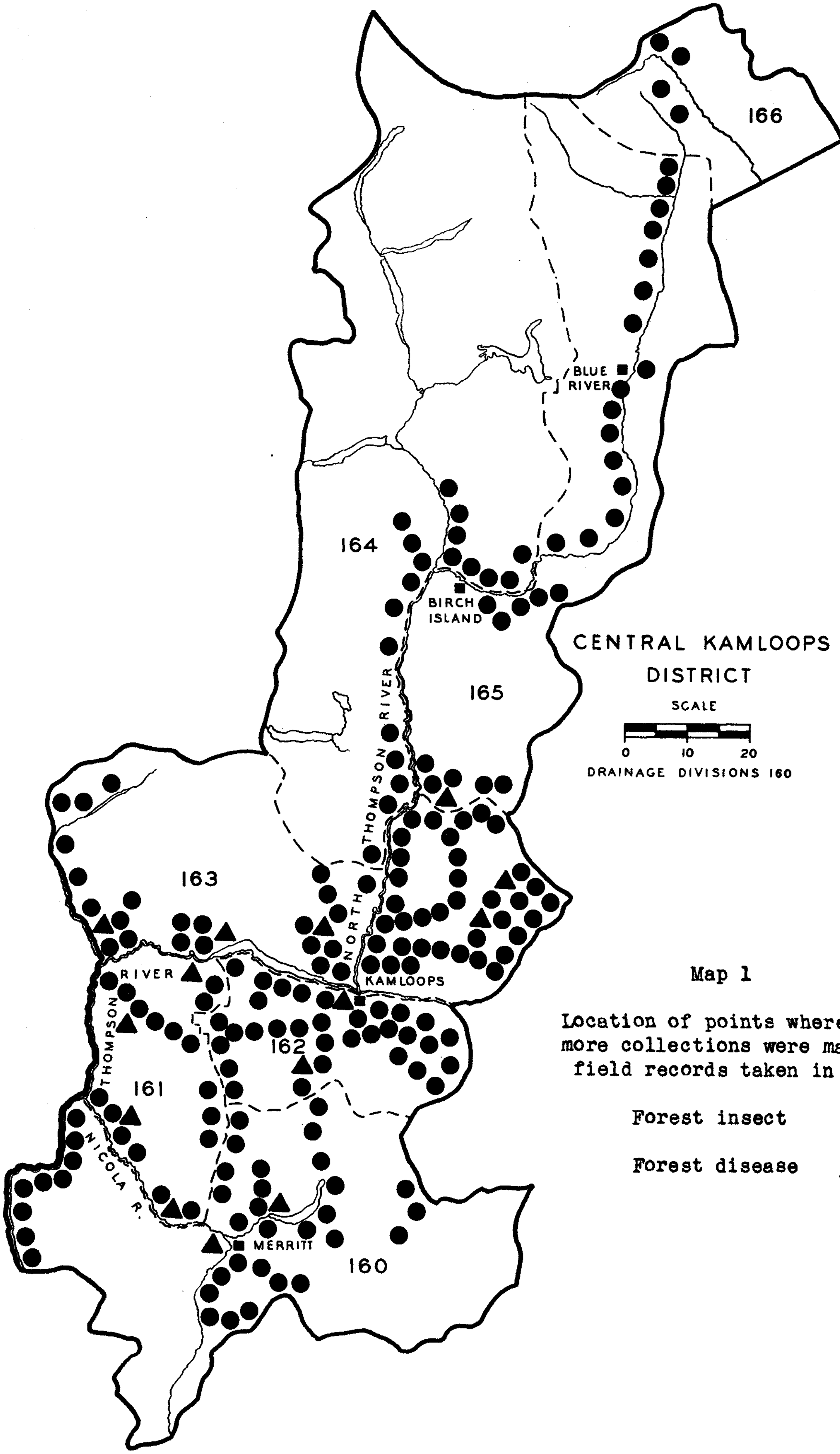
In August, Babylon weeping willows at 10 locations in the District were tallied and placed in one of five groups as shown in Table 12.

1. Healthy - dense crown, green foliage
2. Light damage - thin crown, yellow foliage
3. Moderate damage- very thin crown, loss of some foliage, some dead branches
4. Severe damage -- 50 per cent dead branches
5. Dead

Table 12

Condition of Babylon Weeping Willow at 10 Locations in the Central Kamloops District, August, 1960

Location	No. and condition of trees					Totals
	healthy	light	moderate	severe	dead	
North Kamloops	242	152	43	19	29	485
Brocklehurst	130	36	17	7	4	194
Westsyde	79	39	9	0	1	128
Kamloops	99	78	41	22	11	251
Valleyview	116	86	24	4	9	239
Savona	4	7	2	1	0	14
Cache Creek	9	5	1	2	4	21
Ashcroft	3	9	3	5	0	20
Lytton	14	6	1	0	0	21
Merritt	17	4	0	1	5	27
Totals	713	422	141	61	63	1400

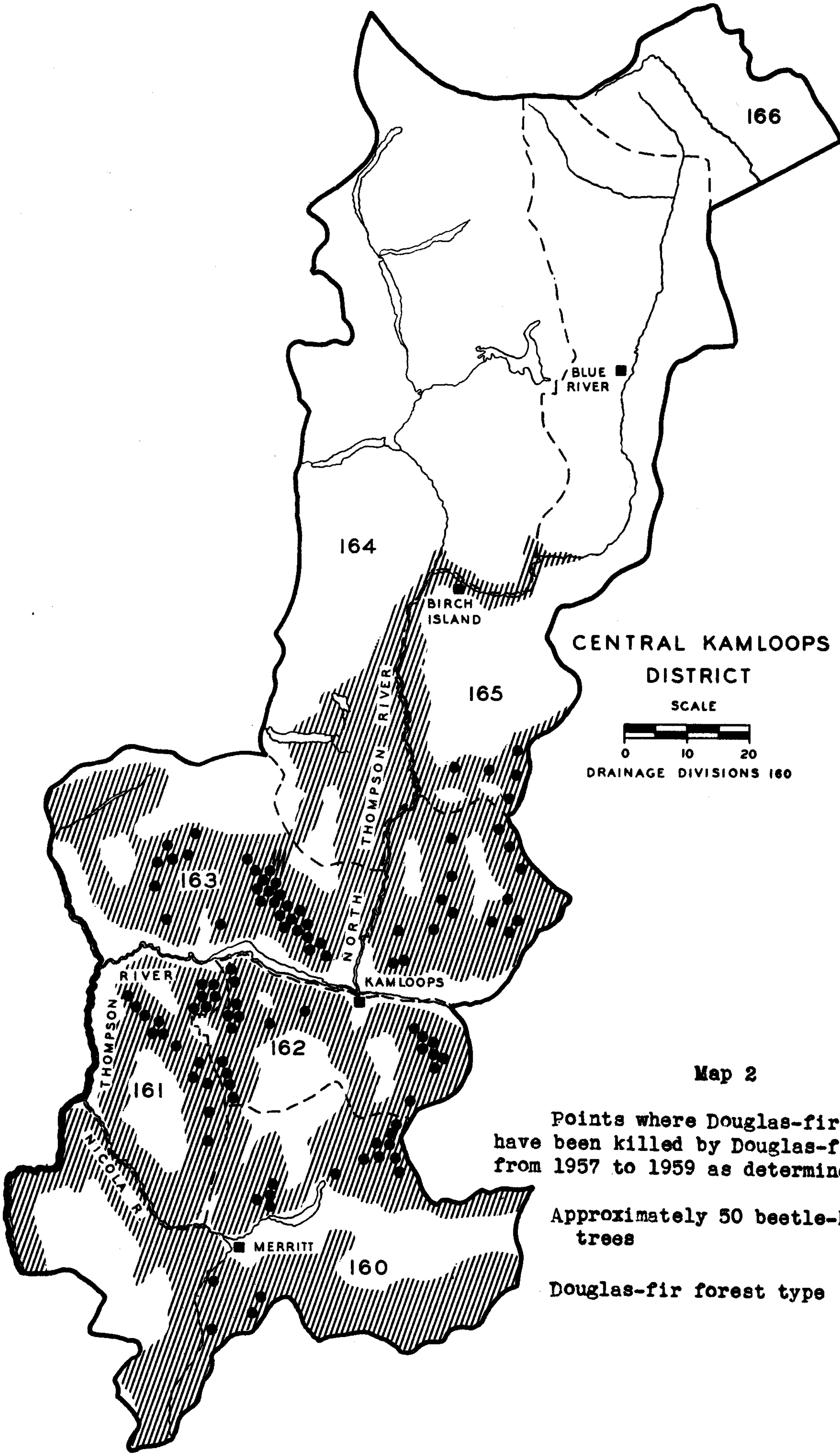


Map 1

Location of points where one or more collections were made and field records taken in 1960.

Forest insect ●

Forest disease ▲



Map 2

Points where Douglas-fir trees have been killed by Douglas-fir beetle from 1957 to 1959 as determined in 1960.

Approximately 50 beetle-killed trees ●

Douglas-fir forest type

ANNUAL REPORT OF FOREST BIOLOGY RANGER

for

EAST KAMLOOPS DISTRICT

1960

FOREST BIOLOGY SURVEY

EAST KAMLOOPS DISTRICT

1960

B. A. Sugden

INTRODUCTION

Field work in the East Kamloops Forest Biology Ranger District began during the first week in April and continued until the last week in November. During the field season a total of 385 insect and 14 forest disease collections were made. Table 1 contains a list of the host trees and the number of insect and forest disease collections made from each species. Map 1 shows each location where one or more insect and forest disease collections or field records were obtained in 1960.

Table 1

Collections by Hosts

East Kamloops District - 1960

Coniferous hosts	Forest insects	Forest diseases	Broad-leaved hosts	Forest insects	Forest diseases
Cedar, western	1	-	Alder spp.	20	-
Douglas fir	96	4	Aspen, trembling	9	-
Hemlock, western	18	-	Birch spp.	19	2
Juniper, Rocky Mountain	3	-	Ceanothus spp.	9	-
			Cherry, choke	20	-
Larch, western	18	-	Cottonwood, black	28	2
Pine, lodgepole	16	2	Ocean spray	5	-
Pine, ponderosa	43	-	Willow spp.	27	1
Pine, Scots	1	-	Miscellaneous	37	3
Pine, western white	3	-			
Spruce, Engelmann	13	-			
			Total	174	8
Total	212	6	Grand total	386	14

STATUS OF INSECTS

Douglas-fir Beetle, Dendroctonus pseudotsugae Hopk.

During April and May, 1960, the needles of Douglas-fir trees killed by the Douglas-fir beetle in 1959 began to fade and turn red. The large number of fresh red tops in the Ingram Creek-Monte Lake area showed that the 1959 estimate of the Douglas-fir beetle population for that region had been conservative. In the remainder of the District a light population persisted. Table 2 contains numbers and volumes of Douglas fir killed by the Douglas-fir beetle during 1957, 1958 and 1959. To obtain the figures shown in the table the average volume of five infested trees was taken at each infestation examined.

Table 2

Number and Volume of Douglas-fir Trees Killed by Douglas-fir Beetle in the East Kamloops District in 1957, 1958 and 1959 as Determined in 1960

Location	Number of trees	Volume (cubic feet)
Lumby	157	13,980
Cherryville	132	10,536
Enderby to Mabel Lake	179	13,425
Westwold to Salmon Lake	210	13,280
Falkland	252	17,136
Ingram Creek	800	54,000
Woods Lake	160	10,400
Westwold to Monte Creek	300	20,400
Pinaus Lake	114	6,840
Duck Range	60	3,600
Shuswap	40	2,400
Adams Lake (east side)	120	8,400
West side of Okanagan Lake	358	21,480
Princeton to Aspen Grove	206	14,420
Mara to Sicamous	77	5,775
Squilax	54	3,510
Totals	3,219	219,582

The total count of beetle-killed Douglas fir for 1957, 1958 and 1959 exceeded that for 1957 and 1958 by 1,859 trees. Most of these trees were killed in 1959 and showed up as red tops in 1960.

The foliage of Douglas-fir trees infested by Douglas-fir beetles in 1960 at Ingram Creek, Bear Creek, Monte Lake and Pillar Lake, had commended to fade and turn red by mid-September. These trees were not included in Table 2. Map 2 shows the distribution and volume of beetle-killed fir for the years 1957 to 1959 inclusive.

Mountain Pine Beetle, Dendroctonus monticolae Hopk.

Light populations of mountain pine beetle remained active in the Mabel Lake, Trinity Valley and Douglas Lake districts. In addition, beetle-killed white pines were examined at Malakwa and Scotch Creek. Table 3 contains the tree species, number of trees and volume killed by the mountain pine beetle.

Table 3

Number of Trees and Volume Killed by Mountain Pine Beetle in East Kamloops District during 1958 and 1959

Location	Pine species	No. of trees killed	Volume (cu. ft.)
Mabel Lake and Trinity Valley	western white	686	42,868
Scotch Creek	western white	52	3,640
Sicamous to Malakwa	western white	112	8,960
Douglas Lake	ponderosa	146	15,974
Douglas Lake	lodgepole	116	1,641
Totals		1,112	73,083

During 1959, mountain pine beetles killed four of 10 Scots pine on Dominion Forest Service Experimental Plot Number 62 near Pritchard. The infested pine were growing in a mixed stand of Douglas fir, ponderosa and lodgepole pines and ranged from six to eight inches d.b.h. There was no further damage to the Scots pine in 1960, but a ponderosa pine adjacent to the beetle-killed trees was infested by mountain pine beetle. The ponderosa and Scots pines were about 20 years old. Ambrosia beetles had infested the lower three feet of the stem of the Scots pines killed in 1959.

Western Pine Beetle, Dendroctonus brevicomis Lec.

Western pine beetles occurred sporadically throughout the range of ponderosa pine in the District. The populations remained low and damage was restricted to a few trees near Aspen Grove, Penticton, Okanagan Centre and Silver Creek. Ponderosa pine attacked near Penticton had been infested for a number of years by pine needle scale and at Okanagan Centre western pine beetle were found in trees infested with the Oregon pine engraver.

Red Turpentine Beetle, Dendroctonus valens Lec.

Scots pine growing on Dominion Forest Service Experimental Plot Number 59 near Westwold were infested on the lower four feet of the stem by the red turpentine beetle. All three trees on the plot were attacked but only one had died in 1960. These pine had been severely damaged by porcupines prior to beetle attack.

Engelmann Spruce Beetle, Dendroctonus engelmanni Hopk.

The light population of Engelmann spruce beetle reported in 1959, on a White Rocks Mountain logging operation, had subsided. During a survey, two spruce trees were found that had been attacked in 1960 but in both instances the beetles had been unsuccessful.

In the sub-alpine forest near Spa Lake, north-east of Falkland, a deck of 16 Engelmann spruce logs had been lightly infested in 1960. The logs had been cut in the late spring of the same year.

Western Balsam Bark Beetle, Dryocoetes confusus Sw.

Western balsam bark beetle activity has declined in the sub-alpine forests near Bolean Lake and the headwaters of Scotch Creek on the Adams Plateau. Plots established in 1958, near Bolean Lake, were surveyed again in September of 1960. Table 4 contains the number and volume of alpine fir killed on the three plots.

In 1958 a total of 62 alpine fir trees were infested while in 1960 only four fir were attacked. This decline in western balsam bark beetle activity, found on the plots, was representative of the status of the beetle in all sub-alpine forests surveyed in the District during 1960.

Table 4

Number and Volume of Alpine Fir Trees Apparently Killed by Western Balsam Bark Beetles near Bolean Lake, on Three Two-acre Plots, September, 1960

Plot number	No. of fir attacked in 1958	No. of fir attacked in 1960	Percentage of fir killed	Volume of fir killed (cu. ft.)
1	29	0	42	5,760
2	16	3	21	3,600
3	17	1	27	3,995
Totals	62	4	-	13,355

Oregon Pine Engraver, Ips oregoni (Eich.)

Ponderosa pine tops and limbs that remained on sites of 1960 winter and spring logging operations near Okanagan Landing and on the Salmon River Indian Reserve were heavily infested during the spring of 1960. Oregon pine engraver beetles were observed entering ponderosa pine slash and eggs were found in some galleries on April 27. This material contained callow adults and pupae when re-examined shortly after mid-June. The pole-sized pine remaining on these logged areas may be attacked in the spring of 1961.

During 1958 and 1959, the Oregon pine engraver appeared to attack the crowns of young ponderosa pine. To obtain information regarding the distribution of attacks on pine by this species, two trees were felled in mid-February. By mid-May the trees were infested and samples of the scolytids found under the bark were taken. A sample consisted of a one-foot cylinder of bark removed at five-foot intervals from the butt to the upper crown. Tables 5 and 6 show the number and species of scolytids found under each sample.

The crown of the tree felled at Okanagan Centre began at 13 feet and that of the Salmon River tree at 18 feet. Attack by the Oregon pine engraver was confined to the crown in both instances. The limbs and main stem of the upper crown had been infested by Pityogenes carinulatus The main stem below the crown had been lightly infested by the larger I. emarginatus and the stump had been attacked by the red turpentine beetle.

Table 5

Number and Species of Scolytidae per Sample from a Ponderosa Pine Felled in February near Okanagan Centre and Examined in May, 1960, East Kamloops District

No. of ft. from butt	Diameter of sample (inches)	Thickness of bark (mm.)	Scolytid species	No. of beetles
Stump	9.2	24	*Dendroctonus valens*	8
5	7.5	12	*Ips emarginatus*	3
10	6.8	12	*I. emarginatus*	2
15	6.3	10	*I. oregoni*	7
20	5.3	9	*I. oregoni* and	20
			Pityogenes carinulatus	1
25	4.2	7	*I. oregoni*	10
30	3.2	5	*I. oregoni* and	1
			Pityogenes carinulatus	7
35	1.5	4	*P. carinulatus*	5

Table 6

Number and Species of Scolytidae per Sample from a Ponderosa Pine felled in February on Salmon River Indian Reserve and Examined in May, 1960, East Kamloops District

No. of ft. from butt	Diameter of sample (inches)	Thickness of bark (mm.)	Scolytid species	No. of beetles
Stump	10.3	27	*Dendroctonus valens*	5
5	9.0	18	*Ips emarginatus*	4
10	8.2	14	*I. emarginatus*	9
15	7.4	12	*I. emarginatus*	6
20	6.1	11	*I. emarginatus* and	2
			I. oregoni	14
25	5.3	10	*I. oregoni*	18
30	4.0	8	*I. oregoni* and	9
			Pityogenes carinulatus	5
35	3.3	5	*P. carinulatus*	4
40	1.7	4	*P. carinulatus*	2

Sawyer Beetles in Fire-killed Ponderosa Pine, Monochamus spp.

On July 7, 1960, fires occurred at Carrs Landing and O'Keefe in ponderosa pine forests. The Carrs Landing fire extended over 1300 acres and the O'Keefe fire damaged about 220 acres. Both fires were under control on July 8.

During the latter part of October a plot was established at the site of each fire by Forest Biology Rangers J. Grant, E. Morris and W. Bitz. Ten ponderosa pine were felled and sampled at Carrs Landing and five felled and sampled at O'Keefe. Eight samples, consisting of one-foot sections, were cut from the main stem of each tree, beginning at the base. These blocks were peeled and split, and the number of entrance holes and the depth of penetration recorded. Tables 7 and 8 show the damage by Monochamus spp. larvae to the fire-killed pine at Carrs Landing and O'Keefe.

Table 7

Damage to Fire-killed Ponderosa Pine by Monochamus spp., Carrs Landing, October, 1960, East Kamloops District.

Tree no.	D.b.h. (inches)	Height (feet)	Av. no. of entrance holes per sq. ft.	Maximum penetration (inches)
1	9.0	60	3.58	4.0
2	9.5	69	1.06	4.0
3	10.0	62	3.23	4.0
4	11.5	70	1.44	3.5
5	12.5	71	2.90	4.2
6	10.0	60	3.11	3.7
7	10.5	63	2.37	3.0
8	12.0	79	0.23	2.0
9	8.5	66	0.63	3.0
10	11.5	80	0.20	2.2

The ratio of pupal cells to entrance holes at the Carrs Landing plot was 1 to 6.7 and 1 to 2.4 at the O'Keefe Plot. The upper two thirds of the trees sampled had been more heavily infested than were the lower portions. Evidence of woodpecker predation was noted on all trees felled. The sawyer beetle larvae were most vulnerable to woodpecker predation after the pupal cells had been formed.

Table 8

Damage to Fire-killed Ponderosa Pine by Monochamus spp., O'Keefe, October, 1960, East Kamloops District.

Tree no.	D.b.h. (inches)	Height (feet)	Av. no. of entrance holes per sq. ft.	Maximum penetration (inches)
1	8.5	52	2.87	5.0
2	10.0	63	1.68	3.5
3	9.3	50	2.51	3.5
4	11.5	54	3.72	4.5
5	11.0	66	2.22	4.0

Infested sections of fire-killed pine were taken to the Insectary at Vernon so larvae could complete their development and adults be obtained for identification. At the time of writing two species have emerged from the samples, Monochamus oregonensis Lec. and M. maculosus Hald.

Ambrosia Beetles, Trypodendron lineatum (Oliv.)

Cedar poles in the bush near Sugar Lake attracted a large population of ambrosia beetles during early June. Severe damage to the poles was averted by the use of chemical spray.

Satin Moth, Stilpnotia salicis (L.)

New infestations of satin moth occurred near Okanagan Centre and Vernon in 1960. At Okanagan Centre the infestation extended over two and a half acres bordering the shore of Okanagan Lake. Defoliation of black cottonwood ranged from 50 to 100 per cent. The average d.b.h. of the defoliated trees was 10 inches. Willow and aspen growing in the understory were also severely defoliated. Moths were flying by June 16. North of Vernon a group of seven ornamental poplar shade trees were heavily defoliated.

Counts of overwintering satin moth larvae were made at Duck Lake and Shuswap. At each locality, three black cottonwood over 12 inches d.b.h., were selected in a grove where satin moth had been active. Samples consisted of square-foot areas of bark surface spaced at two-foot intervals on the south side of each tree, from one foot above ground level to a height of seven feet. All hibernacula on the samples were tallied. Comparative numbers of overwintering satin moth larvae for the years 1958, 1959 and 1960 are shown in Table 9.

Table 9

Numbers of Hibernating Satin Moth Larvae per Square Foot of Bark Surface, in Three One-foot-square Samples from Each of Six Black Cottonwood Trees at Shuswap and Duck Lake, East Kamloops District, 1958, 1959 and 1960

Tree no.	Location	D.b.h. of tree (inches)	Av. no. of larvae per sq. ft. 1958	1959	1960
1	Shuswap	16	51	1	0
2	Shuswap	14	26	0	0
3	Shuswap	14	33	3	0
4	Duck Lake	12	30	26	4
5	Duck Lake	14	31	45	1
6	Duck Lake	13	27	38	7

The infestation at Shuswap has subsided. Defoliation of black cottonwood and trembling aspen at Duck Lake was moderate to severe in 1960. A group of seven trembling aspen died, presumably from repeated attack by satin moth. Table 9 indicates that little defoliation may be expected in 1961.

Spruce Budworm, *Choristoneura fumiferana* (Clem.)

One-year-cycle spruce budworm larvae were rare in the District during 1960.

The populations of two-year-cycle budworm remained low in the subalpine forests of the Adams Plateau, Monashee and Spa Hills. No larvae were found on Engelmann spruce or alpine fir examined in the accessible portions of these forests.

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

Larvae of the black-headed budworm were taken infrequently in collections during 1960. A total of five larvae was collected, four from Engelmann spruce and one from Douglas fir.

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

During 1960, poplar and willow borer damage was found in four will remain active in 1961 but the population should continue to decline.

Aspen Leaf-miner, Phyllocnistis populiella Cham.

The aspen leaf-miner remained active throught the District but a decline was apparent in some groves of trembling aspen. Plots established and sampled in 1959 were sampled again this year. Tables 12 and 13 contain information obtained from these samples for 1959 and 1960.

Table 12

Aspen Leaf Surfaces Mined and Number of Adults Produced in Samples, East Kamloops District, 1959 and 1960

Location	Percentage of leaf surfaces with mines		Number of adults per leaf surface	
	1959	1960	1959	1960
Carlin	82	41	.24	.11
Phillips Lake	71	86	.19	.32
Falkland	74	14	.16	.01
Glenemma Range	32	58	.08	.25

Table 13

Mortality of Aspen Leaf-miner in 100-cocoon Samples, East Kamloops District, 1959 and 1960

Location	Percentage mortality			
	Parasitism		Other causes	
	1959	1960	1959	1960
Carlin	25	29	2	4
Phillips Lake	18	21	4	12
Falkland	16	36	5	3
Glenemma Range	34	31	11	6

The aspen leaf-miner is expected to remain active in 1961.

Jack Pine Needle-miner, Zelleria haimbachi Busck.

Larvae of the jack pine needle-miner were common throughout the widely separated localities. The greatest damage occurred near Larkin. Most of the large willows had been killed over approximately four acres. This infestation will remain active in 1961.

Occasional groups of willows bordering the Salmon River west of Falkland have been attacked by the poplar and willow borer for several years. Some tree mortality has resulted.

West of Squilax three clumps of willows had been attacked and the largest trees had died.

Poplar and willow borer damage to alders was noted southwest of Sicamous along the shore of Shuswap Lake. The attack was light on all the alder trees examined. There was no tree mortality.

Willows attacked by the poplar and willow borer ranged from two to six inches d.b.h. and infested alder ranged from two to three inches. Damage will probably continue through 1961 as larvae were found in samples taken at each infestation.

Pine Needle Scale, *Phenacaspis pinifoliae* (Fitch)

Light damage to the needles of marginal ponderosa pine occurred from Winfield south to Oliver. Mortality of reproduction and pole-sized pine, weakened by repeated attacks of pine needle scales, continued in 1960. Since 1955 an estimated 1,295 ponderosa pine have been killed by the pine needle and black pine leaf scales. This situation has improved during 1959 and 1960 with the decline in population of the scales. Many of the weakened trees are apparently recovering.

In October samples of ponderosa pine foliage were collected at random from Naramata, Summerland and Winfield, and four needles of the 1960 growth on each of three samples were examined to determine the condition of the scales. Only scales established on the inner surfaces of the needles were counted. Data obtained from these samples are contained in Table 10.

The decline in number of scale examined on 12 needles in 1960 as compared to the number in 1959 parallels the trend observed throughout the infestation. There were insignificant amounts of predation and parasitism of scales but the main cause of scale mortality has not been determined. Occasional ponderosa pine trees may still be found, however, that support a large population of pine needle scales.

Table 10

Number of Pine Needle Scales Examined and Percentage of Scale Mortality on Samples of 12 Current Needles of Ponderosa Pine from each of Three Locations, East Kamloops District, 1959 and 1960

Location	Av. length of needles (inches)		No. of scales examined		Percentage scale mortality	
	1959	1960	1959	1960	1959	1960
Naramata	4.69	4.75	1,377	58	97	24
Summerland	4.38	4.27	658	32	9	16
Winfield	4.10	4.23	676	115	51	12

Black Pine Leaf Scale, Nuculaspis californica (Cole.)

The black pine leaf scale continued to infest ponderosa pine from Naramata south to Skaha Lake. The infestation was much less severe than during the past five years.

Samples of ponderosa pine foliage infested with black pine leaf scale were taken from the same trees as those sampled in 1959 near Naramata and Skaha Lake. The inner surfaces of four needles from each of three samples were examined and the condition and number of scales recorded. Data obtained from these samples are shown in Table 11.

Table 11

Number of Black Pine Leaf Scales Examined and Percentage Mortality on 12-needle Samples of Ponderosa Pine Needles, East Kamloops District, 1959 and 1960

Location	Av. length of needles (inches)		No. of scales examined		Percentage scale mortality	
	1959	1960	1959	1960	1959	1960
Naramata	3.31	4.05	820	201	58	72
Skaha Lake	5.06	4.78	130	111	29	36

Some scales examined were killed by predators and parasites however most of the scales had died from unknown causes. The black pine leaf scale range of ponderosa pine at lower elevations in the southern portions of the District. A light infestation extending over four acres of reproduction ponderosa pine on the west side of Vaseaux Lake remained active. Examination of the branch tips and leaders on three ponderosa pines averaging seven feet in height showed that 84 per cent of the tips and leaders had been infested. This is an increase of six per cent over 1959; however, of the 84 per cent of leaders and branch tips infested only 12 per cent had been completely damaged. Reproduction ponderosa pine generally appeared to be more adversely affected by the jack pine needle-miner than were the larger trees.

A Flea Beetle on Alder, *Altica* sp.

During 1960, two small infestations of a flea beetle on alder were found. Near the mouth of Salmon River severe skeletonization extended over three acres and north of Larkin similar damage occurred on one acre.

An infestation near the Kelowna Airport remained active but skeletonization of the alder leaves was much lighter in 1960.

A Leaf Beetle on Poplar, *Chrysomela scripta* Fab.

A large population of this species, near Winfield, caused severe damage to seven small ornamental poplars. Beetles were numerous on August 26, 1960; some pupae and large larvae were also present.

A Sawfly in the Staminate Flowers of Ponderosa Pine, *Xyela* sp.

Although there were generally more staminate flowers on ponderosa pine in 1960 than in 1959, the flower crop was not heavy. To determine the degree of infestation of staminate flowers the same trees that were sampled for the past three years were used. At each locality, three flower clusters were examined on the north, south, east and west sides of the lower third of the crown on each of three trees. A total of 36 flower clusters was examined at each locality. Table 14 shows the percentage of staminate flowers infested in seven localities annually from 1957 to 1960.

The infestations have remained active though a general decline is evident on most of the plots.

The plots established in May 1958 were examined again in 1960. At each plot three trees were sampled by hanging four cylindrical traps, at the cardinal points in the lower crown of each tree. The plots were visited daily and the number of *Xyela* sp. larvae that emerged from the flowers and dropped into each trap, recorded.

Table 14

Ponderosa Pine Staminate Flowers Infested by <u>Xyela</u> sp.
East Kamloops District, May, 1957 - 1960

Location	Percentage of flowers infested			
	1957	1958	1959	1960
Pritchard	45	87	31	6
Westwold	55	no flowers	no flowers	32
Glenemma Range	92	82	64	15
Winfield	39	56	no flowers	33
Kelowna	26	49	18	no flowers
Oliver	94	73	68	29
Princeton	14	11	no flowers	24

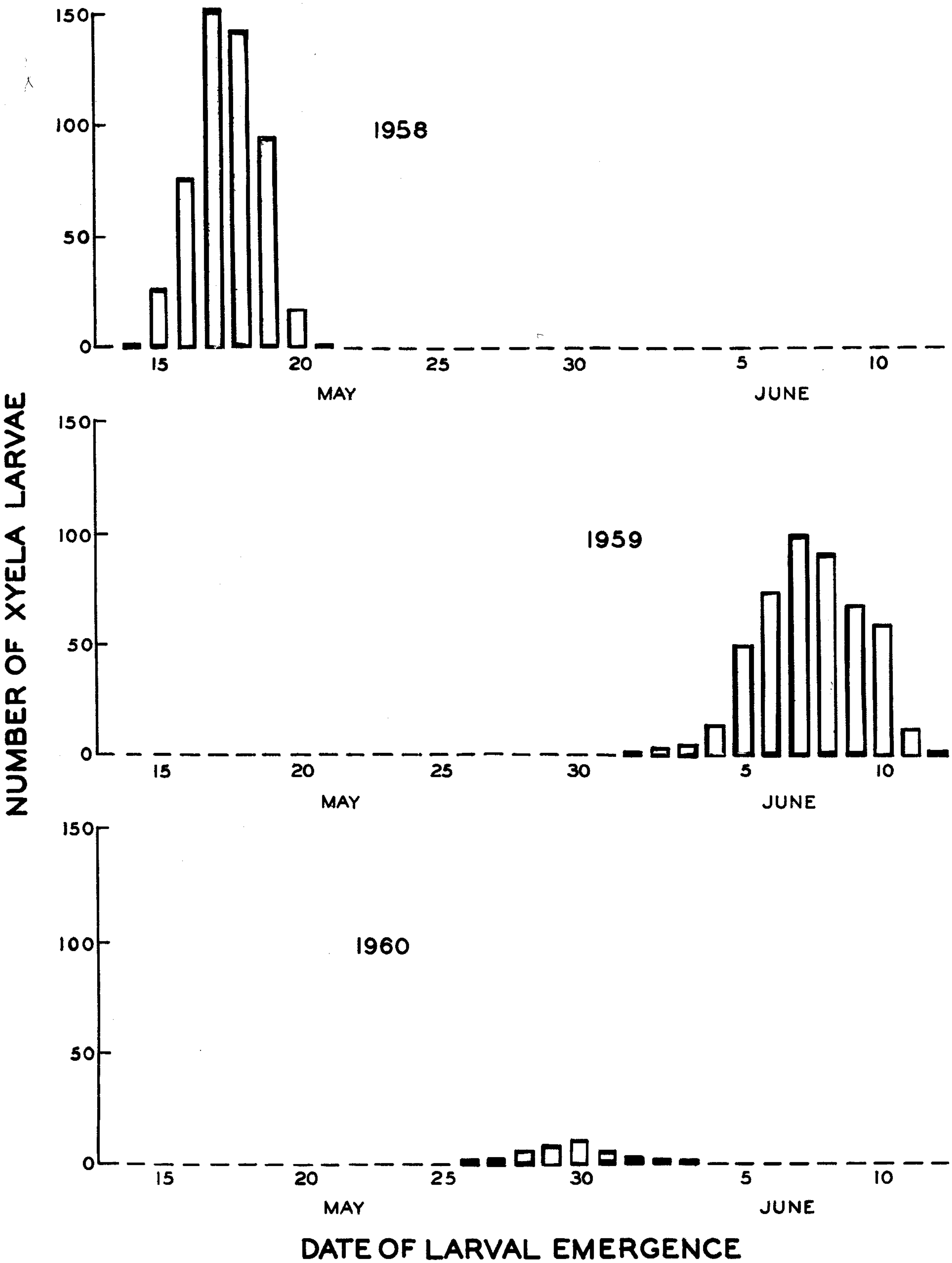
Graph 1 shows the number of larvae recorded daily and the emergence periods for 1958, 1959 and 1960.

The beginning of the emergence dates range from May 14 in 1958 to June 1, 1959 and May 26, 1960. This variation may be attributed to temperatures in the spring while the staminate flowers were developing. The larvae left the flowers about the time the pollen was released. There was a poor crop of staminate flowers on ponderosa pine on the plots and the numbers of <u>Xyela</u> sp. larvae taken in the traps was extremely low in 1960.

A Ponderosa Pine Cone-borer, <u>Dioryctria auranticella</u> (Grote)

During 1960 the cone crop on ponderosa pine was light throughout the District. In the Okanagan Valley at lower elevations, whenever cones were found, damage by the larvae of <u>D. auranticella</u> was present. Since 1957, 20 cones have been selected at random from each sample tree at six localities annually and examined for <u>D. auranticella</u> damage. The percentages of cones infested from 1957 to 1960 are shown in Table 15.

Due to the variability of the cone crop Table 15 does not indicate a population trend but shows only the annual cone damage on selected trees. Larvae of <u>D. auranticella</u> were infesting first year cones at Oliver, Winfield and Glenemma Range in 1960.



GRAPH I. NUMBER OF XYELA SP. LARVAE THAT DROPPED INTO TRAPS FROM STAMINATE FLOWERS OF PONDEROSA PINE – GLENEMMA RANGE – EAST KAMLOOPS DISTRICT – MAY 14 TO 22, 1958 ; JUNE 1 TO 12, 1959 AND MAY 26 TO JUNE 3, 1960.

Table 15

Percentages of Second Year Ponderosa Pine Cones Infested by *Dioryctria aurantiella* (Grote) from 1957 to 1960, East Kamloops District

Location	Percentage of cones infested			
	1957	1958	1959	1960
Glenemma Range	73	76	54	31
Winfield	68	74	71	no cones
Keremeos	48	52	38	no cones
Oliver	45	68	73	18
Richter Pass	70	72	62	no cones
Anarchist Mountain	62	36	29	11

Douglas-fir Cone Moth, *Barbara colfaxiana* Kearf.

The cone crop on Douglas fir was light throughout the District. Sampling points which were established in 1959 to assess the cone damage were examined in 1960, but Douglas-fir cones were present on only one plot at Grandview bench, where 62 per cent of the cones on three trees had been infested.

A Sawfly on Western Hemlock, *Neodiprion* sp.

Colonial feeding sawflies were numerous on some western hemlock near Cherryville, Sugar Lake and Kingfisher Creek. Damage was light except in the Kingfisher area; there defoliation ranged from a trace to 50 per cent on understory hemlock and extended over approximately 10 acres.

A Sawfly on Douglas Fir, *Neodiprion* sp.

Colonial feeding sawfly larvae were common on Douglas fir throughout most of the District in 1960. They did not, however, occur in sufficient numbers to cause noticeable damage.

A Sawfly on Ponderosa Pine, *Neodiprion* sp.

During 1960 populations of sawflies on ponderosa pine declined. Sawfly eggs were hatching on May 27 at Glenemma Range. A total of 34 eggs had been laid on two ponderosa pine needles.

Spotless Fall Webworm, *Hyphantria* cunea (Drury)

Fall webworm defoliation was severe on many shrubs and trees bordering roads and streams and on range land. Preferred hosts were chokecherry, black cottonwood and alder. The webs were larger than in 1959; frequently chokecherry shrubs, up to six feet in height, were completely enveloped by webbing.

Counts were made for a mile along the east side of the road bordering Duck Lake. A total of 164 webs were recorded, 108 on chokecherry and 56 on black cottonwood. At the north end of Kalamalka Lake damage was lighter. Only 37 webs, all on chokecherry, were counted along the south side of a mile of road-way.

Cecidomyids Infesting Ponderosa and Lodgepole Pines, Cecidomyiidae

During 1960 cecidomyid larvae continued to infest twigs and candles of ponderosa and lodgepole pines. Damage was lighter than in 1958 and 1959. Three plots established in 1959 were surveyed. On each plot three trees were sampled, two trees 15 feet or over and one tree under nine feet. Samples were examined at mid and lower crown levels on the larger trees and from the upper crown only on the small tree. A sample consisted of two one-foot twigs from the cardinal points of each tree, making a total of 40 samples for each plot. Table 16 contains information obtained from the samples examined on three plots.

Table 16

Number of Cecidomyid Larvae, Number of Twigs and Candles of Ponderosa and Lodgepole Pines Infested and Killed in 40-twig Samples from Each of Three Plots, East Kamloops District, April, 1960

Location	Pine species	No. of twigs		No. of larvae	No. of candles		No. of larvae
		infested	dead		infested	dead	
Monte Creek	ponderosa	11	-	27	1	-	3
Squilax	ponderosa	29	6	116	3	-	4
Squilax	lodgepole	2	-	9	14	3	85

On ponderosa pine, a cecidomyid that attacked around the needle base, caused the most damage. Heavy infestation resulted in death of terminal growth. The cecidomyid larvae infested and killed occasional candles on the terminal growth of lodgepole pine in 1960.

Douglas-fir Tussock Moth, Hemerocampa pseudotsugata McD.

Douglas-fir tussock moth larvae were taken in collections from Douglas-fir trees near Yellow Lake, Keremeos and Vaseaux Lake. They were not plentiful, the maximum number of larvae per collection being three.

Red-humped Apple Worm, Schizura concinna A.S.

Populations of the red-humped apple worm were high in the North Okanagan, Salmon Arm and Chase districts. The outbreaks were sporadic but defoliation of infested trees and shrubs ranged from 25 to 100 per cent. They appeared tolerant in host selection, feeding on the leaves of willow, trembling aspen, black cottonwood, Douglas maple, saskatoon, wild rose and Ceanothus sp.

Yellow-necked Caterpillar, Datana ministra Dru.

Larvae of the colonial feeding yellow-necked caterpillar were common throughout the Okanagan Valley. Heavy defoliation was usually confined to the upper crown of hawthorn and saskatoon shrubs and birch trees.

A Woolly Aphid on Lodgepole Pine, Adelges sp.

A light to medium infestation of a woolly aphid occurred on reproduction lodgepole pine four miles west of the eastern boundary of Three Brothers Game Reserve and one half mile north of the highway. It extended over about an acre. The aphids were established on the 1960 growth. Needles on infested tips were somewhat discolored by mid-July and dropped when touched.

Western Hemlock Looper, Lambdina fiscellaria lugubrosa (Hulst)

The population of western hemlock looper remained low. A total of 17 larvae was collected from the following hosts: Douglas fir 13, western hemlock one, western white pine one, western larch one and Engelmann spruce one. Maximum number of larvae per collection was two.

A Spider Mite on Engelmann Spruce, Tetranychus sp.

In 1960 spider mites infested three Engelmann spruce trees at Vernon. Approximately 80 per cent of the foliage had been damaged on one tree while on the other two about 40 per cent of the needles had been affected. The spruce, used as ornamentals, were growing on an exposed dry site.

Douglas-fir Needle-miner, Contarinia spp.

The populations of Douglas-fir needle-miner remained low throughout the District.

MISCELLANEOUS INSECTS

East Kamloops District 1960

Insect	Host	Number of collections	Remarks
Abagrotis mirabilis Grt.	Py	2	May 2 and Sept. 13
Caripeta divisata (Wlk.)	F, H, L	12	Max. no. of larvae 5 in collection from H
Ectropis crepuscularia Schiff.	F	8	uncommon on conifers in 1960
Eupithecia annulata Hlst.	F	13	June 7 - July 12
E. filmata Pears.	F	2	June 7
E. luteata bifasciata (Dyar)	F, L	5	July 5 - Aug. 11
E. niphodophilata Dyar	Js	2	April 28
E. placidata Tayl.	Js	1	Aug. 9 uncommon in 1960
E. pseudotsugata McK.	F	1	Aug. 11 uncommon in 1960
E. transcanadata McK.	F	1	Aug. 9 uncommon in 1960
Feralia comstocki Grt.	F	17	July 5 - Sept. 9
F. jocosa Gn.	F	3	June 8 - Sept. 9
Gabriola dyari Tayl.	F	1	uncommon in 1960
Glena nigricaria B. & McD.	Py	1	uncommon in 1960
Griselda radicana Wlshn.	F	9	uncommon in 1960
Melanolophia imitata Wlk.	F, H, Pw	52	General throughout; no. of larvae to collection 8
Nepytia canosaria Wlk.?	F	29	June 7 - July 12; dryer portions of District

Insect	Host	Number of collections	Remarks
Panthea spp.	F, Py, Pl, L	5	uncommon in 1960
Pero behrensarius Pack	F, L, Pw	21	common throughout the District
Semiothisa adonis B. & McD.	Py	2	uncommon in 1960
S. granitata Gn.	F, H, L	48	general throughout; max. larvae to collection from F, 8 and H, 26
S. sexmaculata Pack.	L	5	max. to collection, 19
Stenoporpia satisfacta B. & McD.	F, L, Se	5	May and early June
S. *excelsaria* Stkr.	F, L, H	5	August
Xylomoges hiemalis Grt.	F	2	uncommon in 1960
X. perlubens Grt.	F	4	uncommon in 1960
Zale duplicata largera Sm.	Pl	1	uncommon in 1960
Zeiraphera diniana Gn.	L	5	uncommon in 1960
Z. fortunana Kft.	Se	2	uncommon in 1960

STATUS OF DISEASES

Important Diseases

A Needle Cast of Pine

Many ponderosa pine stands were affected in 1960 by *Elytroderma deformans* (Weir) Darker. The most seriously infected stands were near the following localities: Glenemma Range, Okanagan Centre, Terrace Mountain, Peachland to Summerland, Falkland and Westwold. Two quarter-acre plots were established in 1960 at Glenemma Range and Vernon to obtain annual data on the progress of this needle fungus.

Larch Needle Cast

Larch needle cast, Hypodermella laricis Tub., was common on western larch in 1960. An estimated 2,000 acres of mature and reproduction larch were infected between Mabel and Hidden Lakes. Other stands of larch that had a brown scorched appearance were noted near Eagle Bay, Sweets Bridge, Mara, Canoe, Terrace Mountain and Anarchist Mountain.

Dwarf Mistletoe on Lodgepole Pine.

Dwarf mistletoe, Arceuthobium americanum Nutt., was found on lodgepole pine in Three Brothers Game Reserve near the eastern boundary of E. C. Manning Provincial Park. All the pines on one and a half acres were infected.

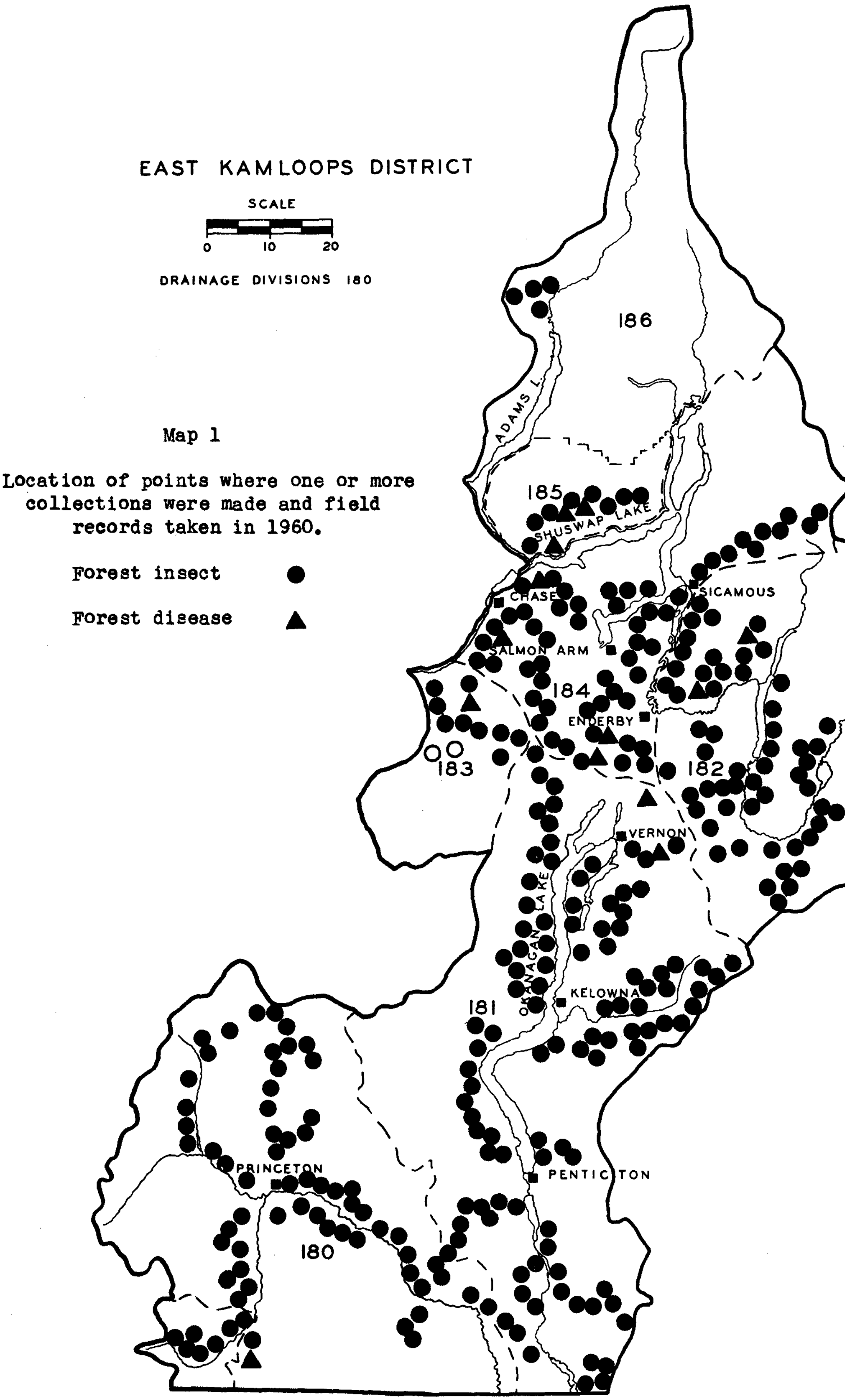
Exotic Plantations

Three exotic plantations, near Westwold and Pritchard, were checked in 1960. Table 17 shows the condition of the trees on the plots.

Table 17

Summary of Disease and Insect Conditions on Exotic Plantations - 1960

Xp number	Location	Exotic species	Remarks
59	Westwold	3 Scots pine	All damaged by porcupine and attacked 1960 on lower stems by red turpentine beetles. One died in 1960.
60	Westwold	American elm	Two large limbs broken probably by snow.
62	Pritchard	10 Scots pine	Four Scots pine attacked in 1959 by mountain pine beetle, died 1960. Two Scots pines with severe mechanical injury; remainder normal.

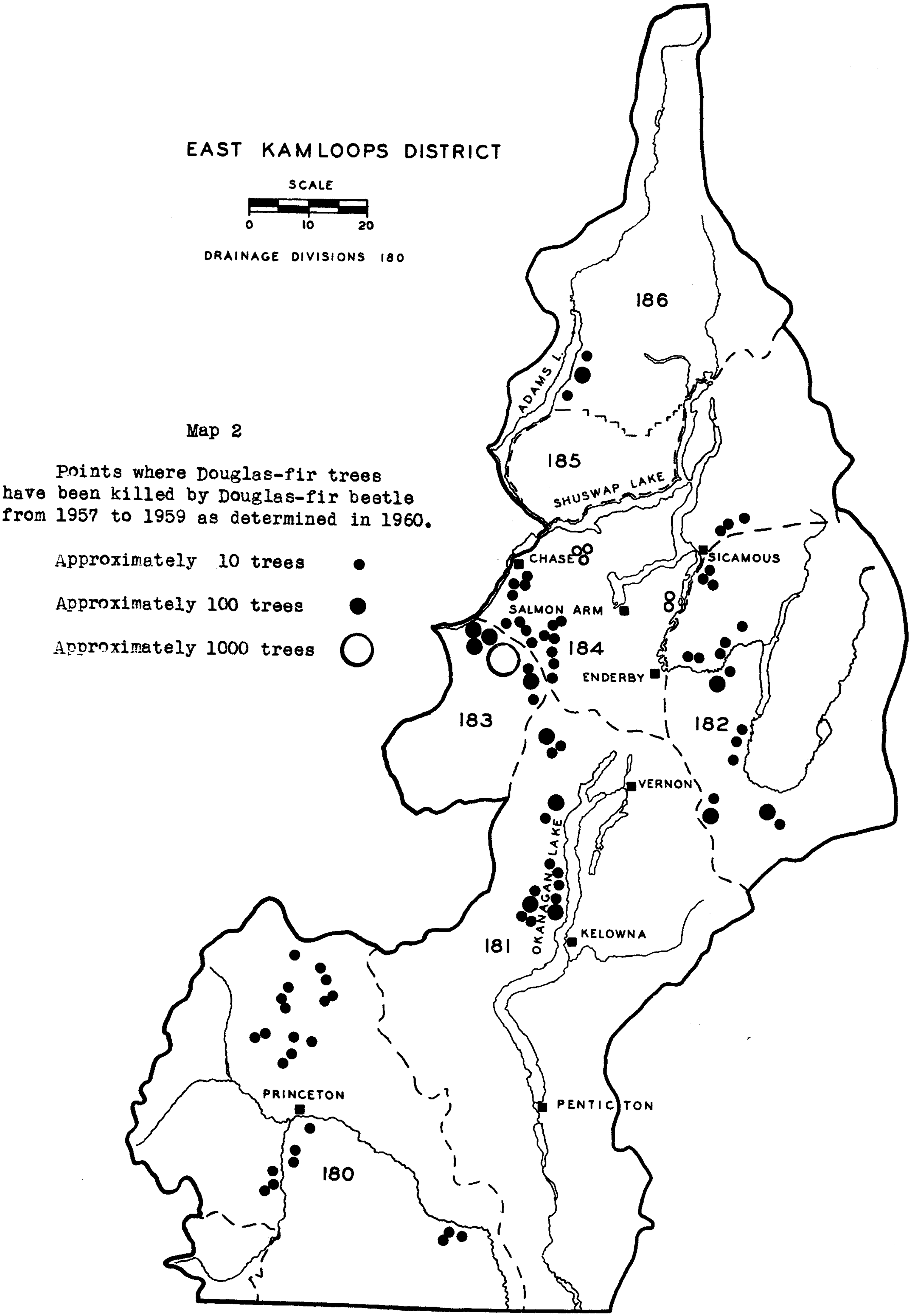


Map 1

Location of points where one or more collections were made and field records taken in 1960.

Forest insect ●

Forest disease ▲



Map 2

Points where Douglas-fir trees have been killed by Douglas-fir beetle from 1957 to 1959 as determined in 1960.

ANNUAL REPORT OF FOREST BIOLOGY RANGERS

BRITISH COLUMBIA

1960

NELSON FOREST DISTRICT

FOREST BIOLOGY SURVEY

NELSON FOREST DISTRICT

1960

J. Grant

INTRODUCTION

There were no changes in Forest Biology Ranger personnel in 1960; R. J. Andrews, R. O. Wood and J. Grant were again assigned to the East, Central and West Nelson districts respectively.

The 1960 field season was notable for a scarcity of the more important defoliators. Appraisal of losses caused by the Douglas-fir beetle in 1959 revealed that there had been a comparatively heavy attack in the Kettle Valley and Beaverdell districts and in parts of the East Kootenay Valley. The mountain pine beetle continued to deplete stands of white and lodgepole pines in many localities, but infestations of the Engelmann spruce beetle were few and local.

An outbreak of the forest tent caterpillar is increasing in the Golden area, and the aspen leaf-miner epidemic continued over most of the District.

Larch needle cast infections were quite general again in 1960 in the Central and West Nelson districts but damage was less severe in the Creston area than in the previous three years.

ANNUAL REPORT OF FOREST BIOLOGY RANGER

for

WEST NELSON DISTRICT

1960

FOREST BIOLOGY SURVEY

WEST NELSON DISTRICT

1960

J. Grant

INTRODUCTION

Survey work began in the West Nelson District on May 10 and the last field trip ended on October 13. Three hundred and ten forest insect and 47 forest disease collections were taken in 1960; they are listed by hosts in Table 1. Location of points where one or more collections or field records were taken are shown in Map 1.

Table 1

Collections by Hosts

West Nelson District, 1960

Coniferous hosts	Forest insects	Forest diseases	Broad-leaved hosts	Forest insects	Forest diseases
Cedar, western red	8	-	Alder, mountain	6	2
Douglas fir	38	7	Alder, Sitka	9	-
Fir, alpine	24	4	Aspen, trembling	12	2
Fir, grand	14	-	Birch, fountain	3	-
Hemlock, western	22	-	Birch, western white	6	4
Juniper, common	1	-	Cherry, bitter	1	-
Larch, western	19	-	Cherry, choke	1	-
Pine, lodgepole	19	5	Cottonwood, black	9	1
Pine, ponderosa	20	1	Elder, blueberry	3	-
Pine, western white	19	2	Hawthorn, black	1	-
Spruce, Colorado blue	1	-	Maple, Douglas	1	-
Spruce, Engelmann	17	-	Poplar sp.	1	1
			Willow spp.	25	-
			Miscellaneous	30	8
			Total	108	18
Total	202		Grand total	310	47

STATUS OF INSECTS

Douglas-fir Beetle, *Dendroctonus pseudotsugae* Hopk.

In 1960 an increase in the number of red-topped Douglas-fir trees in the western part of the District indicated that the 1959 attack had been heavy, compared with the previous five years. Over 90 per cent of the known Douglas-fir mortality occurred in the Beaverdell and Kettle Valley ranger districts. Many trees infested in 1959 were late in turning colour, probably as a result of an unusually wet autumn. Heavy needle drop began in some localities in early June, 1960, before the trees had turned red, rendering the assessment of damage more difficult than usual.

The extent of Douglas-fir tree mortality caused by bark beetles in the period 1957 to 1959 was determined in 1960 by counting dead trees from vantage points, and by close examination of the more accessible infested groups. Trees, in as many localities as was feasible, were measured to ascertain their average volume; 63 cubic feet was the average volume of beetle-killed trees in the Kettle Valley and Beaverdell ranger districts.

Table 2 shows, by locality, the number of trees and the volume killed by Douglas-fir beetles in 1957 to 1959 inclusive as determined in 1960.

Table 2

Number and Volume of Douglas-fir Trees Killed by Douglas-fir Beetles in the West Nelson District, 1957 to 1959, as Determined in 1960

Locality	Region No.	Compartment No.	No. of trees	Volume (cu.ft.)
Westkettle R.	24	2,3,4,7	208	12,480
Beaverdell Cr.	24	6	70	4,200
Upper Kettle R.	15	7,12	87	5,220
Upper Kettle R.	24	1	44	1,760
Conkle L.	15	3	12	480
Midway-Hypolite Cr.	15	10,11	81	5,910
Greenwood-Boundary Cr.	15	10	374	26,244
Phoenix	15	3	30	2,100
Eholt-Grand Forks	15	3	58	2,320
Cascade-Sheep Cr.	16	1,2	14	900
Totals			978	61,614

On June 29, an examination of two groups comprising about 120 dead trees on Boundary Sawmills Tree Farm License, showed that many of the teneral adults resulting from the 1959 attack were still in the trees. As a measure to reduce further losses from the 1960 beetle flight, Boundary Sawmills cut a series of trap trees at the edge of the forest surrounding the infested groups. These logs were removed in October at the same time as the beetle-killed trees were salvaged. Although it was not possible to evaluate the trap tree program, the presence of numerous beetle broods in these logs indicated that a new portion of the summer beetle flight had been diverted from making new attacks in standing timber.

On October 12, a small percentage of the beetle broods in trap-tree logs which had been felled the first week July, 1960, had already reached the pupal stage. This observation is noteworthy because progeny of beetles attacking as late as July normally ovewinter as larvae. This species is not known to overwinter successfully in the pupal stage.

Mountain Pine Beetle, *Dendroctonus monticolae* Hopk.

Infestations continued in the lodgepole pine stands of upper Kettle River Valley and on Boundary Creek. Although no aerial survey was made in 1960, ground surveys indicated that the populations had not undergone any marked change in the last two years. Sparsely scattered groups of dead trees were noted over about 16 square miles on the Kettle River between Mohr and Bruer creeks, with the largest concentrations being south of Winnifred Creek.

A few heavily infested trees were found on Boundary Creek in 1960, but this infestation appeared to be limited by a scarcity of susceptible trees of sufficient size. The average d.b.h. of seven trees attacked in 1960 was only 10 inches, with extremes of 9.5 and 12.5 inches.

Notes were taken on the development of beetle broods in these localities in an attempt to determine the time of the 1960 beetle flight; however, as neither infestation could be visited during July this was unsuccessful. On June 15, the majority of the 1959-infested trees at both localities contained prepupal larvae in their pupal cells; on June 29, pupae outnumbered larvae at the Boundary Creek infestation but no teneral adults were found.

Approximately 100 white pine trees were killed by mountain pine beetles in 1959, in the Needles-Graham Landing area between Upper and Lower Arrow lakes. Infestations were generally restricted to small groups of pole-sized trees, many of which displayed symptoms of blister rust infections. A group of 80 mature white pine near the north end of Whatshan Lake was killed by bark beetles; the 1959 attack had accounted for roughly one half of the total.

Western Balsam Bark Beetle, Dryocoetes confusus Sw.

Populations apparently are decreasing in the Inonoaklin and Kettle River valleys of the Monashee Range; red tops resulting from the 1959 attack were considerably scarcer than those of the preceding years.

An examination of an old infestation near the 6000 foot level between Mt. Moore and Jubilee Mountain revealed that 60 per cent of the alpine fir over four inches d.b.h. had been killed. Surviving trees were almost all in the smaller diameter classes. This area is on the edge of an extensive outbreak covering an estimated 16 square miles, but except for a few groups of freshly infested trees around its perimeter, the infestation has died out.

Small groups of red-topped alpine fir were noted at 4500 feet elevation near Leadville Creek, on Thompson Mountain east of Creston, and near the headwaters of Boundary Creek.

An Ambrosia Beetle, Trypodendron lineatum (Oliv.)

In early June, ambrosia beetles infested about 3000 red cedar poles which had been left unpeeled and scattered through the forest above Graham Landing. The beetle flight apparently had started about June 1 when peeling and decking of the poles had just begun, and continued through June 13. By June 23 the main flight had ended. The lateness of the flight compared with other localities in southern B. C. may be explained by the high elevation (3000 to 3500 feet) and the heavy snowfall which persisted until late in the spring.

In an effort to kill beetles already in the poles and to prevent further attack, the logging operator had sprayed them with fuel oil; an examination on June 23 showed that this treatment had killed from 60 to 70 per cent of the beetles in decked and peeled poles, but that a few beetles had entered after the spraying, possibly in areas of incomplete spray coverage. Poles still unpeeled and scattered about in the shady woods contained a higher population than did those which had been peeled and decked in the open. This could have been due to the spray's failure to penetrate the bark, or to the beetles' preference for shaded, unpeeled logs.

A single Engelmann spruce windfall at 4700 feet elevation near the Monashee Highway had been heavily infested by June 24. Three wood samples from the lower bole had from 60 to 80 entrance holes per square foot.

Ten western hemlock and western white pine logs which had been dumped beside a road four miles east of Crawford Bay had been lightly infested before June 11. Entrance holes averaged four per square foot. The beetles had already penetrated the wood to an average depth of one inch, although there were two feet of packed snow in the shade beneath the logs.

A Fir Engraver, Scolytus ventralis Lec.

Scattered small groups of grand fir at Blewett and in the southern part of Creston Ranger District were killed by this beetle in 1959. Some of the trees at Creston had been injured by the 1958 drought, but those at Blewett appeared to have been healthy prior to the beetle attack.

Evidence of old attacks was quite common in a grand fir stand near Boswell, but no mortality had resulted. Many of the pole-sized trees had elliptical patches of dead bark and cambium six to 10 inches in length scattered over the lower half of the bole.

A single egg gallery was found in a dead alpine fir at 4900 feet elevation on the Cascade-Rossland road.

Oregon Pine Engraver, Ips oregoni Eich.

No damage was known to have been caused in 1960. In the previous three years, several infestations had occurred in ponderosa pine stands of the Kettle Valley and Grand Forks districts.

Western Hemlock Looper, Lambdina fiscellaria lugubrosa (Hlst.)

This species was present in 18 per cent of the collections taken from all conifers except pines during the larval feeding period. Populations were low throughout the area sampled; the maximum number of larvae in a three-tree beating collection was three.

Poplar and Willow Borer, Sternochetus lapathi (L.)

Cottonwood trees up to 10 inches d.b.h. and willows between Duck Lake and the south end of Kootenay Lake were again infested in 1960. The ground surrounding the root collars of the more heavily infested poplars was covered with boring dust. Second growth cottonwoods on the slopes east of Ymir were infested and a grove of willows surrounding a swamp near Bunchgrass Lookout, Grand Forks District, were riddled with larval galleries. Sitka alder bushes at an elevation of 5100 feet on Santa Rosa Summit and along Kokanee Creek had been attacked and many of the stems were killed.

A Pine Shoot Borer, Eucosma sonomana Kft.

The Kettle River Valley in the vicinity of Cascade was the only area where pine shoot borers caused noteworthy damage in 1960. Between 40 and 50 per cent of young ponderosa pines up to 20 feet in height sustained damage to either the main leaders or branch terminals.

Although adults began to emerge from overwintering pupae in the unheated insectorium at Vernon in March, larval development in the field was apparently retarded by cold weather in May and June. The first emergence of larvae from mined shoots at Cascade was observed on July 5.

Aspen Leaf-miner, Phyllocnistis populiella Chamb.

All trembling aspen stands except those in the southern parts of Nelson and Creston districts were infested in 1960. In most localities where infestations were moderate there was little change from the 1959 level, but in the Edgewood District where the epidemic has persisted at a very high level since 1954, there was a marked reduction in the percentage of leaf surfaces mined.

Sampling was conducted at three plots to determine the degree of infestation and survival of the 1960 generation of leaf-miners. The plot at Crawford Creek which was sampled in 1959 was discontinued because of a foliage disease which caused premature leaf-drop in that area. Sampling procedure was the same as in 1959; the leaves on two 12-inch branch samples from each of five trees on each plot were examined. The percentage of leaf surfaces mined and the number of adults produced per leaf surface are shown in Table 3. Table 4 shows mortality in the cocoon stage caused by parasitism and other factors.

Table 3

Percentage of Aspen Leaf Surfaces Mined and Adult Aspen Leaf-miners produced per Leaf Surface, West Nelson District, 1959 and 1960

Locality	Percentage of leaf surfaces with mines		No. of adults produced per leaf surface	
	1959	1960	1959	1960
Greenwood	43.2	56.0	0.14	0.18
Grand Forks	31.4	32.9	0.10	0.22
Barnes Creek	73.9	45.0	0.18	0.13

Table 4

Mortality of Aspen Leaf-miners in Cocoons in 100-cocoon Samples, West Nelson District, 1959 and 1960

Locality	Percentage mortality			
	Parasitism		Other Causes	
	1959	1960	1959	1960
Greenwood	3	1	4	9
Grand Forks	6	1	20	10
Barnes Creek	18	30	7	11

A Hemlock Sawfly, Neodiprion sp.

Although 31 per cent of three-tree beating collections taken during the larval period contained this species, populations were much lower than in 1959. The largest number taken in one collection was 31 in 1960, compared with 477 the previous year.

Black Pine Leaf Scale, Nuculaspis californica (Cole.)

A new locality record was established for this pest of ponderosa pine in 1960. Four pole-sized trees close to the lakeshore at Kuskanook were infested. The only other locality in the Nelson Forest District where this scale has been found is Cascade.

A Woolly Aphid on Western Larch, Adelges oregonensis Annand

A moderately heavy infestation of woolly aphids believed to be this species was noted on western larch reproduction in the lower valley of Hallmark Creek, Creston District. The upper crowns and branch ends of the open grown trees were noticeably whitened on July 18. Adelges oregonensis Annand was quite scarce between Rock Creek and Camp McKinney where a heavy infestation was observed in 1958.

Hemlock Woolly Aphid, Adelges tsugae Annand

There was a light infestation on the lower branches of a few mature hemlocks growing along Goat River two miles west of Kitchener.

A Leaf Blotch-miner, Lyonetia saliciella Busck

Up to 90 per cent of the willow foliage in the Edgewood District was damaged in June by this miner. Sitka alders and white birches were quite heavily infested in the Inonoaklin Valley and around Whatshan Lake.

A Weevil Attacking Spruce Seedlings, *Pissodes schwartzi* Hopk.

A few Colorado blue spruce seedlings imported from Holland and planted in a nursery at Erickson in the spring of 1960 were infested. Larval mines were most numerous about the root collars but extended down the large roots and up the stems. Larvae in pupal cells, pupae, and teneral adults were found in the infested seedlings the first week of October. The absence of native spruces in the environs of the nursery would indicate that some other species of conifer is the natural host. Norway spruce, Mugo and Scots pines in the nursery had not been attacked.

A Noctuid on Blueberry Elder, *Synedoida divergens* (Behr.)?

Most of the blueberry elders in the vicinity of Grand Forks, Trail and the southern part of the Creston District were stripped of their foliage in August. The nocturnal-feeding larvae believed to be *Synedoida divergens* (Behr.) could be found during the day under loose debris around the base of the bushes, and in bark fissures on the larger trees. An undetermined disease caused heavy mortality in the later instars.

Larch Sawfly, *Pristiphora erichsonii* Htg.

No evidence of feeding damage was found anywhere in the District in 1960.

Larch Casebearer, *Coleophora laricella* (Hbn.)

Although this insect has spread through the larch stands of northern Idaho and northeastern Washington, none has yet been found in the West Nelson District.

Cecidomyiids Infesting Twigs of Lodgepole Pine

Midges, of at least two species, damaged lodgepole pine twigs and shoots in the Creston and Beaverdell districts. In the vicinity of Beaverdell Creek, both lateral branch tips and the main leaders of pine reproduction had been killed.

Spotless Fall Webworm, *Hyphantria cunea* Dru.

The fall webworm is usually scarce, except for the Grand Forks, Castlegar-Trail, and Creston districts, but in 1960 populations were low even in these localities. One exception was McRae Creek Valley east of Christina Lake. Table 5 shows the number of webs, by host, counted on both sides of 1.5 miles of road, from a moving vehicle.

Table 5

Spotless Fall Webworm Strip Counts, McRae Creek Bridge to 1.5 Miles East, West Nelson District, August 24, 1960

Host	No. of webs per half mile			Av. per
	Mile 0.0.5	0.5-1	1-1.5	mile
Mountain alder	22	22	18	41.3
Willow	2	0	0	1.3
White birch	2	0	0	1.3
Trembling aspen	1	0	0	0.7
Blueberry elder	0	1	0	0.7
Totals	27	23	18	45.3

Larch Shoot-borer, Argyresthia laricella Kft.

This insect was scarcer in 1960 than in 1959. No new locality records were established.

OTHER NOTEWORTHY INSECTS

Insect	Host	Number of collections	Remarks
Acleris variana (Fern.)	H	1	Decrease from 1959
Altica spp.	Cot, W, Dt	4	Decrease from 1959
Anoplonyx laricivorus Roh. & Midd.	L	7	Maximum of 7 larvae
A. occidens Ross	L	6	" " 3 "
Barbara c. siskiyouana Kft.?	Bg	1	Waneta - in cones
Choristoneura fumiferana (Clem.) (1-year)	F	2	Scarce
C. fumiferana (Clem.) (2-year cycle)	F	0	None found, Monashee
Chrysomela a. interna Br.	Dt	1	light defoliation - Monashee
Conophthorus monticolae Hopk.	Pw	1	common in cones - Nelson

Insect	Host	Number of collections	Remarks
Contarinia constricta Condr.	F	1	Christina Lake
C. cuniculator Condr.	F	3	Christina Lake, Edgewood
C. pseudotsugae Condr.	F	2	Gray Creek, Edgewood
Chionodes retiniella B. and Busck	Py	2	Needle-miner; scarce
Datana ministra Dru.	Bo, Bi, etc.	3	common, Grand Forks
Dioryctria abietivorella (Grote)	Bg	1	cones - Waneta
D. auranticella (Grote)	Py	1	boring in leader, Boswell
Ectropis crepuscularia Schiff.	Pw, H, Bi, Ds	8	Av. one per collection
Enypia moillietti Blckmre.	F	1	rare in 1960
E. venata Grt.	Se, H	2	rare in 1960
Eupithecia annulata Hlst.	F, H, Se	8	Common, Kootenay Lake
Feralia comstocki (Grt.)	Bg, H, F, Pl	11	Widespread
F. jocosa Gn.	H, F	2	Edgewood, Kitchener
Gabriola dyari Tayl.	F, H	2	Rare in 1960
Glena nigricaria B. & McD.	Py	5	Kettle Valley
Incisalia eryphon Bdv.	Pw	1	rare
Malacosoma disstria Hbn.	Lombardy Poplar	1	one egg mass, Creston
M. pluviale Dyar	Hawthorn	1	uncommon
Melanolophia imitata Wlk.	Pl, H, F, Ba, Bg, C, L	28	common and widespread

Insect	Host	Number of collections	Remarks
Mitoura nelsoni Bdv.	C	2	Creston
Nematocampa filamentaria Gn.	H, Bg, Ds	3	uncommon
Nepytia canosaria Wlk.?	F	4	common, Kootenay Lake
Nycteola frigidana Wlk.	Cot	4	immense numbers of newly emerged adults in Trail-Salmo area, July 8-20
Orgyia antiqua badia Hy. Edw.	H, Dt	2	uncommon
Phalonia sp.	Jc	1	Grand Forks, damaging ornamental junipers
Pikonema alaskensis Roh.	Se	2	11 in one collection, Phoenix
Recurvaria sp.	Bg	1	Mining 1959 needles, Boswell
Semiothisa adonis B. & McD	Pl, Py	4	Gray Creek; Kettle Valley
S. granitata Gn.	F, H, Ba, Bg, Pw, Se, C	31	common
Stenoporpia excelsaria Stkr.	Pl, Py, F	5	July and August
S. satisfacta B. and McD.	Py, F	3	May and early June

STATUS OF FOREST DISEASES

Important Diseases

Larch Needle Cast

Heavy infections of *Hypodermella laricis* Tub. were widespread in the western part of the West Nelson District, chiefly at higher elevations. Severe damage was observed between Rossland and Sheep Creek; at Sheep Lake; upper Boundary Creek Valley; Eholt and Pass Creek in the Grand Forks district; Conkle Lake; Bridesville; Kettle Valley north of Damfino Creek; upper Westkettle Valley; Barnes Creek, Snowshoe Lake and Inonoaklin Valley in the Edgewood district. Infections were generally less severe than in 1959 in Nelson and Creston ranger districts, although some discoloration was noted in most localities visited.

Needle Cast of Ponderosa Pine

Foliage discoloration caused by Elytroderma deformans (Weir) Darker was again prevalent in parts of Kettle Valley and Grand Forks ranger districts. In 1960 some suppressed trees and the lower branches of the overstory at Johnstone, Ingram and Kerr creeks were dead, presumably as a result of repeated foliage infections.

Douglas-fir Needle Cast

Infections were not as severe in 1960 as in the two previous years. Noticeable foliage discoloration occurred at many points throughout the District, but it was usually confined to understory trees.

Blister Rust of Lodgepole Pine caused by Peridermium stalactiforme Arth. & Kern

On August 24 a strip six chains long and one half chain wide was run through a young stand of lodgepole pine 9.2 miles east of Christina Lake, to determine the extent of injury caused by this rust. Trees in two-inch d.b.h. classes were separated into four categories: (1) healthy; (2) infected by Peridermium; (3) killed by Peridermium; and (4) dead, other causes; Table 6 shows results of the tally.

Table 6

Condition of Lodgepole Pine on a Six by One-half Chain Strip, 9.2 Miles East of Christina Lake, West Nelson District, 1960

D.b.h. (inches)	No. of trees examined	Percentage of trees			
		Healthy	Killed by Peridermium	Infected	Dead, other causes
2	40	45	23	2	30
4	85	69	8	19	4
6	51	78	2	20	0
8	16	56	6	38	0
10	0	0	0	0	0
12	2	50	0	50	0
Totals	194	65	9	18	8

Twenty-seven per cent of the stems either had been infected or killed by the disease which had caused lesions up to eight feet in length on the lower bole. The injury had been aggravated by rodents, presumably squirrels, which had repeatedly chewed the bark surrounding the slowly spreading lesions. Tree mortality from other causes was confined to the smaller d.b.h. classes and was attributed to suppression in the overcrowded parts of the stand, and in a few cases, to snow breakage.

Dwarf Mistletoe on Western Larch

Three new locality records for larch mistletoe, *Arceuthobium campylopodum* f. *laricis* Jones were established in 1960, all in the southwestern part of the District. Infected trees were found at Bridesville, near Zamora, and near the boundary between the Kamloops and Nelson Forest districts on Anarchist Mountain. Map 2 shows the location of points where examinations have been made for larch mistletoe since 1958. It will be noted that none has yet been found north of Westbridge, nor west of Boulder Creek on the Monashee Highway.

Foliage Diseases of Aspen

Conspicuous foliage discoloration and premature leaf drop caused by *Marssonina brunnea* (Ellis and Everh.) Sacc. was prevalent in trembling aspen stands in the Kootenay Lake region. Groves of trees in Crawford Creek Valley were almost bare by the middle of August.

Pollaccia radiosa (Lib.) Bald. & Cif. infections were common at Eholt, Rossland, and on Hypolite Creek near Midway. Pole-sized stands at Eholt displayed a brownish tinge by mid-June.

OTHER NOTEWORTHY DISEASES

Host	Organism	Locality	Remarks
Alder, mountain	*Polyporus cinnabarinus*	Blewett	New host record.
Birch, western white	" "	Sirdar Grand Forks	On dead logs.
Buckthorn, alder-leaved	*Puccinia coronata* Corda	Westbridge Sheep Lake	New B.C. record; leaf rust; does not affect forest trees.
Douglas fir	*Camarosporium* sp.	Kerr Creek	Bud necrosis.

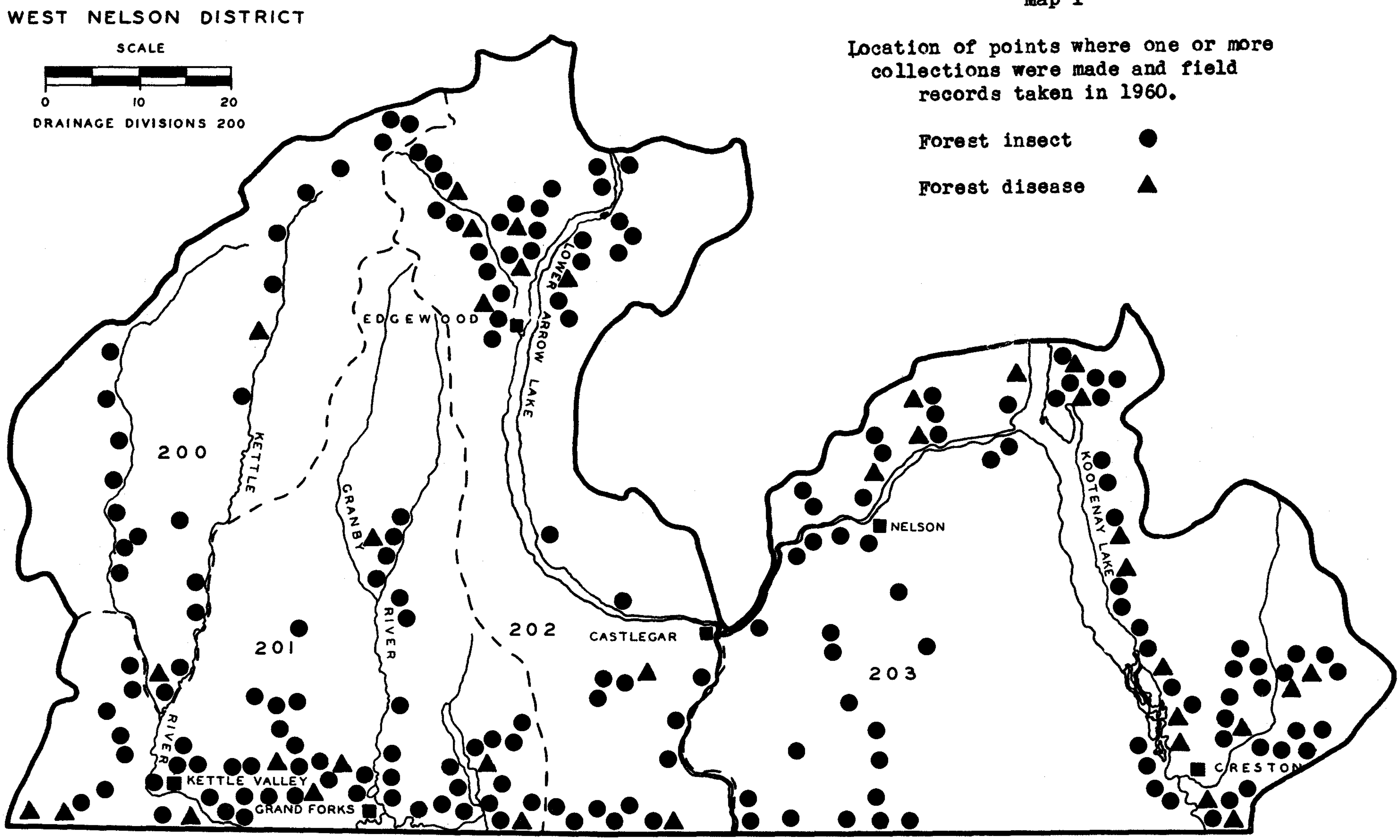
Host	Organism	Locality	Remarks
Douglas fir	?*Hendersonia* sp.	Boswell	Bud necrosis
Fir, grand	*Melampsorella caryophyllacearum* Schroet.	Rykerts	Unusual host
Hemlock, western	*Uraecium holwayi* Arth.	Duhamel Creek	Rust on cones
Spruce, Engelmann	*Arceuthobium campylopodum* ? f. *laricis* Jones	Christina Lake	Dwarf mistletoe
	Chrysomyxa weirii Jacks	Kokanee Park	Needle rust
	Pleospora sp.	Gidon Creek	Needle blotch, new record.

Map 1

Location of points where one or more collections were made and field records taken in 1960.

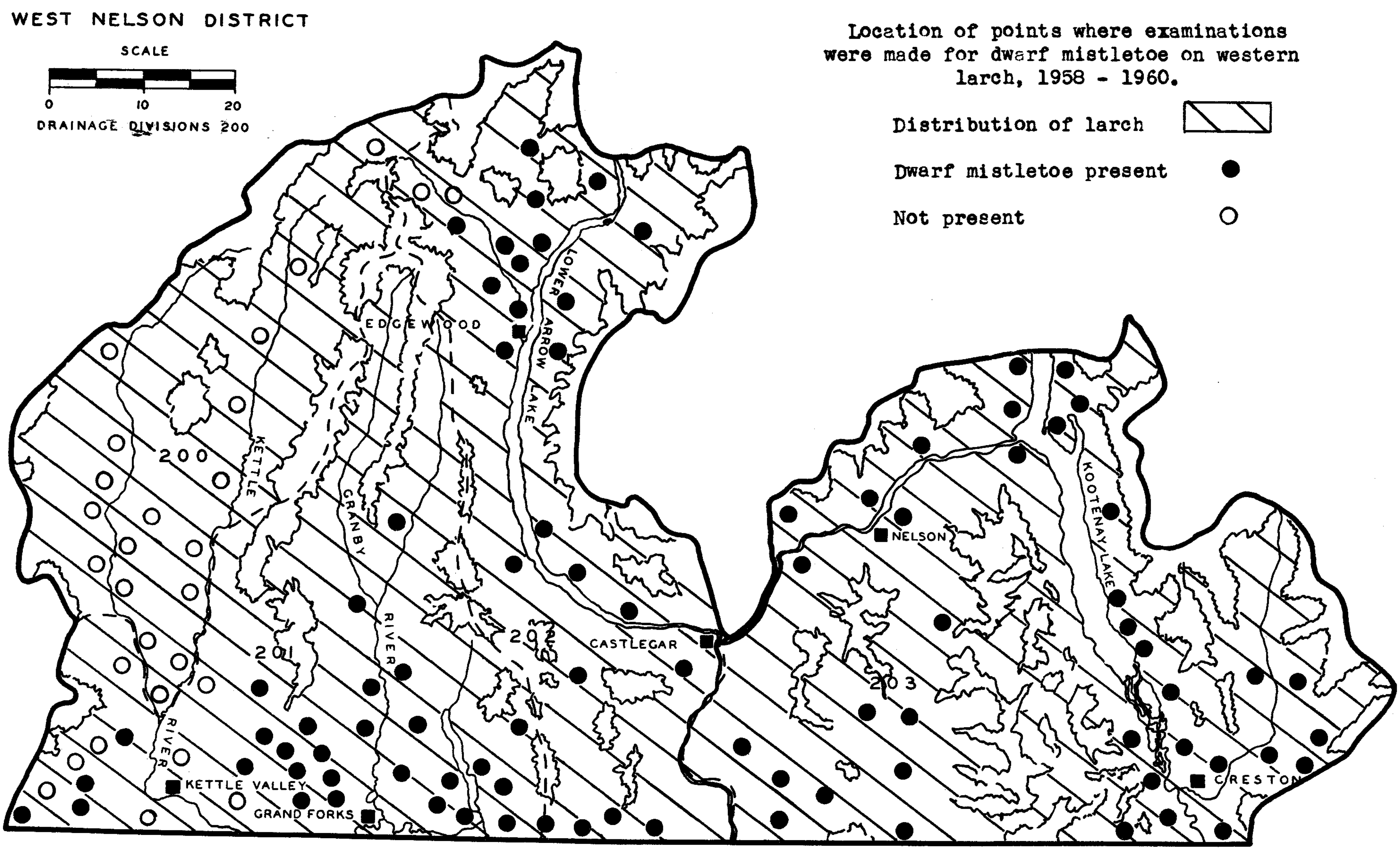
Forest insect ●

Forest disease ▲



Map 2

Location of points where examinations were made for dwarf mistletoe on western larch, 1958 - 1960.



ANNUAL REPORT OF FOREST BIOLOGY RANGER

for

CENTRAL NELSON DISTRICT

1960

FOREST BIOLOGY SURVEY

CENTRAL NELSON DISTRICT

1960

R. O. Wood

INTRODUCTION

Field work in the Central Nelson District commenced on May 11 with the opening of the New Denver Ranger cabin and terminated on October 21. During this period, one week was spent in Vernon and five weeks assisting in other districts.

Two reconnaissance flights over parts of the Revelstoke, Arrowhead, Nakusp and New Denver ranger districts were made with a total flying time of six hours.

Table 1 lists, by hosts, the 356 forest insect and 29 forest disease collections submitted; location points of these collections are shown on Map 1.

Table 1

Collections by Hosts

Central Nelson District - 1960

Coniferous hosts	Forest insects	Forest diseases	Broad-leaved hosts	Forest insects	Forest diseases
Cedar, western red	22	2	Alder spp.	12	2
Douglas fir	42	6	Aspen, trembling	5	1
Fir, alpine	9	2	Birch, western white	13	-
Hemlock, mountain	1	-	Cottonwood, black	7	3
Hemlock, western	70	4	Maple, Douglas	3	-
Larch, western	11	-	Willow spp.	26	1
Pine, lodgepole	24	-	Miscellaneous	17	2
Pine, ponderosa	2	-			
Pine, western white	58	4			
Pine, whitebark	1	-			
Spruce, Engelmann	28	2			
Yew, western	5	-			
			Total	83	9
Total	273	20	Grand total	356	29

STATUS OF INSECTS

Mountain pine beetle, *Dendroctonus monticolae* Hopk.

A slight decline in the number of beetle-killed white pine was evident in the Central Nelson District in 1960, particularly along the Big Bend Highway, but areas of infestation continued in the Upper Arrow Lake region. An increase in the number of red tops was noticed on the slope above Silverton, and approximately 150 lodgepole pine red tops were counted at Enterprise Creek. Table 2 gives the general location and number of beetle-killed white pine counted from aerial surveys and road vantage points in 1960. Blister rust and pole blight were contributing factors to the number of dead and dying pine as ascertained by spot checks. Map 2 shows the distribution of tree mortality caused by the mountain pine beetle in white and lodgepole pine.

Estimating the average d.b.h. and height of white pine in the Central Nelson District as 14 inches and 84 feet respectively, the 2400 red-topped trees shown in Table 2 constitute an approximate loss of 74,500 cubic feet.

Table 2

Number of Western White Pine Trees Killed by Mountain Pine Beetles 1957-1959 inclusive, as Determined by Aerial Surveys, Central Nelson District - 1960

Location	Number of trees	Remarks
West side Upper Arrow Lake and Columbia River, Arrowhead to Revelstoke	1304	mature and immature
Columbia River - Revelstoke to Boat Encampment	229	mostly mature
North-east arm and east side Upper Arrow Lake	622	mature and immature
West side Slocan Lake	90	immature
Silverton	100	mature and immature
Armstrong Lake (south of Beaton)	12	immature
Lardeau River (Howser Crossing)	20	immature
Trout Lake (Asher Creek)	30	mature
Total	2,407	

Engelmann Spruce Beetle, Dendroctonus engelmanni Hopk.

A stand of an estimated 500 dead Engelmann spruce trees was observed by aerial reconnaissance in the Shelter Bay region of Upper Arrow Lake. A ground check failed to show any current beetle activity and all of the inspected trees in this area had been dead for at least two years. On June 15, adults and larvae of the spruce bark beetle were collected from a small group of spruce trees along the Goldstream River road. Several trees had evidence of old beetle activity, but only three, average d.b.h. 12 inches, had new attacks. There has been no recent logging or cutting of trees in this area.

Douglas-fir Beetle, Dendroctonus pseudotsugae Hopk.

Small groups of Douglas-fir trees killed by the Douglas-fir beetle were noted at several points in the District in 1960. The 1960 figures for red-topped Douglas fir trees are about the same as those of 1959. Several small groups of beetle-killed Douglas fir were counted in the Duncan River area which is remote from logging operations. The area was not visited in 1959, but numerous old grey Douglas-fir trees indicate that beetle attacks are not new to this locality. Table 3 gives the location and extent of tree mortality caused by the Douglas-fir beetle.

Table 3

Number of Douglas-fir Trees Killed by Douglas-fir Beetles 1957-1959 inclusive, as Determined by Ground and Aerial Surveys, Central Nelson District - 1960

Location	Number of trees	Estimated volume of timber (cu. ft.)
Downie Creek (Columbia River)	5	275
Upper Arrow Lake (Arrowhead to Beaton)	65	4550
Halfway Creek (Upper Arrow Lake)	6	330
Box Lake (south-east of Nakusp)	5	275
Silverton Creek	10	600
Enterprise Creek	210	13650
Slocan Lake (west side)	16	1280
Lardeau River (Howser Crossing)	17	1360
Duncan Lake and River	90	7200
Total	424	29520

Aspen Leaf-miner, Phyllocnistis populiella Chamb.

In 1960, the first flight of adult leaf-miners was observed south of Slocan City on May 18. Aspen leaves were again heavily attacked by this insect at all locations in the Central Nelson District where sampling of this tree species was undertaken. Table 4 shows the percentage of leaf surfaces mined at four plots where samples consisted of two 12-inch branch tips from each of three trees. The average number of leaves examined at each plot was 75. The table shows little change in leaf-miner population from 1959 levels.

Percentage of cocoon mortality in 100-cocoon samples at three locations is shown in Table 5.

Table 4

Population Sampling of Aspen Leaf-miner at Four Localities in the Central Nelson District - 1960

Locality	Percentage of leaf surfaces infested	Number of adults produced per leaf surface
4 miles north of Revelstoke	98	0.58
8.5 miles south of Revelstoke	99	0.41
Summit Lake (south of Nakusp)	96	0.60
8.5 miles east of New Denver	85	0.54

Table 5

Percentage Mortality of Aspen Leaf-miner Cocoons at Three Localities in the Central Nelson District, 1959 and 1960

Locality	Percentage mortality in cocoon stage			
	Parasitized		Other causes	
	1959	1960	1959	1960
8.5 miles east of New Denver	1	13	3	7
8.5 miles south of Revelstoke	17	33	0	1
Summit Lake (south of Nakusp)	-	10	-	2

A Cottonwood Leaf-miner, Phyllocnistis sp.

Seventy-two per cent of the black cottonwood leaves were infested by a leaf-miner in samples from three trees south of Revelstoke. Miner damage was present throughout the sampled range of cottonwood in the Central Nelson District in 1960; no leaf counts were made at other locations.

A Weevil in Western Red Cedar, Hexarthrum sp.

Adults and larvae of this weevil were collected south-west of Revelstoke in the Begbie Lake area. When these insects were first collected in 1959, it was believed they were active only in the upper third of the host tree, but in 1960 samples of cedar lumber which showed damage resembling that caused by Hexarthrum sp. were taken from a sawmill near Begbie Lake. Some of this lumber was cut from the lower part of the tree, which seems to disprove the earlier reports.

Weevils in Western White Pine, Pissodes spp.

White pine seedlings were commonly infested with Pissodes spp. in Central Nelson District in 1960. Collections of larvae and teneral adults were taken from around the root collars of the host trees; either blister rust or Armillaria root rot was also present on sampled trees. Weevils collected at Kaslo and Galena Bay were identified as Pissodes yosemite Hopk.? Other samples from Mount Revelstoke Park, Keen Creek and Cranberry Creek were identified as Pissodes costatus Mann.

Pine Root Weevil, Hylobius sp.

Root weevil damage was observed on small dead white pine along a new road between Nakusp and Galena Bay. Only one pupa was found, but old pitch blobs were common on roots of dead pine in the area. Other collections of this insect were as follows: several late instar larvae from white pine and Engelmann spruce at Caribou Lake on May 31; one adult from white pine at Brouse on June 2; one adult from Engelmann spruce at Mile 58, Big Bend Highway on June 14.

Poplar and Willow Borer, Sternochetus lapathi (L.)

Several collections of larvae were taken from willow and black cottonwood at widely separated points in the Central Nelson District. Damage to the host trees was most severe at Summit Lake, where willows were heavily attacked, and at Slocan City Park where several black cottonwood shade trees showed evidence of weevil damage. Black cottonwood near Howser were quite heavily infested, and weevil larvae were collected from one tree at a height of nine feet from the base.

Cecidomyiidae Infesting Cones of Western Red Cedar

Larvae of this midge were present in cedar cones througout the District in 1960. Table 6 shows the degree of infestation in five 50-cone collections selected at random at five locations in the Central Nelson District and dissected. The average number of larvae per cone was 5.8; the maximum number was 10.

Table 6

Percentage of Western Red Cedar Cones Infested by Cecidomyiid Larvae in 50-cone Samples, Central Nelson District, 1960

Date	Location	Percentage infested
Aug. 17	Enterprise Creek	10
Aug. 18	New Denver	98
Aug. 30	Shoreacres	12
Aug. 31	Lardeau	74
Sept. 9	West Demars	90

Western Hemlock Looper, <u>Lambdina fiscellaria lugubrosa</u> (Hlst.)

Collections of larvae of this looper in 1960 showed an increase from 1959 in the Big Bend and Upper Arrow Lake areas; elsewhere the population remained about the same. Table 7 shows a comparison of 1960 quantitative 3-tree beating collections with those of 1959. The table is based on western hemlock collections only, although larvae were common on western red cedar and Engelmann spruce along the Big Bend Highway in 1960.

False Hemlock Looper, <u>Nepytia canosaria</u> Wlk.?

Only four larvae of this looper were collected from Douglas fir in the Central Nelson District in 1960; three at Argenta and one at St. Leon Creek.

Table 7

Three-tree Beating Collections of Western Hemlock Looper from Western Hemlock, Central Nelson District, 1959 and 1960

Drainage division	Total collections during larval period		Percentage of collections containing larvae		Av. no. of larvae per positive sample	
	1959	1960	1959	1960	1959	1960
220	11	14	18.2	7.1	1.0	1.0
221	11	8	18.2	0	4	0
222	2	3	0	0	0	0
223	21	6	23.8	33.3	3.6	4.0
225	7	14	14.3	50.0	1.0	1.7
Totals	52	45	19.2	22.2	2.8	2.1

Spruce Budworm, Choristoneura fumiferana (Clem.)

Spruce budworm populations in 1960 remained at a very low level. Five larvae were collected from spruce, hemlock, lodgepole pine and alpine fir.

A Hemlock Sawfly, Neodiprion sp.

Defoliation of western hemlock by the hemlock sawfly was negligible during 1960, and populations were comparable to those of 1959. Collections of from 50 to 130 larvae per 3-tree beating sample were taken along the Big Bend Highway at Mile 13, Goldstream River, Bigmouth Creek and Mile 94. In the remainder of the Central Nelson District the number of larvae per collection was very low. At Woodbury Creek the infestation of 1959 was reduced to a very low population, and only a few larvae were collected.

Black-headed Budworm, Acleris variana (Fern.)

Only one black-headed budworm larva was collected in the Central Nelson District in 1960. The host was western hemlock at Silverton.

Jack Pine Needle Miner, Zelleria haimbachi Busck

Lodgepole pine collections in the Central Nelson District commonly produced larvae of this needle miner. Larval counts on 50 branch tips were made on the lower crown of three saplings selected at random at five locations in the District; table 8 gives the results of these examinations.

Table 8

Percentage of Lodgepole Pine Branch Tips Infested by a Jack Pine Needle Miner in 50-tip samples, Central Nelson District - 1960

Date	Locality	Percentage infested
June 28	Silverton	6
June 28	Winlaw	6
June 28	Shoreacres	2
June 30	Slocan City	4
July 6	Evans Creek (Slocan Lake)	50

A Leaf Blotch-miner, Lyonetia sp.

This insect caused extensive leaf-mining on willow along the Big Bend Highway, Lemon Creek and Carpenter Creek in 1960. Willow leaves at Carpenter Creek were estimated to be 90 per cent infested at two sampling points, and by July 5 many leaves in these areas had dried and dropped. Leaves on western white birch in the vicinity of Trout Lake were moderately infested with the blotch-miner.

A Woolly Aphid on Western Hemlock, Adelges tsugae Annand

This insect is not common in the Central Nelson District. On May 13 numerous egg masses were observed on two western hemlock shade trees at Revelstoke; this is the only location where the insect was found. Figure 1 shows egg masses collected on May 24, 1960.

OTHER NOTEWORTHY INSECTS

Insect	Host	Number of collections	Remarks
Anomogyna mustelina Sm.	F, C, H, Pw	5	Kootenay Lake

Insect	Host	Number of collections	Remarks
Anoplonyx laricivorus Ross	L	3	defoliator
A. occidens R. & M.	L	1	defoliator
Argyresthia laricella Kft.	L	4	numerous dead tips on larch in Kaslo and Lardeau areas.
Campaea perlata Gn.	L, W	2	Kaslo
Caripeta divisata Wlk.	F, H, Pw	5	larvae found at widely separated points
Choristoneura rosaceana (Harr.)	W	2	Kane Cr.
Contarinia cuniculator Condr.	F	1	Kaslo
C. pseudotsugae Condr.	F	1	Slocan Lake
Cosymbia p. griseor McD.	W, Biw	2	Keen Cr.
Dendroctonus valens Lec.	Pw	1	Mile 27, Big Bend Highway - uncommon in Central Nelson District
Dioryctria abietivorella D. & S.	Pw	1	Cronartium gall borer
Ectropis crepuscularia Schiff.	Jc, Ma, Y, H, Pw	8	most common in Big Bend area
Epirrita autumnata Harr.	H	2	Sandon and Keen Cr.
Eucordylea atrupictella Dietz	Pl	1	Slocan Lake
Eupithecia l. bifasciata (Dyar)	F	2	Argenta
E. transcanadata MacK.	F, H	1	Kuskanax Cr.

Insect	Host	Number of Collections	Remarks
Feralia comstocki Grt.	F, H	6	Upper Arrow Lake area
F. jocosa Gn.	F, H	9	Nakusp and Winlaw
Galerucella carbo Lec.	W	2	Duncan River, Summit Lake
Gabriola dyari Tayl.	F	1	unusually low population in 1960
Hypagyrtis nubecularia Gn.	F	1	Little Slocan River
H. piniata Pack.	F, H	2	New Denver and Lardeau River
Hyperetis amicaria H.S.	W, Biw	2	Kaslo
Malacosoma pluviale Dyar	D, Cot, W	5	one tent on cottonwood at Koch Cr., several egg masses on willow at Mile 20, Big Bend Highway
Melanolophia imitata Wlk.	F, H, Se, C	34	common defoliator
Nematocampa filamentaria Gn.	F, H	5	Big Bend Highway
Neophasia menapia F. & F.	Py	1	Brilliant
Nyctobia limitaria Wlk.	F, H	2	Jordan River and Slocan City
Petrova sp.	Pl	4	Slocan Valley and Arrowpark
Phenacaspis pinifoliae (Fitch)	Se	1	unusual in Central Nelson District
Pikonema alaskensis (Roh.)	Se	3	South Slocan and Kootenay L. areas
P. dimmockii (Cress.)	Se	3	New Denver
Protoboarmia p. indicataria Wlk.	H, Pw, F Se, L		common throughout District
Schizura concinna A. & L.	Biw	1	numerous larvae south of Slocan City

Insect	Host	Number of collections	Remarks
S. sexmaculata Pack	L	2	Kaslo and Slocan Lake
Semiothisa granitata Gn.	F, H, Pl, Pw	21	very common
Synaxis jubararia Hulst.	H, C, F	5	Meadow Cr. and Big Bend Highway
Trichiosoma triangulum Kby.	W	5	quite common throughout District
Vespamima sequoiae	Pl, Se	2	pitch blobs quite numerous in Slocan Valley

STATUS OF FOREST DISEASES

Important Diseases

Dwarf Mistletoe on Western Larch

Numerous brooms caused by Arceuthobium campylopodum Engelm. f. laricis Jones were observed on mature western larch in the Springer Creek area of Slocan Lake. This appears to be the most severe area of infection by this parasite which occurs generally throughout the range of larch in the District.

Douglas-fir Needle Cast

Rhabdocline pseudotsugae Syd. was evident on Douglas fir in many areas of the Central Nelson District in 1960. No severe defoliation was observed except at Retallack, where one 4-inch d.b.h. tree had a very heavy needle drop.

Shoestring Root Rot.

White pine in the Central Nelson District was very commonly infected with Armillaria mellea (Vahl ex Fr.) Quel. in 1960 and numerous dead and dying sapling and pole-sized trees showed evidence of the disease.

Larch Needle Cast

The heaviest area of infection by Hypodermella laricis Tub. occurred on the east side of Upper Arrow Lake from Galena Bay south to Halcyon Hot Springs. The discoloration of western larch in this locality extended from the shoreline to an estimated altitude of 2500 feet. Western larch between West Arrowpark and West Demars, and in the vicinity of Slocan Lake was moderately infected.

Exotic Plantations

Examinations of the two exotic plantations in the Central Nelson District were carried out in September 1960. The *Populus* sp. plantation, XP 167, planted at Marblehead in the fall of 1959, showed no mortality. Table 1 gives results of the examination of plantation XP 168 established at Mosquito Landing, Kootenay Lake, in the spring of 1960. Both of the plantations were established from cuttings.

Table 1

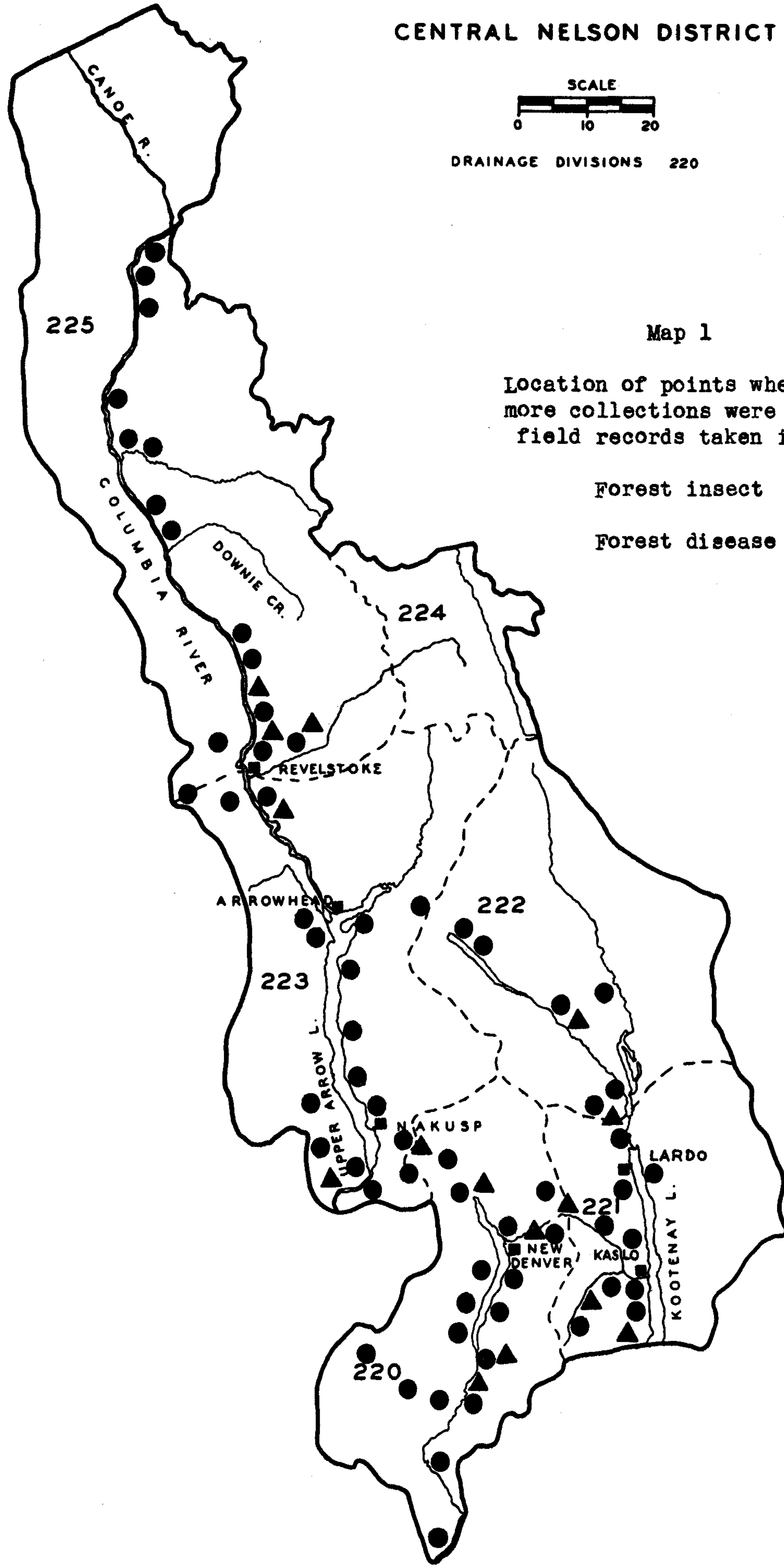
Percentage Mortality of *Populus* spp. at Plantation XP 168, Mosquito Landing, Central Nelson District 1960

Poplar variety	Percentage mortality
P. brooks #10	33.3
P. sargenti Dode	50
P. tristis	0
P. northwest	0
P. petroshyana	16.6
P. brooks #1	0
P. griffin	0
P. vernirubins	66.6
P. gelrica	100
P. F.N.S. 44-52	16.6
P. saskatchewan	100

Drought is believed to be the cause of the heavy mortality in this plantation.

OTHER NOTEWORTHY DISEASES

Host	Organism	Locality	Remarks
Pine, western white	*Cronartium ribicola* J. C. Fisch.	throughout district	White pine blister rust
Saskatoon	*Gymnosporangium clavipes* C. & P.	Enterprise Creek	Alternates on juniper
Cottonwood, black	*Melampsora occidentalis* Jacks.	Lardeau	Douglas fir-cottonwood rust

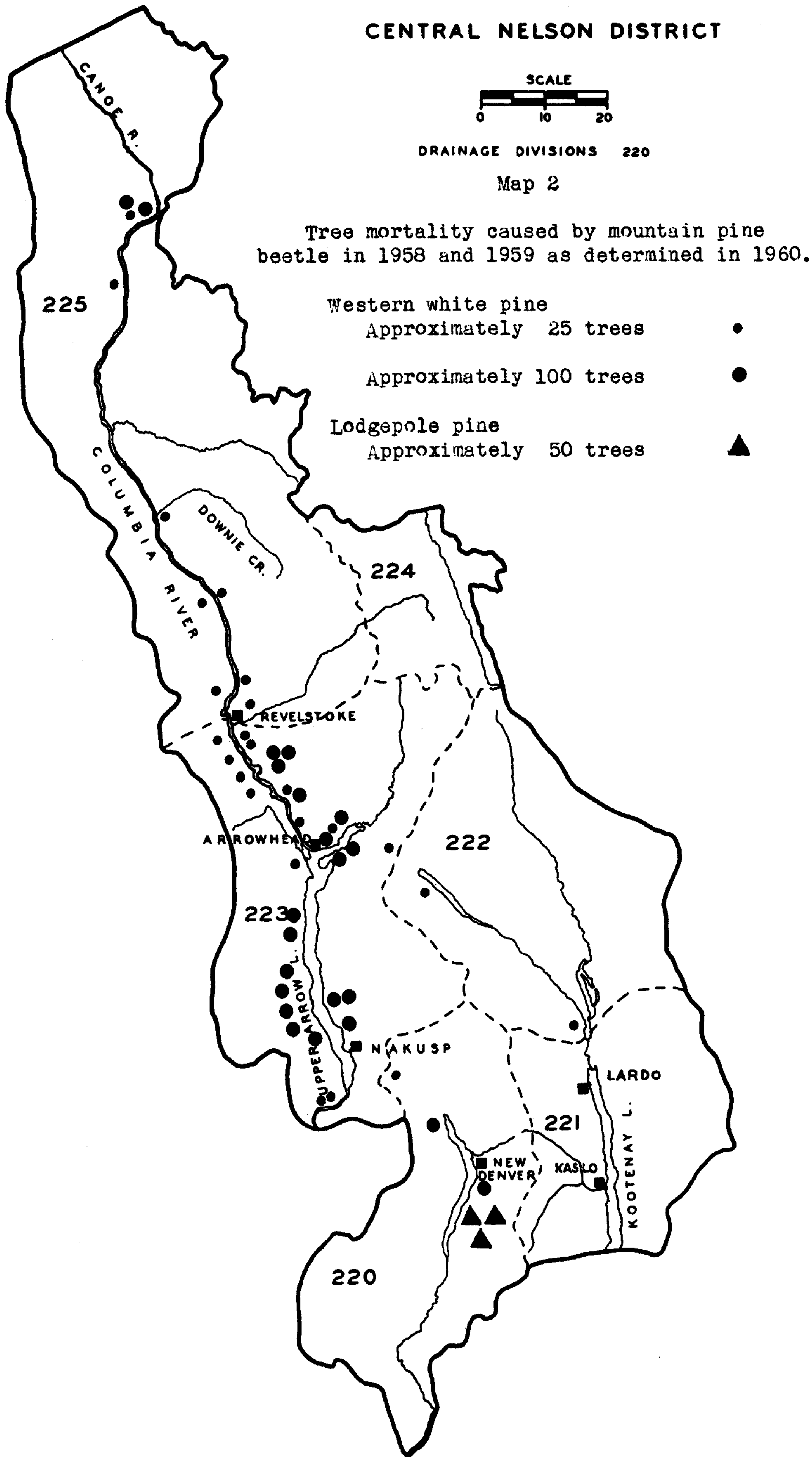


Map 1

Location of points where one or more collections were made and field records taken in 1960.

Forest insect ●

Forest disease ▲


CENTRAL NELSON DISTRICT
SCALE
0
10
20
DRAINAGE DIVISIONS 220
Map 2
Tree mortality caused by mountain pine beetle in 1958 and 1959 as determined in 1960.
Western white pine
Approximately 25 trees
Approximately 100 trees
Lodgepole pine
Approximately 50 trees
CANOE R.
225
COLUMBIA RIVER
DOWNIE CR.
224
REVELSTOKE
222
ARROWHEAD
223
UPPER ARROW L.
NAKUSP
LARDO
221
NEW DENVER
KASLO
KOOTENAY L.
220

ANNUAL REPORT OF FOREST BIOLOGY RANGER

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EAST NELSON DISTRICT

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FOREST BIOLOGY SURVEY

EAST NELSON DISTRICT

1960

R. J. Andrews

INTRODUCTION

Survey work in the East Nelson District started on May 10 and continued to October 14. Five hours of flying time contracted by the Vernon Laboratory were used in a bark beetle survey along the Columbia River Valley from Columbia Lake to Boat Encampment, and three hours, contracted by the British Columbia Forest Service, were used for survey of mountain pine beetle depredations in the Invermere and Canal Flats Ranger districts.

Totals of 364 forest insect and 21 disease collections were taken in the District by Forest Biology rangers and co-operators. Table 1 shows the forest insect and forest disease collections by host. Distribution of the collections is shown on Map 1.

Table 1

Collections by Hosts

East Nelson District - 1960

Coniferous hosts	Forest insects	Forest diseases	Broad-leaved hosts	Forest insects	Forest diseases
Cedar, western red	5	1	Alder spp.	14	-
Douglas fir	69	2	Aspen, trembling	14	4
Fir, alpine	19	2	Birch spp.	32	-
Fir, grand	1	-	Cherry, choke	8	-
Hemlock, western	19	-	Maple, Douglas	2	-
Juniper, common	1	-	Willow spp.	14	-
Juniper, Rocky Mountain	13	1	Miscellaneous	22	-
Larch, western	17	2			
Pine, lodgepole	57	6			
Pine, ponderosa	16	1			
Spruce, Engelmann	31	2			
			Total	106	4
Total	258	17	Grand total	364	21

STATUS OF FOREST INSECTS

Engelmann Spruce Beetle, *Dendroctonus engelmanni* Hopk.

Spruce bark beetles remain active in one area of the East Nelson District. At Foster Creek failure to follow the recommended policy of cutting low stumps and slash disposal resulted in a continuing high population. An inspection of the slash and neighbouring stand revealed a large, and potentially dangerous beetle population. Difficulty with contracting loggers and poor market conditions for spruce have necessitated the abandoning of logging in this area. The area was inspected at the request of the B. C. Forest Service Ranger at Invermere and it was recommended that trees along the border of the neighbouring stand be felled and the slash burned before beetle emergence in 1961.

On request of the Atlas Lumber Company at Elko, two areas of suspected spruce beetle activity were cruised and inspected. There were few current beetle attacks at Cabin Creek and on the north fork of Bloom Creek.

Mountain Pine Beetle, *Dendroctonus monticolae* Hopk.

Two strip cruises were run in two heavy infestations at Coyote Creek and Elk Creek in the Canal Flats Ranger District. Estimated area of the infestations was 150 acres at Coyote Creek and 100 acres at Elk Creek. Damage appraisal was based on five categories: "old grey", trees that were dead and without foliage; "red", dead trees retaining discoloured foliage; "1959 attack", trees attacked in 1959 and changing colour; "1960 attack", current attack with green foliage; and "healthy", trees untouched or unsuccessfully attacked by bark beetles. Table 2 and 3 show the results of the cruises.

Table 2

Percentage of Healthy and Mountain Pine Beetle-killed Lodgepole Pines on Two Strips Totalling 5.8 Acres, Coyote Creek Area, East Nelson District, July, 1960

Condition of trees	No. of stems	Percentage of stems	Total volume (cu. ft.)	Av. vol. per acre (cu. ft.)
Old grey	289	32.6	3,986	687.2
Red	84	9.5	1,158	199.6
1959 attack	38	4.3	524	90.3
1960 attack	11	1.2	151	26.0
Healthy	464	52.4	6,400	1,103.4
Total	886	100.0	12,220	

Table 3

Percentage of Healthy and Mountain Pine Beetle-killed Lodgepole Pines on Two Strips Totalling 3.6 Acres, Elk Creek Area, East Nelson District, July, 1960

Condition of trees	No. of stems	Percentage of stems	Total volume (cu. ft.)	Av. vol. per acre (cu. ft.)
Old grey	115	10.4	1,586	441
Red	63	5.7	868	233
1959 attack	18	1.6	248	69
1960 attack	26	2.5	358	99
Healthy	879	79.8	12,124	3,368
Total	1,101	100.0	15,184	

Beetle populations based on the number of discoloured trees seen from the air appeared to be an estimated 30 to 50 per cent higher at Coyote Creek than at Elk Creek. This however is not supported by data from the cruised strips. Strip cruises, though representing an unbiased sample of an infestation, may not necessarily include the most representative portion of the damaged area.

An infestation at Elk Creek was reported in 1949, but it does not seem likely, due to the small number of dead trees in the area, that a lingering population could have remained active up to the time of the present outbreak. No prior record could be found for the Coyote Creek infestation.

A new infestation comprising 250 lodgepole pine trees at the east end of Bush Lake was discovered in September. Spot infestations of white pine along the northern portion of the Big Bend Highway were mapped from the air.

In the Invermere District the population continued to decline. Sixty red-topped trees at Toby Creek and ten at Steamboat Mountain were the largest groups seen from the air. Map 2 shows the approximate number and distribution of lodgepole and white pine mortality caused by the mountain pine beetle in the East Nelson District as determined in 1960.

Douglas-fir Beetle, Dendroctonus pseudotsugae Hopk.

The annual count of beetle-killed trees indicated that there was increased attack in the Wigwam River Valley in 1959. At Spillimacheen 102 dead trees were counted in three patches. Three other localities where beetle-killed trees were observed are listed in Table 4 which shows the distribution of Douglas-fir mortality caused by bark beetles in the period

1957 to 1959 in East Nelson District, as determined in 1960.

Table 4

Douglas-fir Trees Killed by Douglas-fir Beetle,
East Nelson District, 1957-1959 as determined in 1960

Locality	No. of dead trees	Estimated vol. (cu. ft.)
Wigwam River	105	9,051
Brewster Creek	25	2,155
McCarthy Lake	40	3,448
Spillimacheen	102	8,793
Bluewater	50	4,310
Totals	322	27,757

Forest Tent Caterpillar, Malacosoma disstria Hbn.

A medium population of forest tent caterpillar caused up to 50 per cent defoliation of trembling aspen from Nicholson north to Donald in 1960. Four plots were established and egg masses from three trees counted at each location. Analysis of the plot data shown in Table 5 indicates a heavy population. Barring unfavourable conditions, there are sufficient healthy 1960 eggs to increase the population and cause heavy defoliation in 1961.

During the survey of this area in the third week of July a heavy adult flight was in progress. Large numbers of moths were observed around the lighted stores and street lights of Golden. At this time egg laying was common on coniferous as well as deciduous hosts. Up to 12 egg masses per tree were counted on regeneration lodgepole pine near the Donald plot.

Map 3 shows the approximate boundaries of the infestation.

Aspen Leaf-miner Phyllocnistis populiella Chamb.

A general increase in aspen leaf-miner population south of Golden was evident in 1960. The Big Bend area continued to support a heavy population with 96 per cent of the leaves infested.

Table 6 shows the results of leaf examinations at eight localities.

Table 5

Analysis of Forest Tent Caterpillar Egg Masses Collected from Trembling Aspen Trees, East Nelson District, 1960

Locality	Tree d.b.h. (in.)	Tree height (ft.)	Crown length (ft.)	Total no. 1960 egg masses	Av. no. eggs in five masses	Percentage: Living larvae	Percentage: Dead larvae	Percentage: Undevel-oped eggs	Percentage: Parasitized eggs
3 miles North of Nicholson	5	30	20	17	142	87.1	0.4	8.1	4.4
	5	32	15	18	161	97.4	0.2	2.4	0.0
	4.5	26	18	29	193	99.1	0.0	0.9	0.0
5 miles north of Nicholson	4	40	30	23	175	94.9	0.1	4.8	0.1
	5	40	30	75	174	95.2	0.0	4.8	0.0
	5	40	20	60	185	95.3	0.0	4.4	0.3
7 miles north of Nicholson	4	50	30	331	169	92.3	0.0	7.7	0.0
	4	50	38	120	183	95.9	0.1	4.0	0.0
	4	36	21	159	169	94.8	0.0	5.9	0.3
Donald station	5	40	25	248	143	86.4	0.7	12.5	0.4
	5	45	30	352	137	82.8	0.6	14.3	2.3
	6	40	20	219	150	90.8	0.0	7.3	0.9
	Averages				165.1	92.6	0.17	6.4	0.7

Table 6

Percentage of Trembling Aspen Leaves Infested by Aspen Leaf-miner, East Nelson District, 1960

Locality	No. of leaves examined	Percentage of leaves infested
Cranbrook	399	44
Moyie Lake	177	17
Yahk	437	17
St. Marys Lake	484	60
Dutch Creek	344	25
Five Mi. N. of Dutch Creek	187	50
Brisco	447	23
Bluewater Creek	306	96

Engelmann Spruce Weevil, *Pissodes engelmanni* Hopk.

An annual count of infested terminals on regeneration Engelmann spruce at two plots revealed light attack at Hawkins Creek and a heavier attack at Michel Creek. The method used was to count the number of attacked terminals and laterals on the regeneration trees. On the trees in the two plots heavy multi-terminal growth was common and no lateral attack was noted. Lateral attack occurs only when a number of larvae overflow from the terminal growth to the lateral branches near the junction of the two. Table 7 shows the data obtained from the two plots.

Table 7

Percentage of Engelmann Spruce Reproduction Attacked by Engelmann Spruce Weevil, East Nelson District, 1960

Locality	No. of trees examined	Percentage of stems			
		1960 attack only	Old attack only	1960 and old attack	No attack
Hawkins Creek	90	3.4	55.6	5.5	35.5
Michel Creek	100	17.0	32.0	16.0	35.0

Oregon Fir Sawyer, *Monochamus oregonensis* Lec.

In 1959 a July flight of the Oregon fir sawyer was observed near Bull River. Consequently the dead timber resulting from the 1960 season's fires which started on July 14 was suspect for attack. The three largest burns, all over 8,000 acres, were visited and three dominant tree species were sampled. The method of sampling was to strip three feet of bark from the stem centered at about breast height and record the incidence of attack in the bark and wood. The inspection of the stands was made in September when it was expected that larvae would have entered the wood, however only one entrance hole was found. All other larvae were found between the cambium layer and bark. Table 8 shows the date obtained from sampled trees.

Table 8

Number of Oregon Fir Sawyer Larvae in Fire-killed Trees,
East Nelson District, September, 1960

Locality	Host	No. of trees examined	Burn class	Av. no. of larvae per square foot	
				Under bark	In wood
Gold Creek	L	5	Moderate	1.6	0
Gold Creek	F	5	Moderate	0.4	0
Gold Creek	Se	5	Moderate to severe	0.5	0.1
St. Marys Lake	Pl	10	Moderate to severe	0.3	0
Galbraith Creek	Se	11	Light to severe	0.7	0

False Hemlock Looper, Nepytia canosaria Wlk.?

Light populations of this species were present in the Invermere and Elko drainage divisions. No defoliation was evident on any tree sampled. Table 9 shows the incidence of the false hemlock looper in quantitative collections from Douglas fir in 1959 and 1960.

Table 9

Three-tree Beating Collections of the False Hemlock Looper
from Douglas Fir, East Nelson District, 1959 and 1960

Drainage Divisions	No. of samples taken during larval period		Percentage of samples containing larvae		Av. no. of larvae per positive sample	
	1959	1960	1959	1960	1959	1960
240	21	15	9.5	6.6	5.0	7.0
243	26	45	23.0	17.7	6.8	1.5

European Pine Shoot Moth, Rhyacionia buoliana (Schiff.)

A survey to determine the possible introduction of the European pine shoot moth to native and exotic species of pine in the East Nelson District was carried out in 1960. Plantations of ponderosa and Scots pine, established by the B. C. Forest Service, were inspected but no damage was encountered. There is no establishment for commercial sale of exotic pine species in the District.

A larva collected from ponderosa pine near Wycliffe in 1958 was tentatively identified as Rhycionia buoliana (Schiff); the latest identification, however, has been changed to Rhyacionia sp., believed to be a native species.

A Pine Tip Moth, Rhyacionia sp.

A trace to light damage caused by a pine tip moth on ponderosa and lodgepole pines has been discovered at seven locations. Table 10 shows the localities where tips damaged in 1959 were found.

Table 10

Incidence of Pine Tip Moth Damage, East Nelson District, 1960

Location	Elev.	Host	Av. d.b.h. (inches)	No. of trees inspected	No. of damaged tips
Wildhorse Lake	2500	Pl	5	6	6
Elko-Waldo Junction	2800	Pl	5	8	2
Kimberley Airport	2900	Py	1	10	1
Kimberley Airport	2900	Pl	4	10	1
Premiere Lake	2800	Pl	4	10	3
Premiere Lake	2800	Py	2	10	2
Yahk	2700	Pl	2	40	8

Douglas-fir Needle Miners, Contarinia spp.

Douglas-fir needle miners were common in the Columbia River Valley, Contarinia pseudotsugae Condr. being the most abundant. C. cuniculator Condr. were less common and were found only at Spillamacheen, Toby Creek, Invermere and Brisco.

A Leaf-tier, Pseudexentera improbana oregonana Wlshm.

A heavy population was evident on roadside trembling aspen for two miles along the west side of Windermere Lake. Up to 30 per cent of the leaves had been rolled by June 9. Two other areas where a light populalation occurred were two miles southeast of Marysville and along the Newgate Road.

A Sawfly in the Staminate Flowers of Lodgepole Pine, *Xyela* sp.

To determine the degree of Xyela sp. infestation of staminate flowers of lodgepole pine, random clusters were picked and examined. Three sampling areas were established and the number of infested and non-infested flowers were counted. Almost one third of the flowers examined were infested at Kimberley Airport and near Cranbrook, while 17 per cent were infested near Yahk.

Western Tent Caterpillar, *Malacosoma pluviale* Dyar

The annual roadside count of tents on a half-mile strip at Fort Steele revealed a slight increase in population. A total of 246 tents was counted in 1960 compared with 225 in 1959.

The tents have been classified in two separate categories; elongate tents, representing the more active larvae, and compact tents, representing sluggish larvae. (Wellington, Population Dynamics, Canadian Journal of Zoology, Vol. 35.) The age of the infestation has a marked bearing on the numbers of each classification, a new infestation having predominantly elongate tents and an old, less active infestation having predominantly compact tents.

The two different shaped tents were counted and numbered consecutively for mapping. The compact tents proved to be predominant (71 per cent.) In mapping the tents a certain tendency for grouping was noted in the compact type, however the accuracy of numbering consecutively is limited or biased due to the number of different types on one tree.

Populations were light elsewhere in the District.

A Birch Leaf Blotch Miner, *Lyonetia* sp.

The heavy infestation of a birch leaf blotch miner caused severe browning of foliage on birch and willows from Bush River to Cummings River.

A Needle-feeding Scarabaeid, *Dichelonyx* sp.

More than 80 beetles per collection were taken in beating samples of Douglas fir and lodgepole pine from Fort Steele to Invermere. Near Dutch Creek 10 per cent of the current year's needles had been consumed.

A Midge Infesting Pine Twigs, *Cecidomyia* sp.

A total collapse of the 1959 population was evident in each of the four plots established in ponderosa pine stands in 1958. Branch terminal inspection in May revealed that the moisture content of some of the terminals was very high, however in the higher percentage of terminals examined, the dead larvae were in dried-out tips. Probable cause of the high mortality was the adverse weather conditions in the summer of 1959 and spring of 1960.

Other areas where light populations were encountered are Yahk, Wardner, Galloway, Elko, Kimberley Airport and near Cranbrook.

A Sawfly on Douglas fir, *Neodiprion* sp.

A total of 31 larvae was collected in 12 random samples of Douglas fir. The maximum number of larvae per beating collection was nine, near Dutch Creek.

A Sawfly on Lodgepole Pine, *Neodiprion* sp.

Colonies of *Neodiprion* sp. were common on lodgepole pines near Canal Flats and Wardner.

A Sawfly on Hemlock, *Neodiprion* sp.

A total of 112 *Neodiprion* sp. larvae was collected in five random beating samples of hemlock. Fifty-two larvae at Bush River were the largest yield from a single sample.

A Pine Tube Moth, *Argyrotaenia tabulana* Freem.

A further decline of population was noted through branch counts taken from Kimberley Airport to Canal Flats. The largest number of tubes found in five branch samples was 23 near Kimberley Airport. The following table shows a comparison of the number of tubes on branch samples in three plots, in 1958, 1959 and 1960.

Table 11

Number of Tubes Made by Larvae of a Pine Tube Moth on Branch Samples from Lodgepole Pine in Three Plots, East Nelson District, 1958, 1959 and 1960

Locality	No. of tubes on five branches			Av. no. tubes per branch		
	1958	1959	1960	1958	1959	1960
11 mi. N. Springbrook	101	66	10	20.1	13.1	2.0
Kimberley Airport	171	36	23	34.1	7.1	4.3
Premiere Lake	79	25	12	15.8	5.0	2.2

Spotless Fall Webworm, Hyphantria cunea (Drury)

The annual count of tents on half-mile roadside strips at Bull River and near Elko revealed a nearly total collapse of populations. At Bull River in 1959, 21 tents were counted while in 1960 only one tent was located. A single tent was found near Elko.

Cone Insects of Western Larch

A light population of Cecidomyiidae infesting cones of western larch was found seven miles south of Kimberley and three miles west of Cranbrook in 1960.

A lepidopterous larva was noted in several of the cones, however heavy parasitism was evident and no larvae were reared.

Seed Insects of Western White Birch

Infested white birch catkins were found in three localities in 1960. Near Dutch Creek 96 per cent of the catkins were infested. At White Swan Lake, and near Elko damage was light.

Insectary rearing produced a weevil, Anthonomus sp., and a Lepidoptera from the infested catkins. No further identifications have been made to date.

A Leaf-eating Beetle, Chrysomela alnicola interna Brown

In a 3-bush beating of mountain alder at Doctor Creek more than 300 adults were counted. Heavy skeletonizing and defoliation was prevalent along two miles of creekside alder. Other localities where light feeding by this species occurred were Spillimacheen and Elk Creek.

A Birch Leaf Roller, Eulype sp.

A medium population of this geometrid was found feeding on western white birch near the Silver Basin Road. Defoliation was light for one and a half miles. A light population was encountered near White Swan Lake and the Kootenay River road; defoliation at three locations was negligible.

Red-humped Apple Worm, Schizura concinna A. & S.

Light feeding on roadside rose bushes was noted at three localities, Estella Mine road, Ta Ta Creek and Fort Steele junction. While defoliation ranged to 50 per cent on single bushes, one or two colonies only were found at each location.

Green Striped Forest Looper, Melanolophia imitata Wlk.

Douglas fir and western hemlock were the two favoured hosts of this geometrid. A total of 15 larvae was collected in six samples of Douglas fir containing the green striped forest looper. Nine larvae were found in two western hemlock collections.

Green Spruce Looper, Semiothisa granitata Gn.

The green spruce looper was commonly found on Douglas fir, Engelmann spruce, and western hemlock. In 26 collections from Douglas fir a total of 60 larvae was collected. Three samples from western hemlock and Engelmann spruce yielded six larvae.

Black-headed Budworm, Acleris variana (Fern.)

A single larva was collected from an Engelmann spruce near Donald.

Hemlock Looper, Lambdina fiscellaria lugubrosa (Hulst)

Two collections of the hemlock looper were made from western red cedar and Engelmann spruce. The highest number of larvae was three. One larva was collected from water birch near Wasa bridge.

Spruce Budworm, Choristoneura fumiferana (Clem.)

Larvae were collected from Engelmann spruce, western larch, alpine fir, Douglas fir, and lodgepole pine. The latter host was the most popular, with collections of two to seven larvae. Collection dates ranged from June 16 to July 6.

OTHER NOTEWORTHY INSECTS

Insect	Host	Number of collections	Remarks
Achytonix praeacuta Sm.	F	4	Canal Flats East Cranbrook
Acronicta dactylina Grt.	W	1	Spillimacheen
A. fragilis Gn.	Elder	1	Canal Flats
A. grisea Wlk.	Biw	1	Moyie Lake
A. innotata Gn.	Bi	1	Findlay Creek
A. radcliffei vancouverensis Strand	Saskatoon Elder	2	Kootenay River Rd., St. Marys Lake

Insect	Host	Number of collections	Remarks
Anacamptodes emasculata Dyar	W	1	Single larvae, McGinty Lake
Anoplonyx laricivorus Roh. & Midd.	L	6	Common on all larch sampled
A. occidens Ross	L	8	Common on all larch sampled
Anavitrinella pampinaria (Guen.)	F, Bi	2	Canal flats Wasa Lake
Archips cerasivorana (Fitch)	Chokecherry	2	Ta Ta Creek, Elko Decrease from 1959
A. packardiana Fern.	Se	1	Premiere Lake
Arge clavicornis (Fab.)	W, Bi	2	Wasa Lake, Spillimacheen 3 larvae in one collection
A. pectoralis (Leach)	Biw	2	Spillimacheen; single branch defoliation
Argyresthia laricella Kft.	L	1	1 pupa near Bull R. decrease from 1959
Biston cognataria Gn.	W, Bi, Se	5	Mostly single larvae
Caripeta divisata Wlk.	F	3	Spillimacheen, Canal Flats, St. Marys Lake
Dioryctria auranticella (Grote)	Pl	1	Joseph Creek
D. pseudotsugella Grt.	F	4	From Ft. Steele to Wasa, 4 collections yielded 2 larvae per collection
D. reniculelella (Grote)	Se	4	Highest single collection yielded seven larvae. Ft. Steele, Fairmont, Dutch Creek
Ectropis crepuscularia Schiff.	H	9	All collections taken along Big Bend, largest single collection yielded 4 larvae

Insect	Host	Number of collections	Remarks
Enypia moillieti Blkmre.	F	3	Highest single collection yielded 4 larvae near Dutch Creek
Epirrhanthis substriataria Hlst.	W	1	Nicholson
Eucordylea atrupictella Dietz.	Pl	1	Springbrook
Eucosma sp.	Pl	2	Springbrook, Matthew Creek, new record at Matthew Creek
Eupithecia annulata Hulst.	F, Se	4	Single larva collections Fort Steele, Fairmount, Invermere
E. castigata Hbn.	W	2	Spillimacheen, McGinty Lake
E. fletcherata Tayl.?	Biw	1	Spillimacheen
E. luteata bifasciata Dyar	Ba, H, F, L	11	Common on most coniferous hosts. Largest single collection yielded 8 larvae from Ba
E. pseudotsugata Mck.	F	1	McGinty Lake, Single larvae collected
Euthyatira pudens Gn.	Dogwood	1	Elk Creek
Feralia comstocki Grt.	F, Se, H, Pl, Ba	9	Single and two larvae collections common throughout District
F. jocosa Gn.	H	6	All collections from wet-belt forest on Big Bend
Griselda radicana Wlshm.	Se, F	8	Dutch Creek, Premiere Lake, Fort Steele, St. Marys Lake, Springbrook
Hemichroa crocea (Fourc.)	D	2	St. Marys Lake, Bull River Rd. Single branch defoliation
Hydriomena renunciata Wlk.	D	3	Single larva collections Moyie Lake, St. Marys L. Blacktail Creek

Insect	Host	Number of collections	Remarks
Hypagyrtis nubecularia Gn.	Bi	2	Ft. Steele, Wasa
Hyperetis amicaria H. S.	Biw, Bio, W	3	Fairmont, White Swan L., McGinty Lake
Itame anataria Swett.	Biw, Bio	3	Three and four larvae per collection.
Lexis bicolor Grt.	F	1	Invermere
Meroptera nebulella Riley	Biw	1	Lumberton
Nadata gibbosa Butl.	Biw	2	Canal Flats, St. Marys L.
Nematocampa filamentaria Gn.	F, H	6	One and two larvae per collection. Invermere, Kinbasket L., Boat Encampment
Notodonta simplaria Graef.	W	1	Golden
Panthea virginaria Grt.?	F, Pl	4	Decrease from 1959. Ft. Steele, Canal Flats, Premiere L., St. Marys L.
Pero behrensarius Pack.	F	3	Single larvae collections Premiere L., Luxor, Spillimacheen
Pikonema alaskensis Roh.	Se	8	Up to six larvae per collection. Common throughout the District
P. dimmockii Cress.	Se	6	Up to eight larvae per collection common
Plagodis phlogosaria approximaria Dyar	Bi, W	2	Ft. Steele, Donald
Pleroneura borealis Felt	Ba	2	Bull River, Bighorn Crk.
Pristiphora sp.	L	5	Cranbrook, Matthew Crk., Dutch Crk, Howell Crk., Lodgepole Crk.
Protitame matilda Dyar	W	1	Spillimacheen
Protoboarmia porcelaria indicataria Wlk.	F	3	Yahk, single larvae

Insect	Host	Number of collections	Remarks
Pseudohazis eglanterina Bdv.	Antelope bush	1	Roosville
Pseudothyatira cymatophoroides expultrix Grt.	Biw	1	Lumberton
Semiothisa adonis B. & McD.	Pl	1	Edgewater
S. neptaria Gn.	B, W	2	Wasa, White Swan L.
S. setonana McD.	Js	3	Common on most Js
S. sexmaculata Pack.	L	4	Common throughout the range of host
S. ulsterata Pears.	Bi	1	Wasa L.
Smerinthus cerisyi Kby.	W	1	McGinty L.
Stenoporpia excelsaria B. & McD.?	Pl	1	Cherry Creek
Synaxis jubararia Hlst.	H, Biw	4	Single larva collections Blackwater, Boat Encampment, Kinbasket L, Canal Flats
Xylomoges dolosa Grt.	A	2	Nicholson, Dutch Creek
X. hiemalis Grt.?	F	1	Bummer's Flat
X. perlubens Grt.	F	2	Fort Steele, Decrease from 1959
Zale duplicata Sm.	Pl	1	Decrease from 1959, Couldrey Creek
Zelleria haimbachi Busck	Pl	3	Decrease from 1959 Cherry Crk., Mathew Crk.

STATUS OF FOREST DISEASES

Important Diseases

Needle Blight of Douglas fir Rhabdocline pseudotsugae Syd.

The heavy recurrent infection of Rhabdocline pseudotsugae Syd. on regeneration and immature Douglas fir continued in East Cranbrook, Canal Flats, Invermere, and Spillimacheen Ranger districts.

Fume Damage

Severe browning and needle cast of ponderosa pines two miles south of Kimberley was attributed to fumes from the Kimberley fertilizer plant. The area covered was approximately 20 acres.

Bud Necrosis on Regeneration Douglas fir and Engelmann Spruce

Scattered regeneration Douglas fir from Invermere to Radium was heavily infected by an as yet unidentified disease. Ten Engelmann spruce trees growing in extensive regeneration in an old 40-acre field near Fairmont, were examined. Ten branch samples were taken from each and the number of infected and healthy buds were counted. A total of 2,157 buds were examined; 521 were dead. On infected trees, 52 per cent of the buds were dead.

Coleosporium asterum (Diet.) Syd.

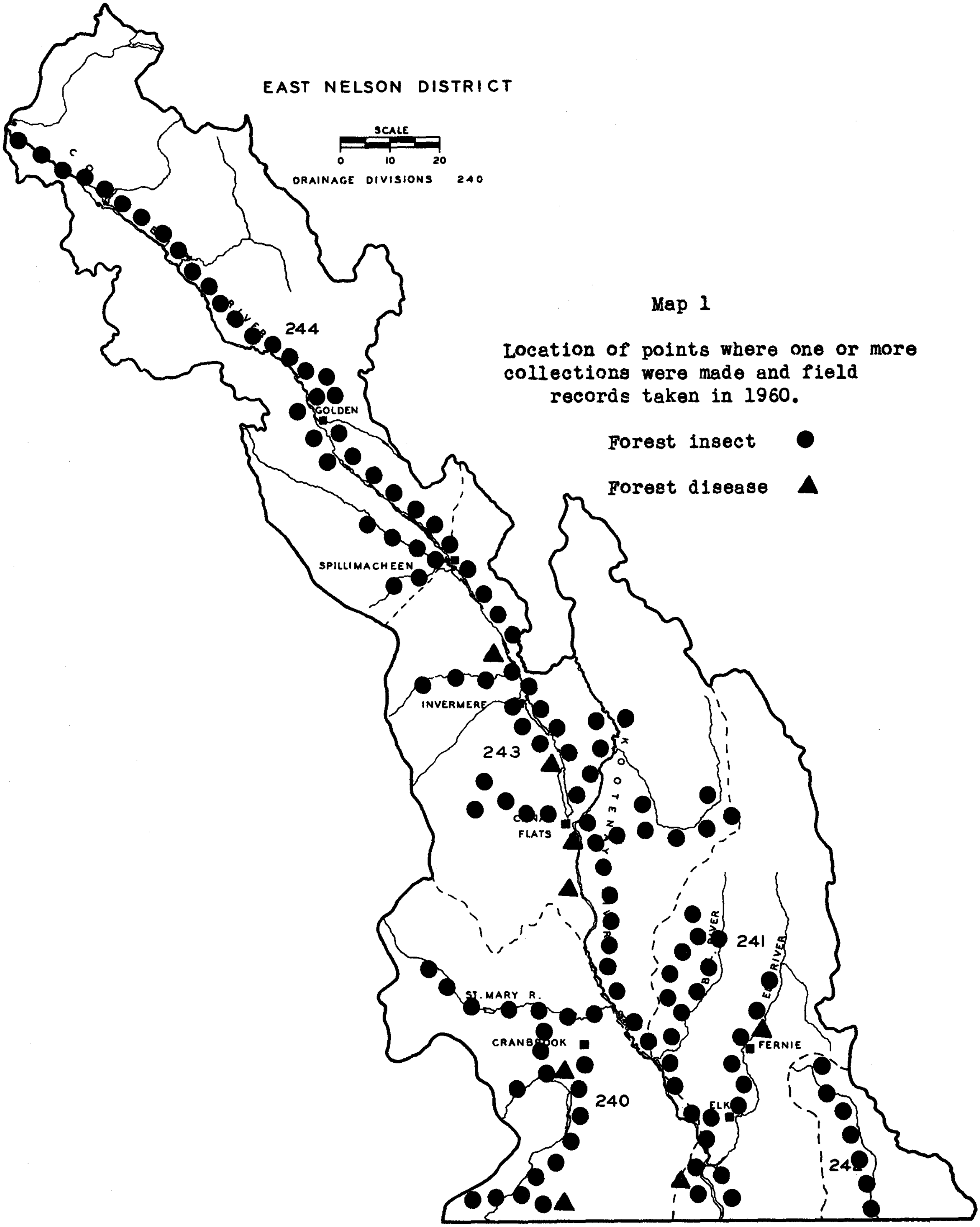
Light to medium occurrence of this needle rust was noted on regeneration lodgepole pines at Coyote Creek.

A Dieback of Douglas Fir

The annual inspection of plots established in 1958 disclosed little new infection. The plot near Waldo was the only location where new infection occurred. Three trees, two with dying branches and the third with the top dying back represented the only damage in 100 tagged trees.

Exotic Plantations.

A new plot, XP 149, was visited in June and disclosed high mortality in European larch. The only site where encouraging results have been obtained is near the Yahk River. On Plot XP 143, where *Pinus sylvestris* L. was planted in 1956 as two-inch seedlings, the average height in 1960 was 18 inches.

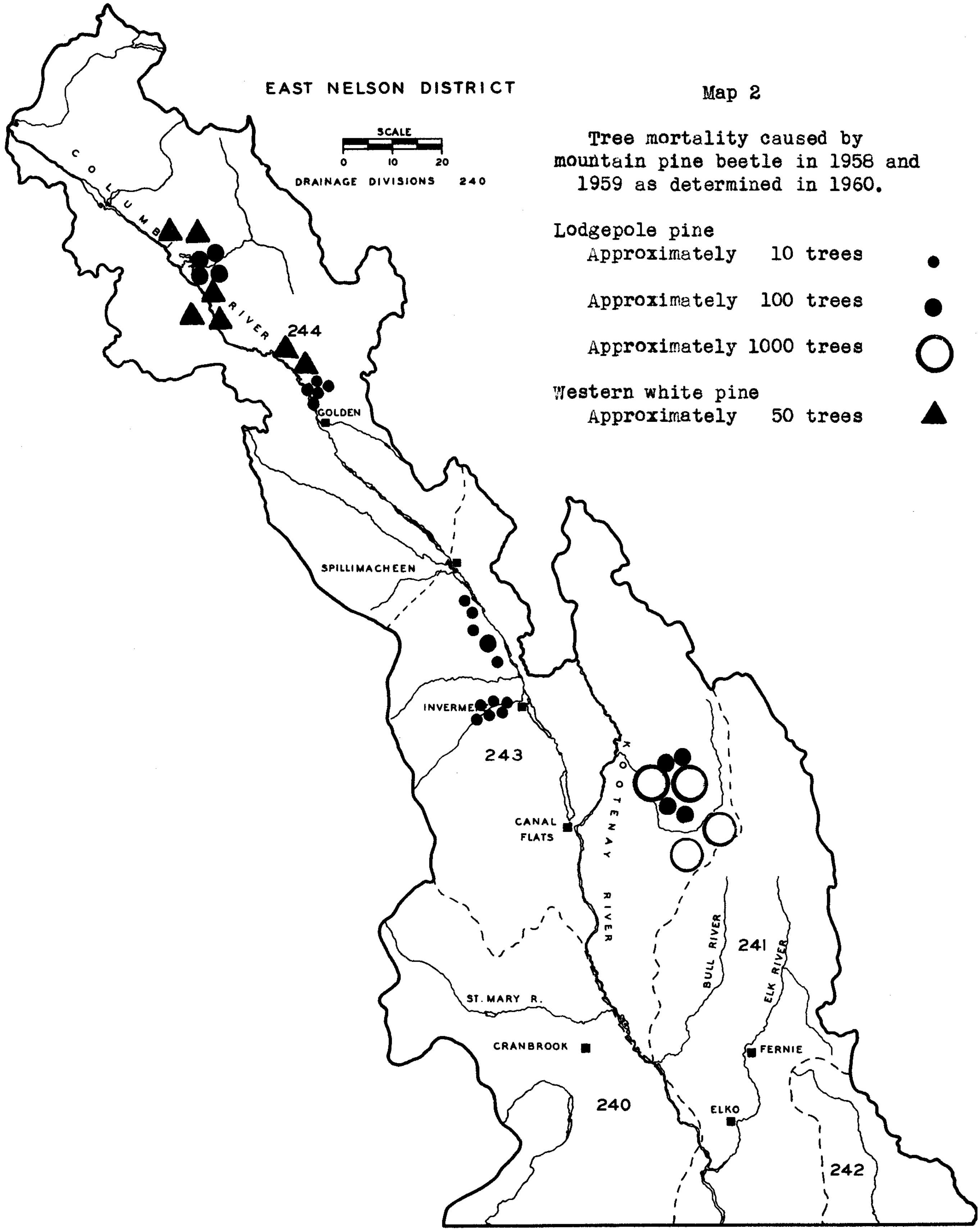


Map 1

Location of points where one or more collections were made and field records taken in 1960.

Forest insect ●

Forest disease ▲

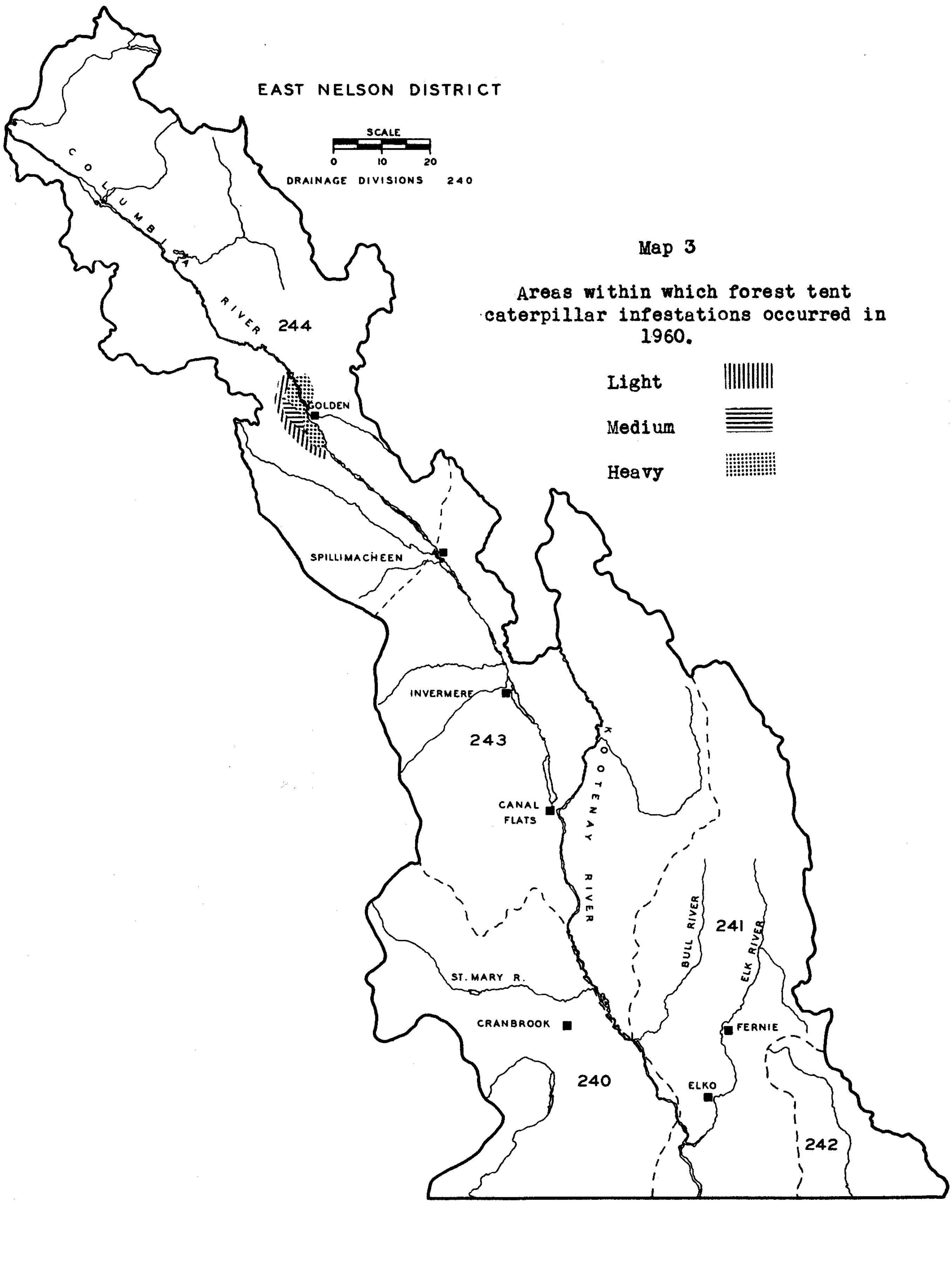


Map 2

Tree mortality caused by mountain pine beetle in 1958 and 1959 as determined in 1960.

Lodgepole pine
Approximately 10 trees
Approximately 100 trees
Approximately 1000 trees

Western white pine
Approximately 50 trees



EAST NELSON DISTRICT
SCALE
0 10 20
DRAINAGE DIVISIONS 240
Map 3
Areas within which forest tent caterpillar infestations occurred in 1960.
Light
Medium
Heavy
COLUMBIA RIVER
244
GOLDEN
SPILLIMACHEEN
INVERMERE
243
CANAL FLATS
KOOTENAY RIVER
BULL RIVER
241
ELK RIVER
ST. MARY R.
CRANBROOK
FERNIE
240
ELKO
242

ANNUAL REPORT OF FOREST BIOLOGY RANGERS

BRITISH COLUMBIA

1960

PRINCE GEORGE FOREST DISTRICT

FOREST BIOLOGY SURVEY

PRINCE GEORGE FOREST DISTRICT

1960

D. W. Taylor

INTRODUCTION

In 1960 the four Prince George Forest Biology Ranger districts were surveyed by T. A. D. Woods and J. Holms in North Prince George and Yukon Territory respectively, and E. V. Morris and D. W. Taylor were responsible for the West and South Prince George districts.

Lake areas were surveyed by dinghy and aircraft in 1960, primarily to map the areas infested by the two-year-cycle spruce budworm. Approximately 7,700,000 acres were affected by this defoliator in the Prince George Forest District. A small infestation of the one-year-cycle spruce budworm near Smith River, Alaska Highway, decreased in intensity at the original centre but increased around its perimeter.

A small population of mountain pine beetle persisted at the southeast end of Takla Lake but the infestation in this area appears to have subsided.

The Douglas-fir beetle caused noteworthy losses in the Quesnel and Hixon districts, and on Stuart Lake. The heaviest tree mortality in recent years occurred in the Buck Ridge area, where 1250 red tops were counted from an aircraft.

An infestation of the forest tent caterpillar near McBride remained unchanged although there was evidence of a population buildup outside the original outbreak.

The aspen leaf-miner, while decreasing in intensity in the northern districts, increased in the West and South Prince George districts.

ANNUAL REPORT OF FOREST BIOLOGY RANGER

for

SOUTH PRINCE GEORGE DISTRICT

1960

FOREST BIOLOGY SURVEY

SOUTH PRINCE GEORGE DISTRICT

1960

D. W. Taylor

INTRODUCTION

The 1960 survey of this District was carried out between June 5 and September 24. In March, initial investigation relating to bark-beetle control work were made at Lodi Lake and in October an annual tent caterpillar egg survey was made near McBride. Twenty-eight hours were spent on aerial surveys, from Telegraph Creek to Bowron Lake.

A total of 300 forest insect and 34 forest disease collections were made in 1960. Table 1 shows the number of collections by hosts and Map 1 shows the approximate location where collections were made.

Table 1

Collections by Hosts

South Prince George District - 1960

Coniferous hosts	Forest insects	Forest diseases	Broad-leaved hosts	Forest insects	Forest diseases
Douglas fir	38	2	Aspen, trembling	18	1
Fir, alpine	49	9	Birch, white	12	-
Hemlock, western	9	-	Cottonwood, black	6	-
Pine, lodgepole	38	7	Willow spp.	19	3
Spruce, black	8	1	Miscellaneous	44	6
Spruce, white	59	5			
			Total	99	10
Total	201	24	Grand total	300	34

STATUS OF INSECTS

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

Sampling indicated that the infestations which had been scattered throughout the area between the Fraser River south of Prince George and the Bowron River, coalesced in 1960 and became centralized mainly in the Willow, Naver and Ahbau River valleys. Separate infestations occupied small areas east of Dewey, west of McBride in the Dore River district, and in part of the Swift and Sovereign River valleys. A total area of approximately 1,360 square miles was affected.

Six study plots have been established in the District, one in 1955, three in 1959, and two in 1960. Only the Barkerville plot can be used for population comparison as it was the only one sampled in 1958, the last "flight year".

In mid-June an 18-inch branch was taken from ten alpine fir trees at each plot, to assess the bud damage and larval population. Table 2 shows the number of tips examined, the percentage killed, and the number of larvae per square foot of foliage.

Table 2

Mortality of Alpine Fir Tips Caused by Spruce Budworm and Number of Larvae per Square Foot of Foliage, South Prince George, 1960

Locality	No. of tips examined	Percentage of tips killed	No. of larvae per sq. ft. of foliage
George Mountain	681	26.4	5.76
Strath-naver	685	42.7	5.14
Genevieve Lake	741	25.7	4.3
Barker-ville	288	5.9	0

In mid-August sampling was repeated, to obtain information on the 1960 defoliation and the current egg population. These data are shown in Table 3.

Table 3

Average Estimated Defoliation, Number and Condition of Pupae, and Number of Egg Masses per Square Foot of Foliage, South Prince George, August, 1960

Locality	Av. estimated defoliation		Pupae		Av. no. of egg masses per sq. ft.
	New	Old	No. adults emerged	No. dead	
George Mountain	80	17	8	3	1.53
Strathnaver	80	21	18	4	0.73
Genevieve Lake	61	10	54	1	2.63
Barkerville	0	0	0	0	0

The larval and egg mass populations shown in Tables 2 and 3 are not as high as those reported in the Babine Lake area in 1958, where some trees have been killed. Tree mortality in the South Prince George District has been confined to understory saplings.

Douglas-fir Beetle, Dendroctonus pseudotsugae Hopk.

The only noteworthy damage caused by this bark beetle in 1960 was in the southern part of the District. A total of 1,250 red-topped Douglas-fir trees, killed in 1957 to 1959 inclusive, were counted on an aerial survey of the Narcosli Creek-Buck Ridge area in 1960. This figure indicates that the 1959 beetle attack was heavier than in the previous year. Based on a volume of 66 cubic feet per tree, the total loss due to bark beetles in this locality in 1957 to 1959 was 82,500 cubic feet.

No 1960 attacks were found around the "Klub" fire near Buck Ridge, where fire-scarred Douglas fir had been infested in 1959.

Mr. R. Woods, Forester for Western Plywoods at Quesnel, reported approximately 900 infested trees on T.F.L. 5, Westply Tree Farm License. Of these, 550 were windfalls.

Alaska Spruce Beetle, Dendroctonus borealis Hopk.

No damage to standing timber was noted in 1960, but control action was undertaken on the Naver Access Road, where several million cubic feet of white spruce logs cut on the right-of-way had been infested. In March 1960, an examination of these logs revealed a high bark beetle population. Although the majority of the logs were to be removed before beetle emergence, it was feared that broods from infested material which was inaccessible to trucks might infest the adjacent stands.

About 51,000 cubic feet decked along the right-of-way and about 4,000 cubic feet of undecked logs were sprayed with an oil emulsion containing 0.75 pounds of ethylene dibromide per Imperial gallon. Parts of the undecked logs were not sprayed, to permit a check on the effectiveness of the application. In addition, at least 75 per cent of the bark was peeled from 193,500 cubic feet of undecked logs inaccessible for spraying. The spray was applied between May 31 and June 7 and the peeling was done between May 26 and June 27.

Logs on the right-of-way at Hay Lake, and in two cold decks were examined by Dr. L. H. McMullen and the writer on June 21, to evaluate the spray operation. Table 4 presents the data obtained from the examination of one-foot square bark samples from sprayed and unsprayed material.

Table 4

Alaska Spruce Beetle in Sprayed and Unsprayed White Spruce Logs, Hay Lake, June 21, 1960

	No. of samples	No. of attacks	No. of progeny	No. of survivors	Percentage mortality
Undecked logs					
Sprayed	14	55	325	42	87.1
Unsprayed	14	55	538	499	7.2
Cold Decks					
Sprayed	10	19	306	2	99.3
Unsprayed	0	-	-	-	-

The low rate of survival in sprayed logs indicates that the control program eliminated the bark beetle hazard. However, ambrosia beetles Trypodendron sp., and wood borers Tetropium sp. in the sapwood were not seriously affected.

Although live larvae were found on June 21 in chips from logs peeled on June 3, it is unlikely that they would have survived the hot dry weather in July.

Forest Tent Caterpillar, Malacosoma disstria Hbn.

The forest tent caterpillar outbreak in the McBride area continued in 1960. With the exception of slight activity south of the main infestation in the Canoe River Valley, defoliation of trembling aspens was confined to the original area. It extended from Dunster to Croydon Station and from one side of the Fraser River Valley to the other.

It was estimated that 20 to 30 per cent defoliation occurred near the northern part of the infestation and 60 per cent near the centre.

To determine population trends, the standard method of sampling was used, i.e., all egg masses from three trees at each sample location were collected. Randomly selected samples of five egg masses from each tree were examined at the laboratory; the results are shown in Table 5.

Table 6 compares the findings of the surveys 1957-1960 inclusive. Although there were fewer egg masses per tree in 1960 than in 1959, and the percentage of living larvae was also reduced, there will probably be moderate to heavy defoliation in the McBride infestation in 1961.

Oblique-banded Leaf Roller, Choristoneura rosaceana (Harr.)

Larvae were collected on June 9 at McBride. During 1958 and 1959 leaf rolling and feeding had occurred on 45 to 90 per cent of the trembling aspens over 100 square miles in the Upper Fraser River Valley. In 1960 many spot infestations were recorded in the valley from Rainbow to the Alberta border. Inaccessibility of these areas and rearing difficulties have so far prevented any detailed study of this species.

Engelmann Spruce Weevil, Pissodes engelmanni Hopk.

Populations appeared to have declined slightly over the District in 1960. Active infestations still remained at Wansa Lake and Cottonwood House near Quesnel. At the study plot established in 1959 at Wansa Lake, only 13 tips, one a lateral, were infested in 1960. This represented a decrease from 46 per cent to 29 per cent in the number of trees infested in 1959 and 1960.

Single infested trees were common throughout the District. One white spruce seedling at the Prince George Experimental Farm had five years of leader growth killed.

Table 5

Analysis of Forest Tent Caterpillar Egg Masses from Trembling Aspens, Tete Jaune Area, October, 1960

Tree no.	D.B.H. (inches)	Tree height (ft.)	Crown length (ft.)	Total no. 1960 egg masses	Av. no. of eggs per mass	Percentage			
						Living larvae	Dead larvae	Undevel. larvae	Paras. eggs
S1	5	36	16	24	119.8	89.5	0	4.5	6.0
S2	6	45	33	15	134.0	73.5	0.1	18.8	7.5
S3	5	36	20	19	143.6	92.7	0.1	5.8	1.2
C1	4	36	24	10	136.8	84.2	0.7	7.6	7.4
C2	4	36	15	8	117.8	74.7	0.2	15.6	9.5
C3	5	43	24	39	137.2	93.6	0	3.5	2.9
N1	5	27	20	16	160.8	73.4	1.4	21.8	3.5
N2	6	42	18	18	134.6	87.1	0.6	4.9	7.4
N3	5	33	15	31	143.4	92.5	0.1	5.0	2.4
	Averages			20	136.4	84.6	.4	9.7	5.3

Table 6

Summary of Egg Surveys of the Forest Tent Caterpillar 1957-1960 Inclusive, McBride, B. C.

Year	Av. no egg masses per tree	Percentage			
		Living larvae	Dead larvae	Undeveloped eggs	Parasitized eggs
1957	11.3	91.2	0.4	7.9	0.6
1958	22.3	90.0	0.4	9.0	0.5
1959	36.0	88.7	1.6	8.0	1.7
1960	20.0	84.6	0.4	9.7	5.3

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

Hemlock looper populations remained at a very low level in 1960; only two collections were taken. One was at Wansa Lake and the other at Albreda, and both contained single larvae. Table 7 shows a comparison of population fluctuations as represented by three-tree beating collections from coniferous hosts in the period 1958 to 1960.

Table 7

Three-tree Beating Collections of Western Hemlock Looper on Coniferous Hosts, South Prince George District, 1958 to 1960

Total no. of collections taken during larval period			Percentage of collections containing larvae			Av. no. larvae per positive collection		
1958	1959	1960	1958	1959	1960	1958	1959	1960
72	49	27	9.7	7.1	7.4	1.4	1.0	1.0

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

No larvae were collected in 1960. Numbers of this insect have declined since 1958.

Saddle-backed Looper, *Ectropis crepuscularia* Schiff.

The saddle-backed looper has been collected in small numbers since 1958. Although the preferred host was alpine fir some of the larvae were feeding on white spruce and western hemlock in 1960. Table 8 shows fluctuations in the numbers of larvae taken in three-tree beating collections in the period 1958 to 1960.

Table 8

Three-tree Beating Collections of Saddle-backed Looper on Conifers, South Prince George District, 1958 to 1960

Total no. of collections taken during larval period			Percentage of collections containing larvae			Av. no. larvae per positive collection		
1958	1959	1960	1958	1959	1960	1958	1959	1960
40	108	84	5.0	13.9	5.9	1.0	1.7	1.2

Aspen Leaf-miner, Phyllocnistis populiella Cham.

This miner increased throughout the South Prince George District in 1960. Some of the sample points were changed from their 1959 locations, but were still representative of their respective areas. Figures shown in Table 9 were obtained by examining leaves from sample trees at five locations, and by dissecting 100 cocoons at each locality.

Table 9

Percentage of Aspen Leaf Surfaces Infested and Mortality of Aspen Leaf-miner Cocoons in 100-Cocoon Samples, South Prince George District, August, 1960

Locality	Percentage of leaf surfaces with mines	Percentage of cocoon mortality	
		Parasitism	Other causes
Prince George	51.	3	2
Cole creek	62	9	2
Stone Creek	58	19	6
Woodpecker	73	9	3
Hixon	71	4	0

Douglas-fir Needle Miners, Contarinia spp.

Mined Douglas-fir needles were found at 11 widely scattered points in the District in 1960. Careful scrutiny revealed that these miners,

C. pseudotsugae Condr., C. cuniculator Condr. and C. constricta Condr. were present over most of the range of Douglas fir but no noticeable discoloration was noted.

Spruce Sawflies, Pikonema spp.

Both the yellow-headed spruce sawfly, P. alaskensis Roh. and the green-headed spruce sawfly P. dimmockii Cress. were found in very small numbers in 1960. Three of the former and four of the latter were collected from white spruce.

A Hemlock Sawfly, Neodiprion sp.

This sawfly has remained fairly common in the Torpy River-Sinclair Mills area in the last three years.

Conifer Sawflies, Neodiprion spp.

Small numbers of larvae were collected from various coniferous hosts, principally Douglas fir, in 1960.

OTHER NOTEWORTHY INSECTS

Species	Host	Number of collections	Remarks
Achytonyx praeacuta Sm.	F, Sw	3	Macalister, Aleza L.
Caripeta angustiorata Wlk.	Pl	5	
C. divisata Wlk.	Ba, F, H	8	Common
Enypia moillieti Blckmre.	F	1	Scarce
E. venata Grt.	F, Sw	3	Uncommon
Epirrita autumnata Harr.	Sw, Bi, Dt	10	Common
E. filmata Pears	Ba	1	Wansa L.
Feralia comstocki Grt.	Ba	4	
F. jocosa Gn.	Ba, H	3	
Griselda radicana Wlshm.	F	2	Macalister
Hydriomena irata Swett.	Sw	1	Tabor Lake

Species	Host	Number of collections	Remarks
Orgyia antiqua badia Hy. Edw.	H, Sw	2	
Nyctobia limitaria Wlk.	Ba, H	8	Widespread
Protoboarmia p. indicataria Wlk.	F, Js, Pl, Sw	9	
Semiothisa granitata Gn.	Ba, F, H, Pl, Sw	17	Widespread and common
Synaxis jubararia Hlst.	H	2	Sinclair Mills
Zale l. duplicata Beth	Pl	1	Narcosli Creek

STATUS OF FOREST DISEASES

Important Diseases

Needle Blight on Alpine Fir

Determination was received in 1960 from the Plant Research Institute in Ottawa, of this disease, Phaeocryptopus nudus , which infected an estimated two acres of alpine fir saplings three miles south of Barkerville in 1959.

Red Heart Rot of White Spruce

The fruiting stages of Stereum sanguinolentum (Alb. & Schw. ex Fr.) Fr. were collected from white spruce log decks at Barbee Lake and in the Willow River Valley.

Needle Rust of Alpine Fir

Both old brooms and the more recent orange stages of Melampsorella caryophyllacearum Schroet. were noted on alpine fir in 1960. Collections were taken at Eaglet Lake, Stone Creek, and Genevieve Lake.

Needle Rust on White and Black Spruce

This rust, caused by Peridermium coloradense (Diet.) Arth. and Kern, persists throughout the area. Its distribution coincides with those of its hosts and it has been noted from Prince George to Lucerne Lake.

Brown Spotting of Aspen Leaves

Damage to aspen leaves caused by a leaf-spotting fungus Sclerotium sp. was widespread in 1960.

Douglas-fir Needle Cast

Symptoms of the important needle cast disease Rhabdocline pseudotsugae Syd. were seen frequently near Dunster. This was the only locality where abnormal abundance of this pathogen was noted.

OTHER NOTEWORTHY DISEASES

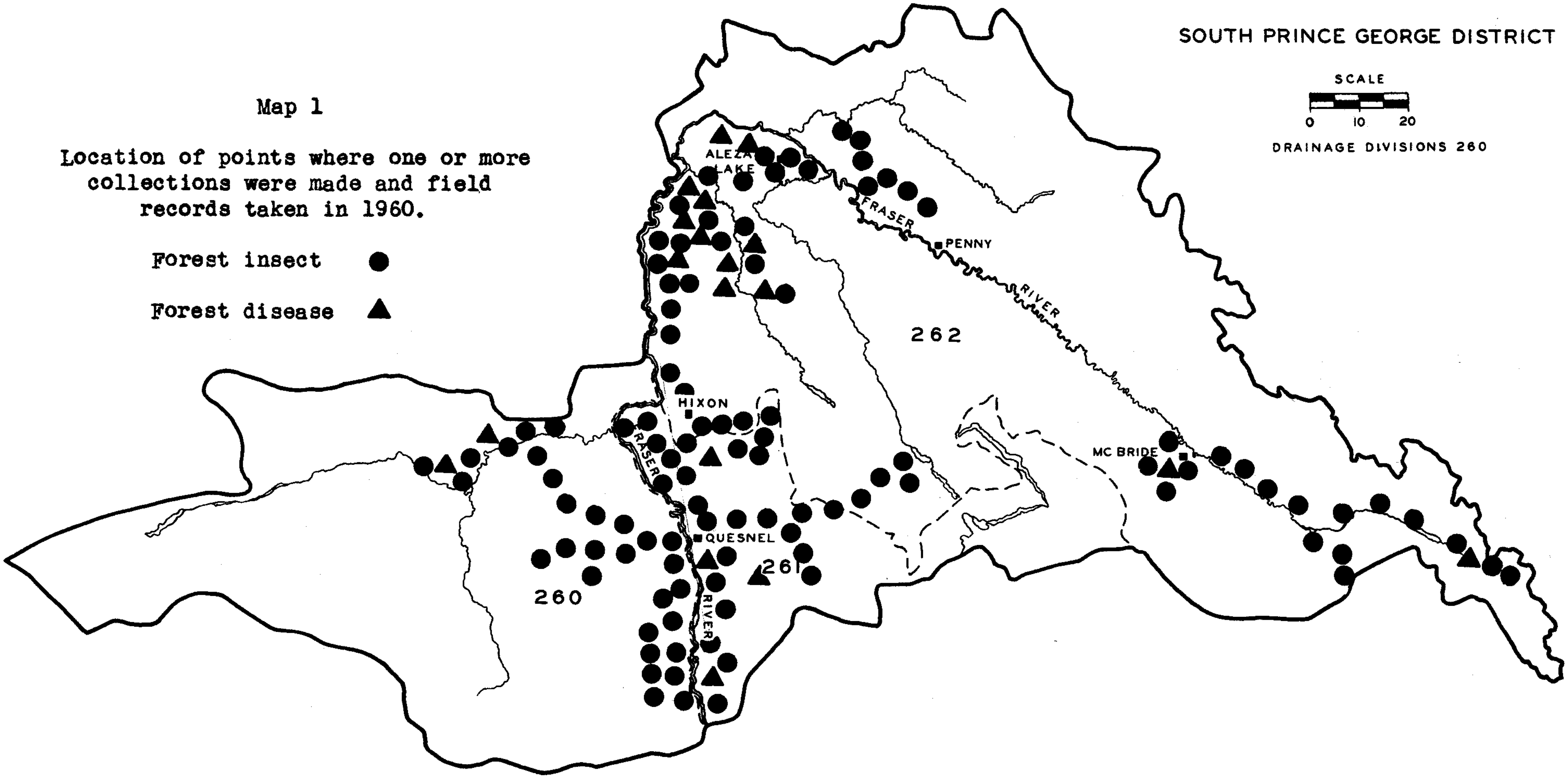
Host	Organism	Locality	Remarks
Fir, alpine	Aleurodiscus amorphus (Pers.) Rabenh. ex. Cooke	George Mtn.	Heavy in spruce budworm infestation.
Fir, alpine	Uredinopsis sp.	Dore Mtn.	Foliage rust
Pine, lodgepole	?Lenzites saepiaria (Wulf. ex Fr.) Fr.	Barbee Lake	Common-log decks, decay fungus.
Spruce, white	Polyporus schweinitzii Fr.	Churchill Mtn.	Root and butt rot.
Willow sp.	Melampsora epitea Thum.	Tabor Creek	Foliage rust, common

Map 1

Location of points where one or more collections were made and field records taken in 1960.

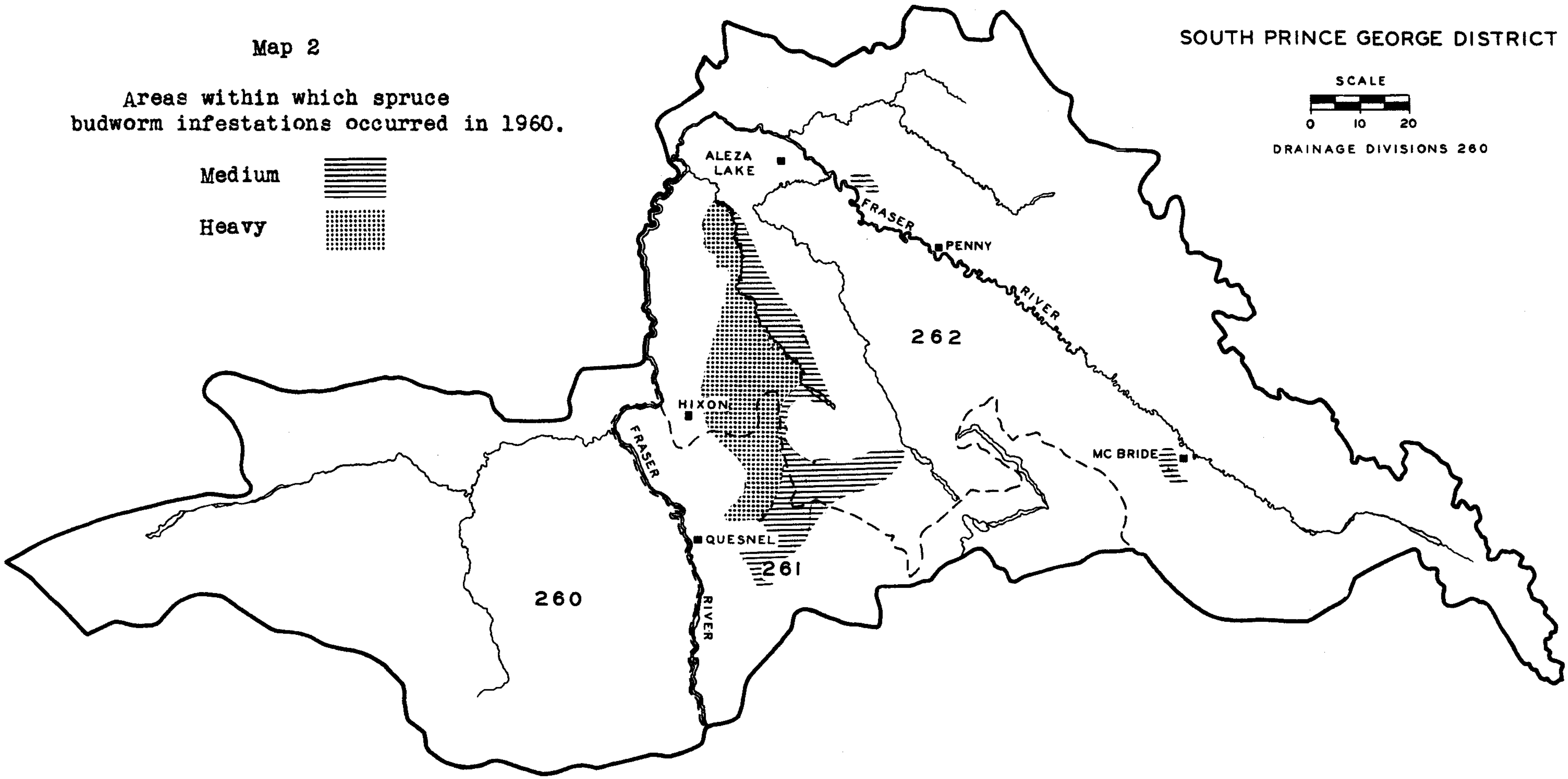
Forest insect ●

Forest disease ▲



Map 2

Areas within which spruce budworm infestations occurred in 1960.

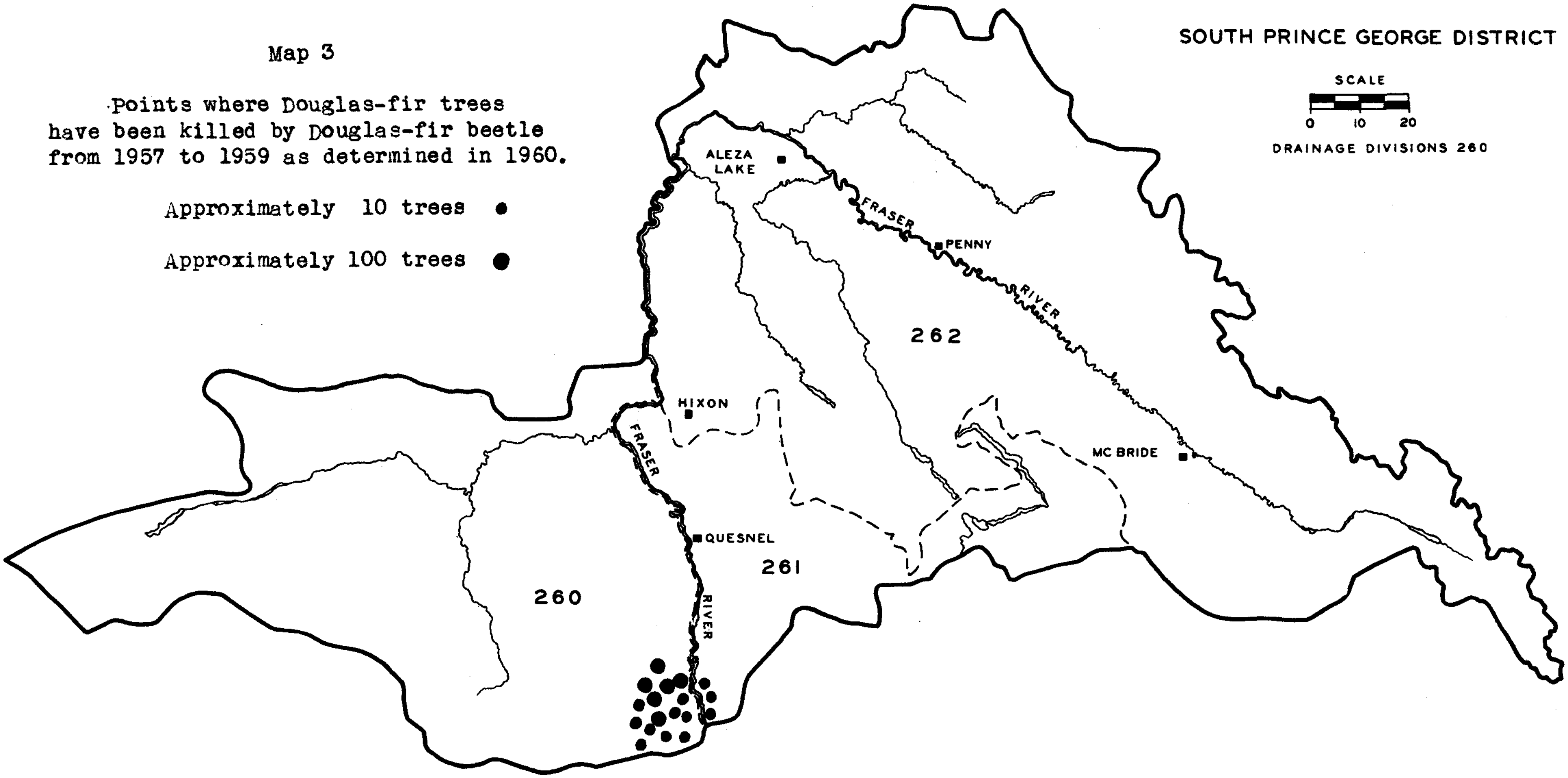


Map 3

Points where Douglas-fir trees have been killed by Douglas-fir beetle from 1957 to 1959 as determined in 1960.

Approximately 10 trees ●

Approximately 100 trees ⬤



ANNUAL REPORT OF FOREST BIOLOGY RANGER

for

WEST PRINCE GEORGE DISTRICT

1960

FOREST BIOLOGY SURVEY

WEST PRINCE GEORGE DISTRICT

1960

E. V. Morris

INTRODUCTION

Field work commenced on May 16 and continued through October 4 in the West Prince George District. A total of 333 forest insect and 26 forest disease collections were made during the season. One week was spent surveying the mountain pine beetle infestation at Takla Lake with ranger D. W. Taylor. Ten hours flying time were spent surveying and mapping the spruce budworm infestation in the West Prince George District.

Table 1

Collections by Hosts

West Prince George District - 1960

Coniferous hosts	Forest insects	Forest diseases	Broad-leaved hosts	Forest insects	Forest diseases
Douglas fir	28	2	Alder spp.	6	1
Fir, alpine	44	4	Aspen, trembling	43	2
Pine, lodgepole	71	8	Birch spp.	10	1
Spruce, black	11	3	Cottonwood, black	11	-
Spruce, white	78	1	Willow spp.	29	2
			Miscellaneous	2	2
			Total	101	8
Total	232	18	Grand total	333	26

STATUS OF INSECTS

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

The spruce budworm infestation in the West Prince George District increased in the northern portion of the District, but remained unchanged within the southern boundaries of the infestation. An aerial mapping survey of the infestation was carried out in conjunction with the South Prince George and East Prince Rupert budworm surveys; a total of 10 hours flying time was spent in the West Prince George District. Map 2 shows the area with medium and heavy infestations. The main infestation was observed as far south as a line extending from Cunningham Lake across the lower end of Stuart Lake to Summit Lake and north to a line from Bear Lake east to Finlay Forks. On the west it extended into the Babine Forest and on the east into the valleys of the Rocky Mountains. This encompassed about 10,625 square miles. Infestations not known prior to 1960 were in the Finlay Forks area and along the Omineca River in the Germansen Landing district.

On the south side of Trembleur Lake where defoliation estimates were made and egg samples taken, the top 30 feet of 80-foot alpine firs were heavily defoliated. At Takatoot Lake the understory alpine fir was up to 50 per cent defoliated and the 1960 growth on the white spruce overstory was up to 70 per cent defoliated. Up to 80 per cent of the new growth on white spruce at Tsayta Lake was defoliated. At Bulkley House on the north end of Takla Lake 80 per cent of the 1960 growth on the white spruce overstory was defoliated. At Trembleur, Takatoot, Tsayta and Takla Lakes where defoliation estimates and egg mass counts were taken, damage was the heaviest encountered in the infestation.

The four budworm plots established in 1956 were sampled in June for larval population and bud damage and in August for defoliation estimates and pupa and egg mass counts. One sample branch 18 inches long was taken from the mid-crown from each of the 10 alpine fir sample trees at each plot, and the percentage of dead tips and the number of larvae present were recorded. Results of this work are contained in Table 2.

Table 2

Examination of Ten 18-inch Alpine Fir Branch Samples per Plot, West Prince George District, 1960

Locality	No. of tips examined	Percentage of tips killed	No. of larvae per sq. ft. of foliage
Davie Lake	571	11.0	0.63
Tudyah Lake	782	23.9	1.66
Pine Pass	777	35.0	5.09
Big Creek	655	61.6	1.72

Table 3

Numbers of Spruce Budworm per Square Foot of Alpine Fir Foliage Based on Ten 18-inch Branch Samples per Plot, West Prince George District, 1956, 1958 and 1960

Locality	No. per square foot of foliage					
	1956		1958		1960	
	Larvae	Pupae	Larvae	Pupae	Larvae	Pupae
Davie Lake	1.06	0	0.84	0	0.63	0
Tudyah Lake	3.42	0	2.46	0	1.66	0
Pine Pass	1.73	0	.96	0.09	5.09	0
Big Creek	5.67	0	0	4.15	1.72	0

Defoliation estimates, egg sampling and pupa counts were conducted in August at eight localities, the data for which are contained in Table 4.

Table 4

Average Estimated Defoliation, Number of Pupae and Status, and Number of Egg Masses of Spruce Budworm, per Square Foot, West Prince George District, August 1960

Locality	Av. estimated percentage defoliation		No. pupae per sq. ft. of foliage		No. egg masses per sq.ft. foliage
	New growth	Old growth	Adults emerged	Dead	
Davie Lake	15	0	0	0	0
Tudyah Lake	25	0	1.45	0.09	1.05
Pine Pass	50	5	4.10	0.30	1.25
Big Creek	40	10	1.70	0.60	0.60
Trembleur Lake	90	20	1.36	0	0.23
Takatoot Lake	90	50	1.52	0	1.42
Tsayta Lake	90	10	2.32	0	0.39
Takla Lake	90	10	.35	0	0

In 1960 the two-year-cycle spruce budworm infestation expanded into two new localities, Finlay Forks and along the Omineca River in the Germansen Landing district. No serious tree mortality has occurred in mature alpine fir and white spruce; some top kill on the reproduction has occurred in the heavy areas of the infestation. Egg sampling in 1960 indicates that the spruce budworm infestation in the West Prince George District will continue in 1961.

Mountain Pine Beetle, *Dendroctonus monticolae* Hopk.

The mountain pine beetle attack on lodgepole pine in the Takla Lake area appears to have subsided in all regions of the infestation. In September three 20-chain strips one chain wide were run at three localities in the infestation to determine the volume of lodgepole pine killed by mountain pine beetle. One strip was run from the shore of the lake at Takla Narrows and two strips were run from the shore at Bivouac Creek. All lodgepole pine over eight inches d.b.h. was tallied on the strips and recorded as: "old grey", trees with no needles; "red", trees attacked in recent years but prior to 1960; "1960 attack", and "healthy". Table 5 gives the results of this work.

Table 5

Lodgepole Pine Killed by Mountain Pine Beetle on Three Strips Totalling Six Acres at Takla Lake, West Prince George District, 1960

Condition of trees	No. of trees	Percentage of stems	Total volume cu. ft.
Old grey	181	38.1	5617
Red	15	3.1	465
1960 attack	1	0.2	31
Healthy	272	58.6	8441

The total volume of lodgepole pine killed by mountain pine beetle in the Takla Lake area up to 1960 was computed from the figures in Table 5. Area of the infestation is approximately 28,000 acres and the total volume of lodgepole pine killed is about 28,400,000 cubic feet in the West Prince George District. This infestation extends into the Babine Forest in the East Prince Rupert District.

Douglas-fir Beetle, *Dendroctonus pseudotsugae* Hopk.

No new red-topped Douglas fir trees were recorded in 1960 at the infestation on Stuart Lake opposite Tachie Village. In 1959, 175 red-topped trees were counted along the south shore, the biggest concentration being opposite Tachie Village.

Oregon Fir Sawyer, *Monochamus oregonensis* Lec.

A survey was conducted in the burned timber at two 1958 fires along the Hart Highway in West Prince George District to determine the years of emergence of Monochamus adults from the 1958 attack on fire-killed white spruce. On May 18, 50 white spruce trees at each of the two fires were classified as to the severity of burn into three classes: severe, medium and light. A section three feet long on the bole, centering about breast height, was marked out with red ribbon. The bark was completely removed from the sample section and each of the Monochamus entrance and exit holes marked and recorded. The plots were re-examined in July and September for new exit holes. Results of this survey are contained in Table 6.

Table 6

Oregon Fir Sawyer Emergence from White Spruce Killed by Fire in 1958, West Prince George District, 1960

Name of fire	Burn class	No. of trees sampled	No. of entrance and exit holes in 3-foot trunk sections 1960				Total exit holes
			May 18		July 21	Sept. 30	
			Entrance	Exit	New exit	New exit	
	L	10	4	0	0	0	0
Fir	M	20	86	10	15	5	30
	S	20	94	32	20	4	56
Total		50	184	42	35	9	86
	L	10	100	9	19	4	32
Lin	M	20	167	29	23	7	59
	S	20	104	32	8	0	40
Total		50	371	70	50	11	131

It is assumed that no emergence had occurred in 1960 before the two plots were marked out, as the weather before May 18, 1960, was cold and wet, retarding the development of the sawyer beetles. All emergence holes recorded on that date had therefore been made in 1959. It will be noted from Table 6 that up to the end of September, 51 per cent of Monochamus emergence at the "Fir" fire and 47 per cent at the "Lin" fire had occurred in 1960.

Aspen Leaf-miner, Phyllocnistis populiella Cham.

The aspen leaf-miner was found throughout most of the District in 1960. The infestation increased at all sample points this year over the 1959 level. For sampling, two apical branches 12 inches long were cut from the lower crown of five permanent sample trees at each of the five plots, and the leaves examined. Table 7 compares the infestation of leaf surfaces and the production of leaf-miner adults at each plot in 1959 and 1960. Table 8 shows mortality in the cocoon stage, in 100-cocoon samples taken at five localities.

Table 7

Population Sampling for Aspen Leaf-miner in West Prince George District 1959 and 1960

Locality	Percentage of leaf surfaces with mines		No. of adults produced per leaf surface	
	1959	1960	1959	1960
Mile 8 Hart Hwy.	27.4	72.0	0.07	0.59
Mile 12 Hart Hwy.	28.5	52.1	0.09	0.04
Mile 8 Summit L. Rd.	16.2	48.4	0.07	0.33
Shelley Road	-	71.8	-	0.53
Shelley Road	-	73.0	-	0.57

Table 8

Mortality of Aspen Leaf-miner in Cocoons Based on 100-cocoon Samples at Five Plots, West Prince George, 1959 and 1960

Locality	Percentage mortality			
	Parasitism		Other causes	
	1959	1960	1959	1960
Mile 8 Hart Hwy.	8	10	60	6
Mile 12 Hart Hwy.	5	9	61	10
Mile 8 Summit L. Rd.	4	4	64	8
Shelley Road	-	4	-	15
Shelley Road	-	10	-	7

A Round-headed Borer, *Tetropium* sp.

Decked logs along a road right-of-way at The Pas Lumber Company's logging operation on the Upper Parsnip River were inspected for *Tetropium* damage in September, 1960. The logs had been felled and cold decked in March 1960 and were attacked by *Tetropium* in the spring of 1960. Six logs were examined at each of the five separate cold decks. One square foot of bark was peeled from the basal, middle and distal portions of each log. The number of entrance holes and the depth of penetration was recorded. Table 9 gives the results of the sampling done on 30 logs which averaged 73 feet in length and 22 inches in diameter.

Table 9

Average Number of Entrance Holes of *Tetropium* sp. on Square-foot Samples from 30 Logs, Upper Parsnip River, 1960

Sample position	Average No. of holes per square foot
Basal	1.10
Middle	2.33
Distal	1.06

The average depth of penetration by *Tetropium* was 1.2 inches and the maximum and minimum were 2.5 inches and 0.1 inches.

A Pitch Nodule Maker, *Petrova* sp.

Seven *Petrova* collections were taken from lodgepole pine reproduction at Fort Fraser, Summit Lake, and Prince George Forest Ranger districts. The heaviest attack was at Mile 50, Hart Highway in the Summit Lake Ranger District.

A Coneworm, *Dioryctria abietivorella* D.-S.

This coneworm was found in pitch nodules on lodgepole pine in the Prince George and Summit Lake area; it was not observed in other parts of the District visited.

Poplar Borer, *Saperda calcarata* Say

Several groups of trembling aspen trees were infested by this poplar borer at Mile 18 Manson Creek road, along the Vanderhoof highway and along the Kenney Dam road. The largest concentration was at Mile 18 Manson Creek road where 10 aspen trees were attacked. Two 3-foot aspen logs infested by this borer were put in rearing cages on June 30 but no adult emergence occurred. Dissection of the logs on September 30 disclosed that the larvae had died in their galleries.

Green-headed Spruce Sawfly, *Pikonema dimmockii* Cress.

This sawfly was distributed generally over the District in 1960. Table 10 compares the incidence of *Pikonema dimmockii* Cress. in 3-tree beating collections from white spruce taken during the larval periods for 1959 and 1960.

Table 10

Three-tree Beating Collections of Green-headed Spruce Sawfly in West Prince George District 1959 and 1960

No. of collections made during larval period		Percentage containing larvae		Av. no. of larvae per positive sample	
1959	1960	1959	1960	1959	1960
76	52	33	23	1.36	1.58

Yellow-headed Spruce Sawfly, *Pikonema alaskensis* Roh.

This sawfly was common in white spruce collections throughout the District in 1960. Table 11 compares the incidence of *Pikonema alaskensis* Roh. in 3-tree beating collections from white spruce taken during the larval period for 1959 and 1960.

Table 11

Three-tree Beating Collections of Yellow-headed Spruce Sawfly in West Prince George District 1959 and 1960

No. of collections made during larval period		Percentage containing larvae		Av. no. of larvae per positive sample	
1959	1960	1959	1960	1959	1960
76	52	35	21	2.22	1.09

Englemann Spruce Weevil, Pissodes engelmanni Hopk.

No increase in white spruce reproduction attacked by this weevil was noted at Summit Lake and Chief Lake. About five per cent of the reproduction along the Sutherland River road was infested.

OTHER NOTEWORTHY INSECTS

Insect	Host	Number of collections	Remarks
Achytonix praeacuta Sm.	F	1	Pr. George
Acronicta grisea Wlk.	W, Bi	2	Vanderhoof, Pr. George
A. lepusculina Gn.	A	1	Summit L.
Allononyma vicarialis Zell.	D, Bi	3	Ft. St. James, Prince George
Anacamptodes emasculata Dyar	D	1	Prince George
Anomogyna mustelina Sm.	Ba	1	Ft. St. James
Archips rosana Linn.	D	1	Ft. St. James
Arge clavicornis (F.)	D, Bi, Sw,	6	Vanderhoof, Pr. George Summit L., Ft. Fraser
Biston cognataria Gn.	Pl, W, A	4	Vanderhoof, Summit L.
Campaea perlata Gn.	Bi, A, W, Cot	12	Summit L., Vanderhoof, Ft. St. James, Pr. George
Caripeta aequaliaria Grt.?	Pl	2	Pr. George, Summit L.
C. angustiorata Wlk.	Pl, Sb	3	Summit L., Pr. George
C. divisata Wlk.	Sw, F, Pl	3	Pr. George, Vanderhoof
Cimbex americana Leach	D, Cot	2	Pr. George
Clepsis persicana Fitch	W, A	2	Summit L., Vanderhoof
Contarinia spp.	F	4	Pr. George, Vanderhoof, Ft. St. James
Cosymbia pendulinaria griseor. McD.	Ba, W	2	Summit L., Vanderhoof

Insect	Host	Number of collections	Remarks
Ennomos subsignarius Hbn.	W	1	Ft. St. James
Epirrhanthis substriataria Hlst.	W, A	6	Ft. St. James, Pr. George
Eucordylea atrupictella Dietz	Sw, W	2	Ft. Fraser
Eupithecia albicapitata Pack.	Sb	1	Vanderhoof; in cones
E. annulata Hlst.	Sw	2	Prince George
E. filmata Pears.	Ba	2	Summit L; Pr. George
E. fletcherata Tayl.	D	1	Prince George
E. luteata bifasciata Dyar	F, Sw, Ba	7	Vanderhoof, Summit L., Pr. George
Feralia comstocki Grt.	Sw, Ba, Pl	5	Prince George, Summit L.
Griselda radicana Wlshm.	Ba	1	Prince George
Hydriomena furcata Thun.	W	1	Prince George
Hypagyrtis piniata Pack.	Sw	1	Ft. St. James
Itame loricaria Evers.	Cot	1	Prince George
Lycia ursaria Pack.	W	1	Prince George
Melanolophia imitata Wlk.	F, Pl	2	Summit Lake
Metanema determinata Wlk.	W	1	Prince George
M. inatomaria Gn.	Sw ?	1	Vanderhoof; accidental host
Nematus mendicus Walsh	D	1	Prince George
Neodiprion spp.	Sw, Pl, F	6	Ft. St. James, Summit L., Pr. George

Insect	Host	Number of collections	Remarks
Nyctobia limitaria Wlk.	Sw, Sb, Ba	4	Summit L., Prince George
Operophtera bruceata Hlst.	D, W	2	Ft. Fraser, Ft. St. James
Orgyia antiqua Hy. Edw.	W	1	Prince George
Pheosia rimosa Pack.	Cot	1	Ft. St. James
Plemyria georgii Hlst.	D, W, Bi, A	5	Ft. St. James, Prince George, Vanderhoof
Protoboarmia porcelaria indicataria Wlk.	Sw, Ba, F	3	Prince George
Pseudothyatira cymatophoroides expultrix Grt.	D, Bi	2	Pr. George, Ft. St. James
Rhabdophaga swainei Felt	Sw	1	Summit L.
Scoliopteryx libatrix Linn.	W	1	Prince George
Semiothisa granitata Gn.	Pl, F, Sw, Sb, Ba	42	Ft. Fraser, Pr. Geo. Vanderhoof, Summit L. Ft. St. James
Semiothisa n. sp.	Pl	3	Summit L., Pr. Geo.
Stenoporpia excelsaria Stkr.	Pl	3	Ft. Fraser, Prince George
Trichiosoma triangulum Kby.	W	1	Summit L.
Vespamima sequoiae Hy. Edw.	Pl	1	Pr. George
Xylomyges dolosa Grt.	A	1	Pr. George
Zale duplicata Beth.	Pl	1	Pr. George
Zeiraphera fortunana Kft.	Sw	1	Ft. St. James
Zenobia pleonectusa Grt.	A	1	Vanderhoof

STATUS OF FOREST DISEASES

Important Diseases

Browning of Aspen Foliage

Browning of aspen foliage caused by Pollaccia radiosa (Lib.) Buld.& Cif. was common on aspen trees at several localities in the District. The heaviest infection occurred in the Vanderhoof Ranger District along the Vanderhoof Highway. This disease was also found at Mile 3, Manson Creek Road and in the Beaverley district.

Cone Rust on Black Spruce

Light infections of the cone rust Chrysomyxa pirolata Wint. were found in the Mapes area and along the Finmoore road at Mile 2. This disease was not found in other parts of the District visited.

Lodgepole Pine Stem Canker

Lodgepole pines in the Punchaw and Mud River areas were found infected with a stem canker Atropellis piniphila (Weir) Lohm. and Cash. This disease was not noted in other parts of the District where lodgepole pine occurred.

Dwarf Mistletoe on Lodgepole pine

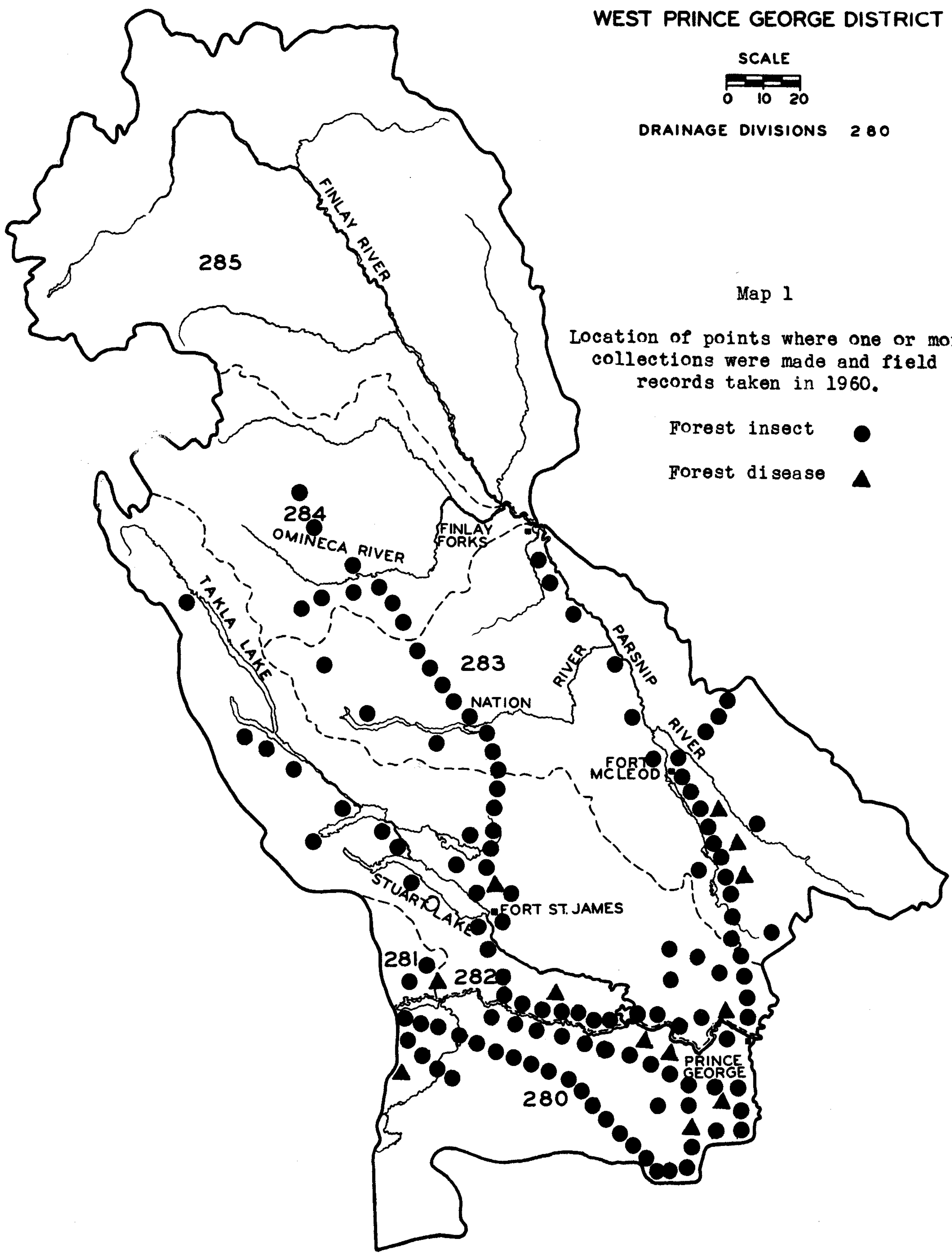
Dwarf Mistletoe Arceuthobium americanum Nutt., was found throughout the Prince George Ranger District on lodgepole pine. It was also found in the Vanderhoof and Summit Lake ranger districts on lodgepole pine reproduction. Several collections were sent to the Forest Pathology Unit for inoculation studies.

Needle Rust on White and Black Spruce

Witches' brooms caused by Peridermium coloradense (Diet.) Arth. and Kern was common on white and black spruce in most parts of the District. The heaviest concentration on black spruce was along the Manson Creek Road and in the Beaverley district.

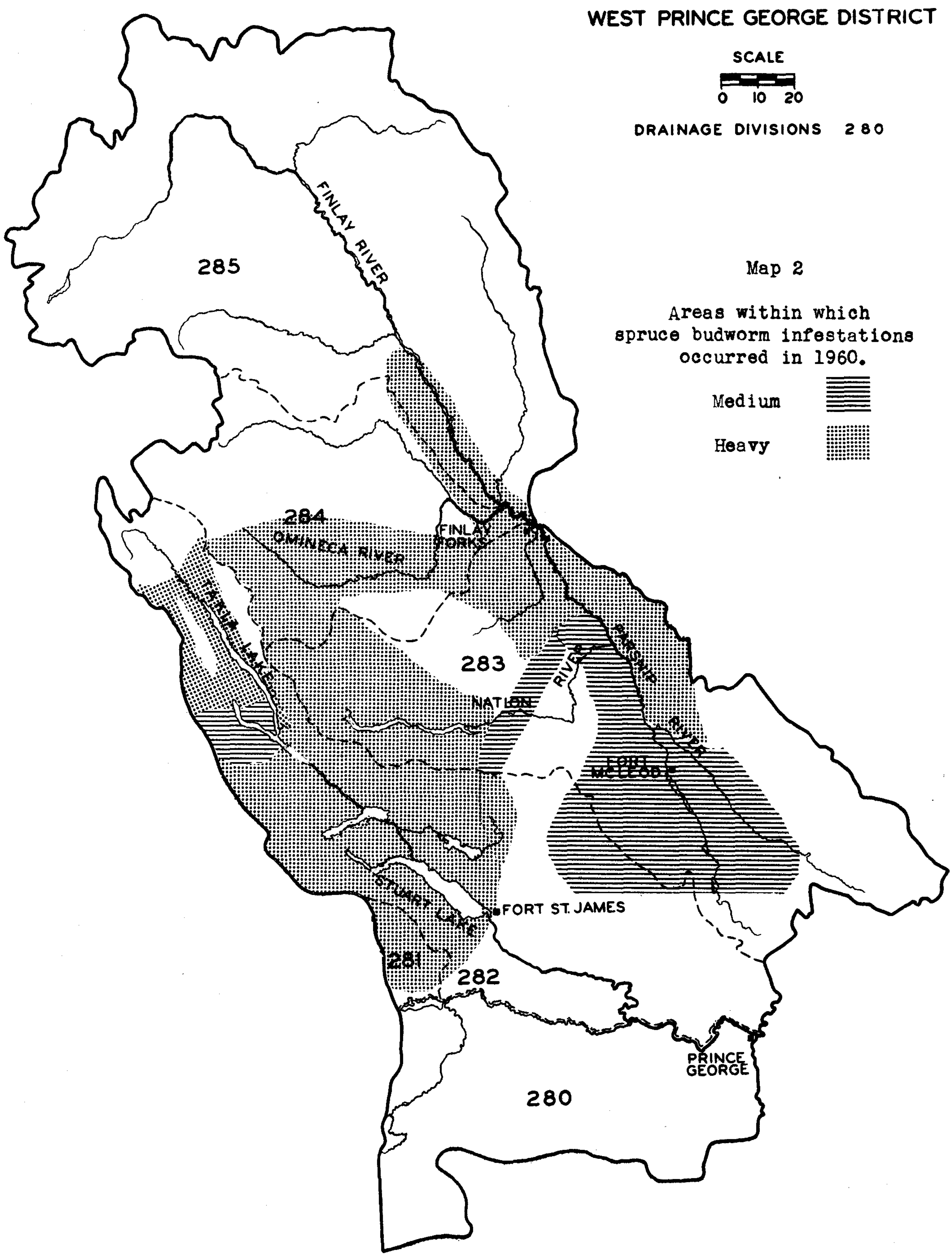
Red Flagging on Alpine Fir

An unknown disease on alpine fir caused branches to die back in stands at Summit Lake and along Hart Highway at McLeod's Lake.



Map 1

Location of points where one or more collections were made and field records taken in 1960.


WEST PRINCE GEORGE DISTRICT
SCALE
0 10 20
DRAINAGE DIVISIONS 280
Map 2
Areas within which spruce budworm infestations occurred in 1960.
Medium
Heavy
FINLAY RIVER
285
284
OMINECA RIVER
FINLAY FORKS
283
NATION
RIVER
PARSNIP RIVER
FORT McLEOD
TAKLA LAKE
STUART LAKE
FORT ST. JAMES
281
282
PRINCE GEORGE
280

ANNUAL REPORT OF FOREST BIOLOGY RANGER

for

NORTH PRINCE GEORGE DISTRICT

1960

FOREST BIOLOGY SURVEY

NORTH PRINCE GEORGE DISTRICT

1960

T. A. D. Woods

INTRODUCTION

Field work in the North Prince George District began on May 31 and terminated on September 17.

A flight for the purpose of mapping the one-year-cycle spruce budworm infestation in the Liard River Valley was made possible by the British Columbia Forest Service.

A trip to Telegraph Creek was undertaken to investigate reported spruce budworm outbreaks in that area.

Table 1 shows the number of forest insect and disease collections by hosts. Maps 1 and 2 show the locations where one or more collections and field records were taken.

Table 1

Collections by Hosts

North Prince George District - 1960

Coniferous hosts	Forest insects	Forest diseases	Broad-leaved hosts	Forest insects	Forest diseases
Fir, alpine	10	1	Alder spp.	19	-
Juniper, common	4	1	Aspen, trembling	23	1
Larch, eastern	30	2	Birch, dwarf	9	1
Pine, lodgepole	39	3	Birch, white	10	-
Spruce, black	22	2	Cottonwood, black	4	1
Spruce, white	80	1	Willow, spp.	37	1
			Miscellaneous	12	-
			Total	114	4
Total	185	10	Grand total	299	14

STATUS OF INSECTS

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

The extent of the spruce budworm infestation in the Smith River region of the Liard River Valley, did not increase in 1960. However, the intensity of attack increased outward from the centre of the infestation around Miles 514-516, Alaska Highway. This was reflected in an increase in general defoliation, though not in actual bud-kill, as indicated in Tables 3 and 5. Sampling methods used to determine the severity of attack were the same as used in 1959. In most instances both the 1959 and 1960 figures will appear in the tables for comparison.

First examination of the infestation was made on June 11, 1960. The beating samples taken in 1959 to determine budworm population were not repeated in 1960, because the larvae were still mining the buds. Single branch samples were taken from white spruce trees up to 20 feet in height at five localities. Percentage buds mined is shown in Table 2.

Table 2

Percentage White Spruce Buds Mined at Five Localities in the Liard River Valley, June 11, 1960

Locality (mileposts) Alaska Highway	Percentage buds mined
508	29.4
514	35.4
518	70.7
528	27.7
538	14.8

In the same area Miles 496-538, on July 21, one 18-inch branch sample from each of three white spruce trees 2.5 inches d.b.h. and from 15 to 20 feet tall was examined for tip damage. As shown by Table 3, the intensity of damage has moved outward toward the fringes of the area. Defoliation estimates were made at five points along the highway on July 21. Ten trees per sample were examined with binoculars and the percentage defoliation of current, and old foliage was recorded. Table 4 gives the 1959 and 1960 estimates.

On August 13, 1960, two branch samples were taken from each of two trees at six localities within the infestation. The branches were examined and catalogued as follows: (a) tips completely defoliated and buds killed; (b) tips completely defoliated but buds not killed; (c) tips 70 per cent defoliated; (d) tips 40 to 70 per cent defoliated and (e) tips 0 to 40 per cent defoliated. Table 5 shows the results for 1959 and 1960.

Table 3

Percentage of White Spruce Tips Defoliated
by Spruce Budworm, North Prince George District, July, 1959-1960

Locality (mileposts) Alaska Highway	Percentage tips with defoliation	
	1959	1960
496	5.8	22.8
502	44.5	41.5
506	36.5	53.7
509	50.2	61.5
512	72.5	100.0
514	98.7	94.2
516	98.8	95.8
522	38.7	73.1
528	7.2	54.1
532	8.5	13.7
538	5.[illegible]	27.1

Table 4

Estimated Defoliation of White Spruce Trees,
North Prince George District,
1959-60

Locality (mileposts) Alaska Highway	Estimated percentage defoliation	
	1959	1960
496	0	1
502	7	20
514	92	90
528	2	3
538	0	2

Table 6 shows the number of egg masses per 100 square feet of foliage surface, as derived from branch sampling in 1959 and 1960. Populations in 1961 are expected to be high again as four of the six samples contained two and one half to four times the number of egg masses required for heavy defoliation.

Table 5

Percentage Defoliation of White Spruce Tips by Spruce Budworm at Six Localities in the Smith River Infestation, North Prince George District, 1959 and 1960

Locality (mileposts) Alaska Highway	Percentage defoliation									
	100 buds killed		100 buds living		70		40-70		0-40	
	1959	1960	1959	1960	1959	1960	1959	1960	1959	1960
494	19	2	1	5	3	17	9	22	68	54
502	90	19	2	60	1	11	1	6	5	6
506	-	13	-	58	-	13	-	9	-	7
514	90	8	2	28	1	41	0	1	6	25
528	22	14	9	27	7	11	21	21	41	26
538	16	7	1	3	3	14	4	23	65	53

Table 6

Spruce Budworm Egg-mass Populations in the Smith River Infestation, August, 1959 and 1960

Locality (mileposts) Alaska Highway	No. branches examined		Total branch area (sq. ft.)		Total No. egg masses		Av. no. egg masses per 100 sq. ft. of foliage surface	
	1959	1960	1959	1960	1959	1960	1959	1960
494	4	4	8.85	12.94	8	10	90	77
502	6	4	10.29	6.40	94	38	914	593
506	-	4	-	6.92	-	38	-	549
514	7	4	16.20	7.51	126	42	777	559
528	4	4	8.78	5.60	12	50	137	892
538	4	4	19.40	4.89	17	4	8.76	1

On August 18, a 1 1/2-hour flight was arranged by the British Columbia Forest Service to map the spruce budworm infestation in the Liard River Valley. Map 3 indicates the area where defoliation was medium to heavy. It was noted that the budworm was confined to the main valley up to timber line, with a few spots along tributary valleys of the Liard River.

Incidental collections containing budworm taken in the month of June from white spruce were as follows: Mile 429, two larvae; Mile 528, 18 larvae; Mile 538.5, 16 larvae; Mile 40 Cassiar Road, three larvae.

On July 20 and 21, standard three-tree beating samples taken from white spruce at four points within the infestation contained both adults and pupae. At the same time two trees were felled and the lower, mid and upper crown of each were examined for egg masses but none were found. Samples taken from black spruce at Mile 498, alpine fir at Mile 498 and eastern larch at Mile 519 contained one larva, one adult and five pupae respectively. On July 31, one mile south of the Cottonwood River Bridge on the Dease Lake Road, one adult was hand-picked from a white spruce tree. In August, two pupae were taken from white spruce at Mile 338 Alaska Highway.

Three small lodgepole pine at Mile 509 and eastern larch at Mile 516, were examined on July 21, 1960. Spruce budworm larvae had damaged 42 and 20 per cent of the tips respectively.

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

The spruce budworm attack in 1960, a "flight year", covered an area in the District from Azouzetta Lake to Francois Creek, and northward into the Callazon-Clearwater Creek valleys as shown in Map 3. Intensity of attack, compared with the two previous years, increased.

In 1958, attack was light over an area along the Hart Highway from Pine Pass to Boulder Creek. In 1959, bud mining ranged from five to 40 per cent at six localities between Azouzetta Lake and Coyote Creek, on the Hart Highway.

On July 1, 1960, one 18-inch branch sample from the lower crown of each of three trees per locality was examined for tip damage. Table 7 shows the percentage defoliation and the number and stage of insects present. Mile 0 referred to in the table is at the northern end of Azouzetta Lake, where the District boundary crosses the Hart Highway.

Table 7

Percentage Defoliation and Number of Budworm Present in Branch Samples, Pine Pass, North Prince George District, July, 1960

Locality (mileposts) Hart Highway	Tree species	Percentage tips with defoliation	Number present	
			Larvae	Pupae
0	Ba	25.7	10	0
4.6	Sw	24.2	5	0
9.5	Sw	100.0	56	0
13.6	Sw	45.9	14	0
13.6	Ba	50.9	25	3
18.6	Sw	33.3	9	0
23.7	Sw	6.2	2	0
30.1	Sw	7.5	1	0
33.0	Sw	13.7	0	1
38.2	Sw	8.6	0	1
41.2	Sw	6.5	0	0

In September two permanent sample plots were established. At Link Creek, 145 miles north of Prince George, 2.5 per cent of the 488 tips examined had been partially defoliated. At Francois Creek, Mile 166 on the Hart Highway, 25 per cent of 224 sample tips were damaged.

Eleven three-tree beating samples collected between June 1 and July 18, 1960, from white or black spruce, lodgepole pine and eastern larch in the Pine Pass, Moberly Lake and Hudson Hope areas contained a total of 26 budworm larvae and 17 pupae.

Eastern Larch Beetle, *Dendroctonus simplex* Lec.

Specimens of this *Dendroctonus* were first found in a felled eastern larch tree at Wildmare Creek, four miles west of Little Prairie. A sample taken on June 1 contained parent adults and eggs. Another sample taken on June 29 contained parent adults and larvae.

Road construction at Mile 281 Alaska Highway resulted in the flooding of several groups of eastern larch. In one group of three "sorrel coloured" trees, two were attacked by eastern larch bark beetles, one severely, the other lightly. On July 15, larvae and parent adults were present. Although other groups of larch in the vicinity had been flooded and were dying, no other attacks were found when these groups were examined on August 19. These trees were small and may not have been attractive to the beetles. On August 19 the same tree sampled on July 15 yielded pupae, callow adults and dead parent adults. This is the first record of the beetle in northern British Columbia.

Aspen Leaf-miner, *Phyllocnistis populiella* Cham.

There was a general reduction in population density of the aspen leaf-miner in 1960. There has been a steady decrease over the last three years.

In the heaviest concentration between Miles 479 and 571 estimated overall decrease was 15 per cent in 1960. In 1959, 80 to 90 per cent of the leaves were infested, and the 1958 level was 100 per cent.

The 1959 and 1960 figures for population trend and survival of the miner are compared in Tables 8 and 9. The information for these tables was obtained by examinations of leaves on two 12-inch branches from each of five aspen trees over three inches in diameter in each locality.

Table 8

Aspen Leaf Surfaces Mined and Number of Adult Leaf-miners Produced in Samples, North Prince George District, 1959 and 1960

Locality	Percentage of leaf surfaces with mines		No. of adults produced per leaf surface	
	1959	1960	1959	1960
Prochniak Creek	11.7	4.3	0.01	0.00
Smith River	68.3	50.9	0.09	0.05
Hyland River	55.4	25.2	0.19	0.02
Mi. 45.5 Cassiar Rd.	30.1	4.4	0.03	0.02

Table 9

Mortality of Aspen Leaf-miners in Cocoons, Based on 100-cocoon Samples from Four Plots, North Prince George District 1959 and 1960

Locality	Percentage mortality in cocoon stage			
	Parasitized		Other causes	
	1959	1960	1959	1960
Prochniak Creek	43	15	7	28
Smith River	33	49	15	12
Hyland River	39	70	7	7
Mi. 45.5 Cassiar Rd.	78	44	9	22

The percentage of leaves damaged in 1960 was slightly lower in the fringes of the Liard River infestation between Miles 462 to 479 and Miles 571 to 627 Alaska Highway. Between Fort Nelson and Muncho Lake, three per cent of the aspen leaves were infested; in 1959, four per cent and in 1958, 10 per cent of the leaves were damaged. In 1960, from Fort Nelson southward only one per cent of the leaves had been damaged compared with two per cent in 1959 and 10 per cent in 1958.

A Poplar Leaf-miner, *Phyllocnistis* sp.

The 1960 survey for the leaf-miner in black cottonwood was more intensive than in 1958. In 1958, sampling consisted of examinations of leaves on two 12-inch branch samples from each of five trees. In 1960, 50 leaves picked at random from roadside cottonwood trees were used to determine severity of attack. Although the sampling methods differed, the figures in Table 10 show that this miner has followed the declining population trend of the aspen leaf-miner in the Liard River Valley.

From Miles 488 to 626, Alaska Highway, the intensity ranged from 10 to 96 per cent leaves infested, with an average of 69 per cent, for 15 points within this region. At 17 points from Mile 710 to 428 the level of infestation ranged from a trace to four per cent.

Table 10

Percentage of Black Cottonwood Leaves Infested by *Phyllocnistis* sp. along the Alaska Highway

Locality (mileposts) Alaska Highway		Percentage leaves infested	
1958	1960	1958	1960
424	428	18	0
476	478	100	10
501	498	100	72
506	508	20	68
533	538	100	74
571	578	100	90

A Leaf-miner on Willow, *Phyllocnistis* sp.

This serpentine miner which attacks one species of willow was first noted in 1958. Since that time extensive surveys have shown it to be confined to the northern portion of the District.

In 1958, an average of 27 per cent of the leaves at three localities were infested. In 1959 an average of four per cent of the leaves were infested at 13 points along the Alaska Highway. Sampling in 1960 covered an area from Mile 488 to 626; 50 leaves picked at random from roadside willows at 10-mile intervals revealed a slight increase over the 1959 level. From Mile 210 north to Mile 468 no trace of the miner was found. The heaviest damage was between Mile 498 and 538 where an average of 11 per cent of the leaves had been attacked. This area is in the Liard River Valley between the Liard River Bridge and Coal River.

A Spruce Gall Midge, probably *Rhabdophaga swainei* Felt

Populations of this midge persisted at a low level throughout the District. Pupae were still being collected on July 13, 1960 from both spruce species. In 1958 the adults had already flown by June 9.

Spruce Tip Moth, *Zeiraphere fortunana* Kft.

The spruce tip moth has been collected for the past two years but in 1960 it did not appear in any white or black spruce collections.

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

A steady increase in both larval population and defoliation has occurred since 1958. At that time, the sawfly was found in small numbers in the southern portions of the District. In 1959 and 1960 there were increases in both damage and number of larch sawfly collected in both the central and northern regions of the District. The number of colonies collected in 1960 reached a new high and there is a possibility of further population increases to infestation level within the next few years.

Larch sawfly larvae were taken at the following localities in 1960: five points between Wildmare Creek and Progress; on the Gold Bar and Beatton River roads; Miles 28.5, 145.6, 230 and 320 Alaska Highway; and at Mile 56 Cassiar Road the northern most collection point.

Black-headed Budworm, <u>Acleris variana</u> (Fern.)

There were no black headed budworm found in collections from white spruce, black spruce and alpine fir in 1960. Previously as many as nine larvae were collected in one sample.

Yellow-headed Spruce Sawfly <u>Pikonema alaskensis</u> Roh.

Distribution of this sawfly is widespread throughout the District. Table 11 shows the incidence of this sawfly in collections and the average number of larvae per positive sample. Figures are taken from standard three-tree beating samples of white spruce made during the larval period.

In 1958 no <u>P. alaskensis</u> were collected from black spruce. In 1959, two larvae were taken in two collections and in 1960, six larvae in four collections.

Table 11

Three-tree Beating Collections of Yellow-headed Spruce Sawfly on White Spruce, North Prince George District, 1958 to 1960

Year	Total no. collections taken during larval period	Percentage of collections containing larvae	Av. no. larvae per positive sample
1958	65	30.8	1.5
1959	65	47.7	2.5
1960	50	54.0	2.5

Green headed Spruce Sawfly, Pikonema dimmockii Cress.

Larvae of this insect were collected in small numbers throughout the District. Collections containing this sawfly in the years 1958 to 1960 are shown in Table 12 as a percentage of the total collections made during the larval feeding period. The number of larvae taken is shown as the average number per positive sample.

Collections of P. dimmockii from black spruce for the last three years are as follows: 1958, none, 1959, three samples with three larvae; 1960, two collections with two larvae. The earliest date the larvae were collected was June 3, while the latest was August 24.

Table 12

Three-tree Beating Collections of Green-headed Spruce Sawfly on White Spruce, North Prince George District, 1958 to 1960

Year	Total no. collections taken during larval period	Percentage of collections containing larvae	Av. no. larvae per positive sample
1958	44	4.5	1.0
1959	69	36.2	1.6
1960	44	36.4	1.4

An Alpine Fir Twig Sawfly, Pleroneura borealis Felt

This twig sawfly was first reported in the District in 1957. The damage at two alpine fir sites, Miles 345.7 and 353, has been slight over the past two years. Comparison figures for the last three years are shown below.

Locality (mileposts) Alaska Highway	Percentage of twigs infested		
	1958	1959	1960
345.7	17	15	12
353	-	25	6

Bruce Spanworm, Operophtera bruceata Hlst.

The spanworm infestation that has existed since 1957 in the area extending from Little Prairie to Mile 95, Alaska Highway, collapsed in 1960.

A possible contributing factor might have been a late spring storm that occurred over this entire area on May 21 to 23, when larvae were in early stages of development. High winds, extreme cold and snow were general throughout. The points where heaviest attack occurred in 1959 were examined in both June and July, 1960. Damage was negligible and very few larvae were found. Damage was noticeable only between Dawson Creek and Fort St. John where a maximum of 30 per cent of the aspen leaves were damaged.

Willow Leaf Blotch-miner, Lyonetia saliciella Busck

In 1960, as in 1959, an extensive survey was conducted to determine incidence of blotch-miner attack on willow. The area covered Mile 210 to 626 Alaska Highway, where 50-leaf random samples were examined at 10-mile intervals. From Miles 221 to 488 the miner was found in very small numbers at only four localities.

Table 13 shows an increase in the upper region of the Liard River Valley and a decrease in the lower region. The collection points within the region are grouped into four general localities.

Table 13

Percentage of Willow Leaves Infested by Willow Leaf Blotch-miner, North Prince George District, 1959 and 1960

Locality	No. points sampled		Percentage leaves infested	
	1959	1960	1959	1960
Liard River	2	2	24	0
Coal River	4	4	21	3
Contact Creek	4	5	8	24
Lower Post	2	5	11	25

Blotch-miner on Trembling Aspen, Lithocolletis sp.

In the 1960 survey of this gracillarid's activity in the District, both an increase and decrease in population intensity was recorded in two adjacent areas. Examinations of 50 leaves taken at random from roadside reproduction-sized trembling aspen were used to determine percentage of leaves infested.

An average of 43 per cent of the willow leaves at eight sample points between Miles 478 and 548 were infested in 1959, compared with 19 per cent in 1960. No miners were found in 1959 between Miles 558 and 598 but in 1960, 13 per cent of the leaves had been damaged. From Mile 210 to 468 no attack was recorded in 1960.

Web-spinning Sawflies, Pamphiliidae

A total of 12 larvae were taken in samples from 10 localities ranging from Moberly Lake to Mile 621 Alaska Highway. Hosts were white spruce, lodgepole pine and alpine fir. In 1958 and 1959 only one or two larvae, probably of the tribe Cephalciini were collected each year.

DISTRIBUTION OF MISCELLANEOUS INSECT LARVAE

North Prince George District

Insect	Host	Number of collections	Remarks
Acronicta grisea Wlk.	D	1	Mile 290, A.H.
Anomogyna perquiritata Morr.	Sb	1	Mile 353, A.H.
Anoplonyx canadensis Hgtn.	Le	2	Fort Nelson
A. laricivorus Roh. & Midd.	Le	5	Fort Nelson, Liard River, Cassiar Road
Arge clavicornis (F.)	D, Bi, W	8	Peace River, Liard River
Biston cognataria Gn.	D	2	Peace River, Fort Nelson
Brephos infans Moesch.	Big, W	4	Peace River, Fort Nelson
Campaea perlata Gr.	A, Bi, D, W	10	Peace River, Fort Nelson
Cerostoma dorsimacullela Kft.	W	1	Mile 438, A.H.
Choristoneura rosaceana Harr.	A, W	4	Peace River, Fort Nelson
Cimbex americana Leach.	Bi, W	2	Peace River, Fort Nelson
Cosymbia pendulinaria griseor McD.	Big, D	2	Fort Nelson
Enypia griseata Grossbeck	Sw	1	Mile 104, A.H.
Epicnaptera americana Harr.	W	1	Mile 384, A.H.

Insect	Host	Number of collections	Remarks
Epirrhanthis substriataria Hlst.	W	1	Mile 384, A.H.
Epirrita autumnata omissa Harr.	D, Sw	4	Peace River
Eupithecia annulata Hlst.	Sb, Sw	3	Fort Nelson, Gold Bar Road, Dease Lake Road.
E. filmata Pears.	Sw	4	Peace River, Hudson Hope, Fort Nelson
E. luteata bifasciata Dyar	Ba, Le, Sb, Sw	6	Fort Nelson, Liard River
E. niphadophilata Dyar	Jc	4	Hudson Hope, Liard River, Cassiar Road
E. ravocostaliata Pack.	W	1	Cecil Lake
E. sheppardata McD.	D	1	Mile 290, A.H.
Feralia comstocki Grt.	Sw	2	Gold Bar Road
Griselda radicana Wlshm.	Sw	2	Progress Hudson Hope
Hemichroa crocea (Four.)	D	1	Mile 133, A. H.
Hydriomena furcata Thun.	W	3	Fort Nelson Cassiar Road
Itame anataria Swett.	A, W	2	Peace River, Fort Nelson
I. fulvaria Vill.	Big	1	Mile 363, A. H.
I. loricaria Evers.	Cot	1	Arras
Lycia ursaria Wlk.	W	1	Hudson Hope
Neodiprion spp.	Pl, Sw	2	Gold Bar Road, Hudson Hope
Notolophus antiqua badia Hy. Edw.	Bi, D, W	3	Peace River, Fort Nelson
Nyctobia limitaria Wlk.	Sb	1	Mile 595, A.H.
Panthea sp.	Pl	1	Hudson Hope

Insect	Host	Number of collections	Remarks
Petrova albicapitana Busck	Pl	4	Peace River
Protoboarmia p. indicataria Wlk.	Sw	3	Fort Nelson
Semiothisa sexmaculata Pack.	Le	2	Fort Nelson Liard River
Smerinthus cerisyi Kby.	A	2	Fort Nelson
Trichiosoma triangulum Kby.	D, W	10	Peace River, Fort Nelson, Liard River
Zale duplicata Beth.	Pl	1	Hudson Hope
Zeiraphera diniana Gn.	Le	1	Moberly Lake Road
Zenobia pleonectusa Grt.	A, W	2	Peace River

DISTRIBUTION OF MISCELLANEOUS ADULT INSECTS

North Prince George District

Insect	Host	Number of collections	Remarks
Agrilus sp.	W	1	Mile 32, A.H.
Altica sp.	A	2	Peace River, Fort Nelson
Anoplodera sexmaculata Linn.	rose	1	Peace River
Asemum atrum Esch.	in flight	1	Mile 532, A.H.
Chrysobothris harrisii (Hentz.)	Sb	1	Beatton River Road
Chrysomela semota Brown	Cot	1	Mile 202.5, A.H.
Cryptocephalus notatus Fab.	rose	1	Hudson Hope
Dichelonyx backii Kby.?	D	1	Hudson Hope
Disonycha alternata Ill.	W	1	Mile 278, A.H.
Dryocoetes affaber (Mann.)	Sw	2	Peace River Liard River
Hylobius pinicola (Coup.)?	Sw	2	Peace River Gold Bar Road

Insect	Host	Number of collections	Remarks
Ips engelmanni group	Sw	1	Wolf Creek
I. oregoni (Eich.)	Pl	1	Cassiar Road
Monochamus oregonensis Lec.	in flight	2	Lower Post
Mulsantina hudsonica Cay.	rose, Pl	2	Beatton River Road
Mulsantina n. sp.	Sb, Pl	3	Peace River, Cassiar Road
Phytodecta notmani Schffr.	W	1	Mile 384, A.H.
Pityokteines minutus (Sw.)	Ba	1	Dease Lake Road
Polygraphus rufipennis (Mann.)	Sw	1	Mile 498, A.H.
Proctorus decipiens Lec.	W	1	Cassiar Road
Syneta pilosa Brown	Le	1	Cassiar Road
Trypodendron lineatum (Oliv.)	Ba	1	Wolf Creek
Xylotrechus undulatus Say	Pl	1	Mile 534, A.H.

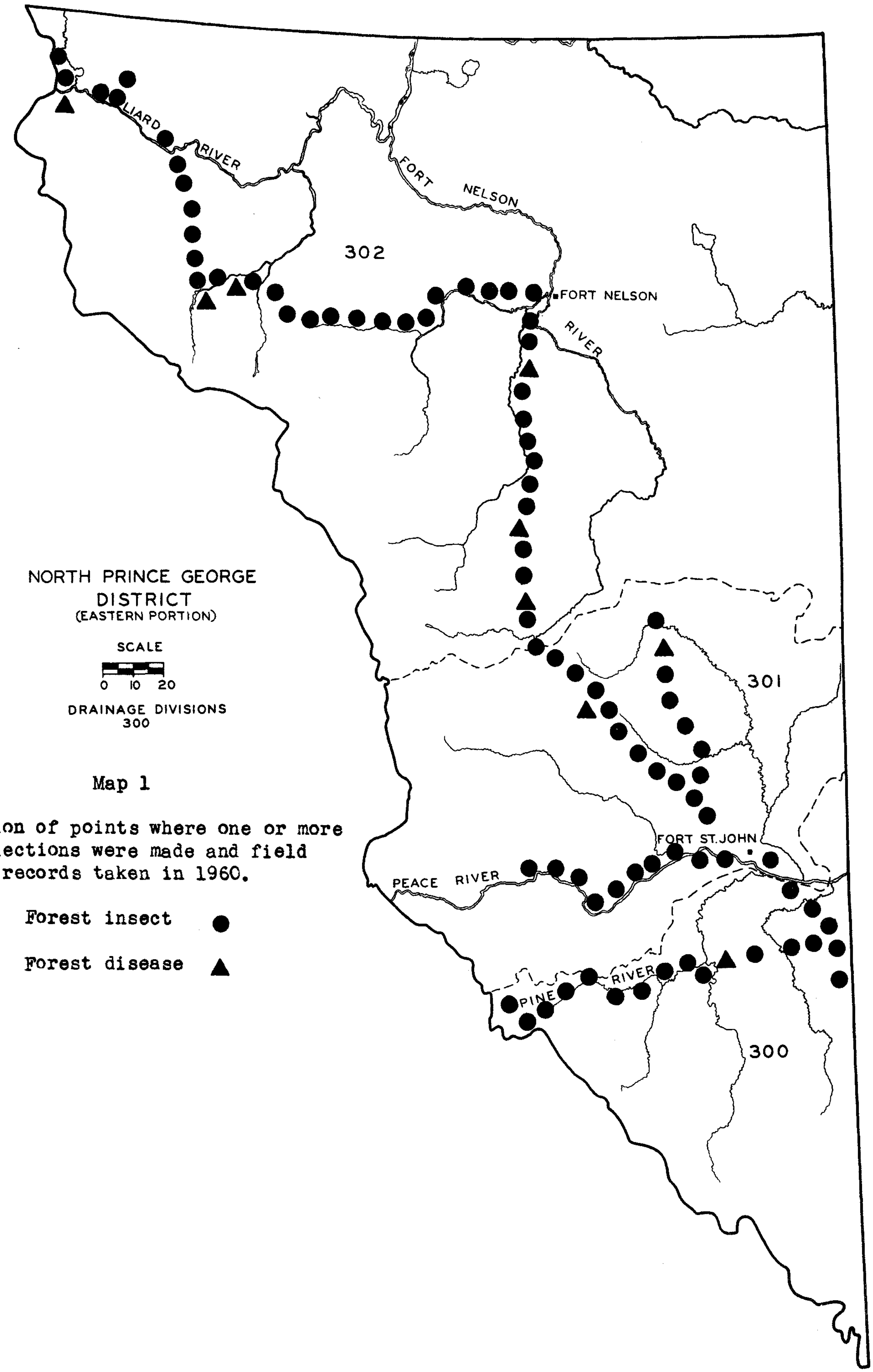
STATUS OF FOREST DISEASES

Exotic Plantations

On June 1, 1960 the Exotic Plantation at Groundbirch (XP 51) was examined. This plot has suffered much damage, caused by both rodents and the widening of the road allowance. Many of the stakes were missing or chewed off close to the ground making it hard to find the seedlings. A total of 25 *Pinus sylvestris* L. were found, of which seven were living but mechanically damaged; 12 living but browsed; three dead, and three healthy. The dead trees were examined for any trace of insect or disease agents but none was found. Two lodgepole pine infected with *Peridermium stalactiforme* Arth. and Kern were found close to the Scots pine seedlings, but no sign of infection was found.

OTHER NOTEWORTHY DISEASES

Host	Organism	Locality	Remarks
Aspen, trembling	Ciborinia seaveri, Gvoves & Bowerm.	Mile 422, A.H.	leaf blotch
Birch, dwarf	Stereum sp.	Mile 213.4, A.H.	canker disease
Juniper, common	Gymnosporangium clavipes C. & P.	Mile 538.5, A.H.	gall rust
Larch, eastern	Melampsora medusae Thum.	Mile 58, Beatton R. Road	needle rust
Pine, lodgepole	Peridermium stalactiforme Arth&Kern	Groundbirch Hart H., Mile 178, A. H.	stem rust
Spruce, black	Peridermium coloradense (Diet.) Arth. & Kern	Mile 434, A.H.	broom rust
Spruce, black	Chrysomyxa ledicola Lagerh.	Mile 546, A.H.	needle rust
Spruce, white	Chrysomyxa ledicola Lagerh.	Cottonwood, River Bridge, (Dease L. Rd.)	needle rust

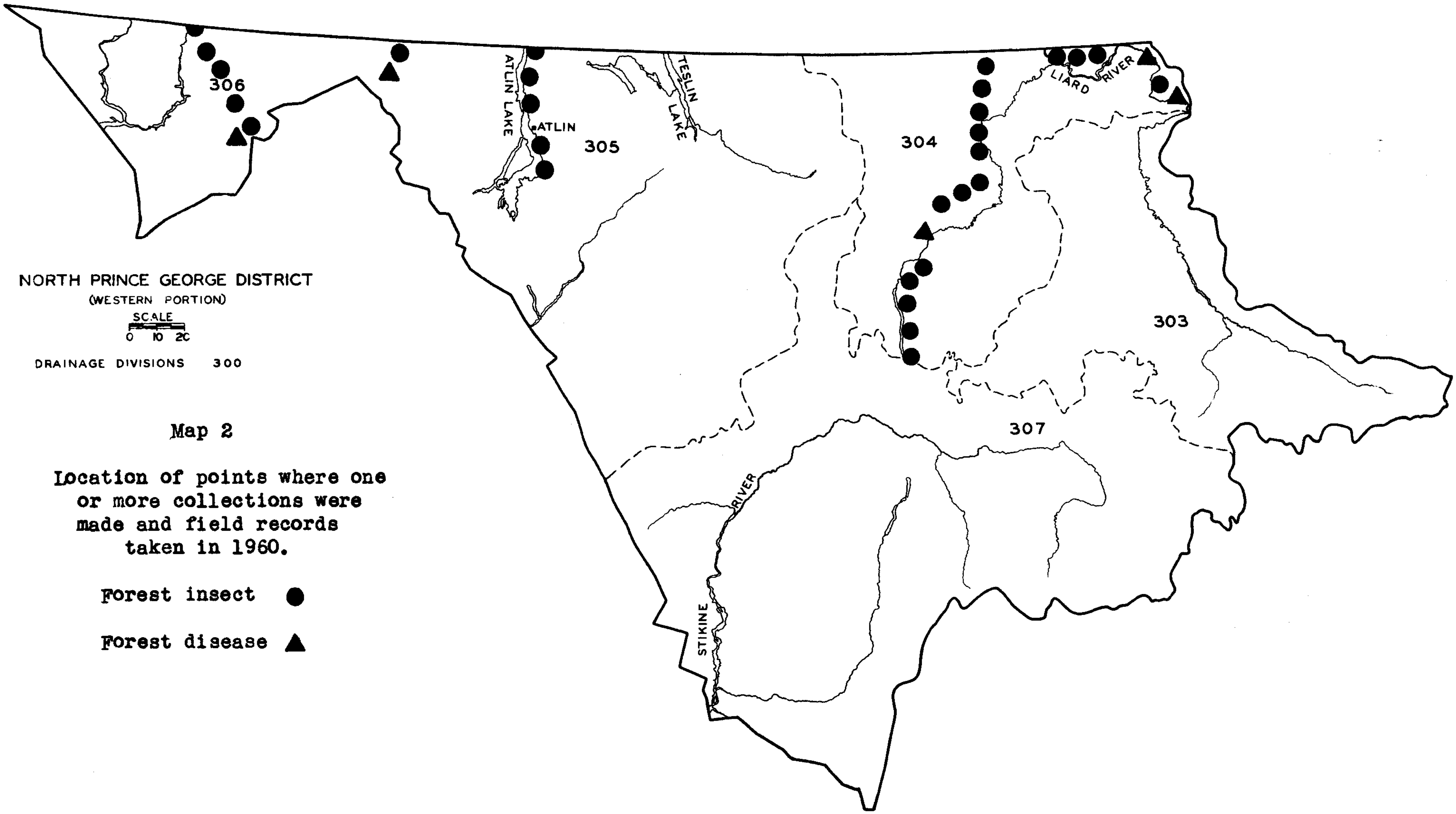


Map 1

Location of points where one or more collections were made and field records taken in 1960.

Forest insect ●

Forest disease ▲

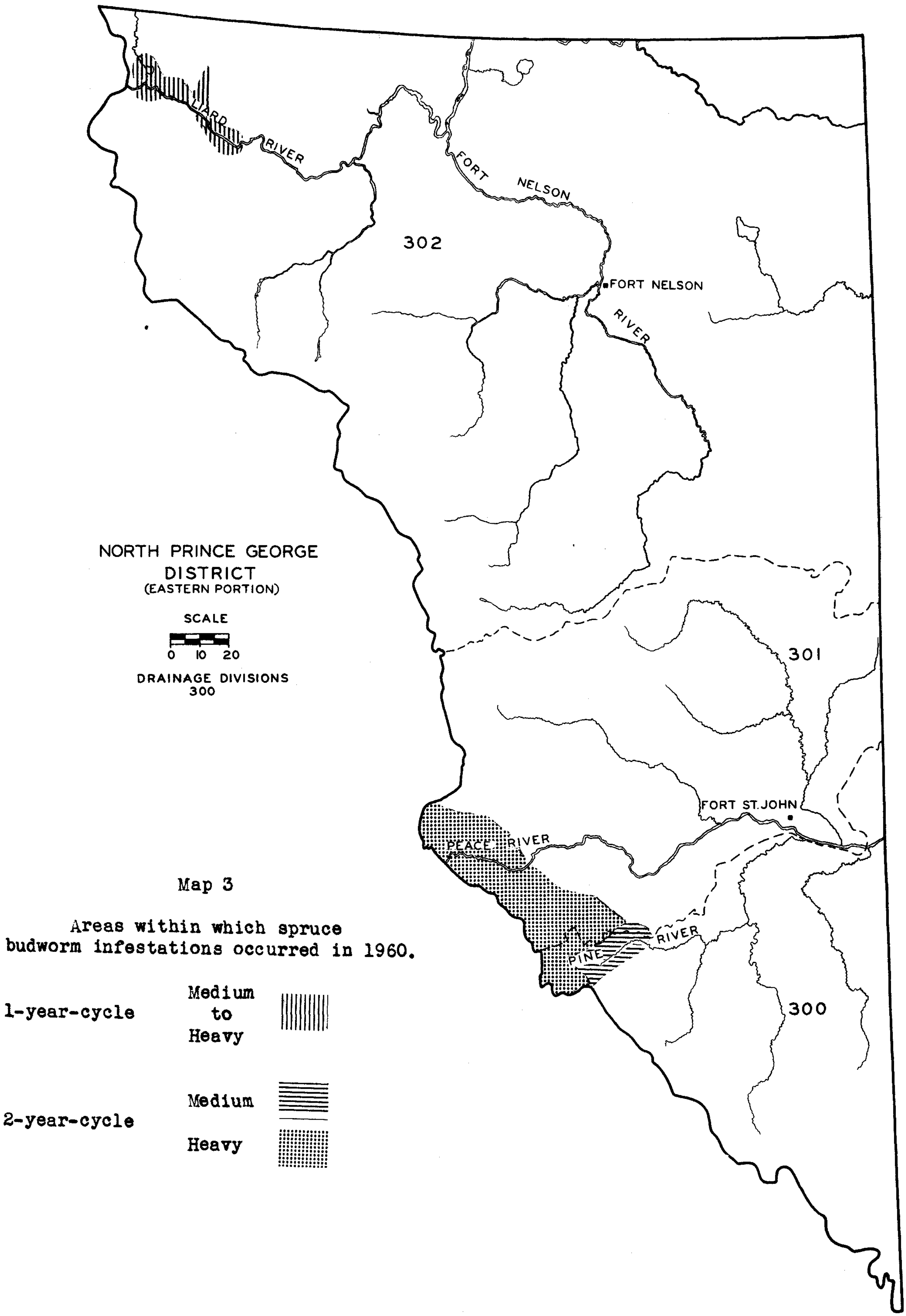


Map 2

Location of points where one or more collections were made and field records taken in 1960.

Forest insect ●

Forest disease ▲



Map 3

Areas within which spruce budworm infestations occurred in 1960.

ANNUAL REPORT OF FOREST BIOLOGY RANGER

for

YUKON DISTRICT

1960

FOREST BIOLOGY SURVEY

YUKON DISTRICT

1960

J. C. Holms

INTRODUCTION

The Forest Insect and Disease Survey in the Yukon Forest Biology Ranger District began on June 1 and terminated on September 2. The areas accessible by roads in Yukon Territory and Atlin Ranger District were surveyed and a flight by helicopter was made through courtesy of the Yukon Forestry Division. A house trailer stationed at the Yukon Forestry Division in Whitehorse was used as headquarters.

"Aklavik" Road is under construction and will extend from Mile 84, Dawson Road north to Fort McPherson. The road was open to Mile 40 during the 1960 field season.

Table 1 shows the host trees and the number of insect and forest disease collections made from each host. Map 1 shows the localities where collections were made and field records taken.

Table 1

Collections by Hosts

Yukon District - 1960

Coniferous hosts	Forest insects	Forest diseases	Broad-leaved hosts	Forest insects	Forest disease
Fir, alpine	9	3	Alder, sp.	-	1
Hemlock, western	1	-	Alder, mountain	11	-
Juniper, common	4	-	Alder, Sitka	4	
Larch, eastern	2	-	Ash, Sitka mountain	3	-
Pine, lodgepole	41	7	Aspen, trembling	76	3
Spruce, black	11	1	Birch, dwarf	24	-
Spruce, Sitka	1	1	Birch, water	3	-
Spruce, white	78	2	Birch, white	13	-
			Cottonwood, black	46	1
			Dogwood, red osier	3	-
			Poplar, balsam	1	-
			Willow	68	5
			Miscellaneous	35	3
			Total	287	13
Total	147	14	Grand Total	434	27

STATUS OF INSECTS

Spruce Seedworm, Laspeyresia youngana Kft.

Nearly all white spruce stands had a light to medium cone crop in 1960. Cone samples, which consisted of 50 cones picked at random from one tree where possible, were taken at four localities in late July. Early instar larvae of the spruce seedworm were present in the infested cones. Table 2 shows the percentage of cones infested by the spruce seedworm for 1959 and 1960.

Table 2

Percentage of White Spruce Cones Infested by the Spruce Seedworm, Yukon District, August 1959 and July 1960

Locality	Percentage infested	
	1959	1960
McKee Creek, B. C.	46	96
Mile 867, Alaska Highway, Y.T.	26	26
Mile 976, Alaska Highway, Y.T.	26	60
Carcross, Y.T.	74	92

Perhaps the general increase in the percentage of infested cones in 1960 was due to the lighter cone crop.

Smaller Western Pine Engraver, Ips latidens (Lec.)?

Small numbers of adults and larvae of this engraver beetle infested lodgepole pine on the Annie Lake Road, 27 miles south of Whitehorse. The beetles infested the upper portions of the pine, which averaged about six inches d.b.h.

Numerous dead and dying lodgepole pine bordered the fairways of the golf course off the Annie Lake Road. The oldest attacked pine, that is, those trees of the initial attack, have lost much of their bark, no doubt due to the numerous tunnels excavated by Ips latidens (Lec.)? The infested trees extend over two miles through the length of the golf course. No newly attacked trees were found in that stand, but a few recently attacked lodgepole pine were found scattered along the road west of the golf course. All or most of the attacked trees were fairly exposed, being border trees. These fringe trees may have been climatically weakened prior to the beetle attack.

A few smaller western pine engraver adults were found infesting standing lodgepole pine on the McClintock River Road, about 27 miles southeast of Whitehorse. The open-growing lodgepole pine stands bordering the McClintock River Road very much resembled the stands along the Annie Lake Road to the south-west. A small number of lodgepole pine lightly infested by this beetle was found off Canyon Mountain Road east of Whitehorse.

The damage caused by this beetle was very apparent as the extremely numerous galleries lead to the dropping of the bark, exposing a naked trunk on the upper portions of the lodgepole pine. Woodpecker activity was not evident.

The population of Ips latidens (Lec.)? appeared low in 1960 and should continue at a low level in 1961.

Lodgepole Pine Beetle, Dendroctonus murrayanae Hopk.

Adults and larvae of this species infested standing lodgepole pine on the Annie Lake Road, south of Whitehorse. Damage was caused by the beetles girdling the trees at the root collar.

The lodgepole pine beetle was working in conjunction with the smaller western pine engraver, but it was not certain whether the pine beetle or the pine engraver had first attacked the trees. It did appear, though, that the damage caused by Ips latidens (Lec.)? was older and more extensive than that caused by D. murrayanae Hopk.

Trees attacked by the lodgepole pine beetle were quite confined and scattered along the Annie Lake Road; a few recently attacked trees were found.

A few adult lodgepole pine beetles were found in standing trees bordering McClintock River Road. The beetles appeared to have made little headway in the open-growing lodgepole pine stands. In this area, as at Annie Lake Road, the lodgepole pine beetle was working at the root collar, while the smaller western pine engraver was found in the upper stem of the same trees.

A small number of lodgepole pine infested by the lodgepole pine beetle was found near Canyon Mountain Road east of Whitehorse, in trees that had been attacked by the smaller western pine engraver.

Large Aspen Tortrix, Choristoneura conflictana (Wlk.)

This insect caused medium defoliation of trembling aspen trees in the infestation two miles north of Carmacks. The area of the infestation did not appear to have increased in 1960 and remained at approximately 500 acres.

Four feet was cut from the top of each of five trembling aspen trees at the Carmacks infestation. The trees averaged two inches d.b.h., were 15 to 20 feet in height, and were taken to be representative of the stand. It was decided to take upper crown samples as the tops were most noticeably defoliated. The sample was taken to determine the percentage of defoliation. Table 3 shows the results of this examination.

Table 3

Defoliation of Trembling Aspen by the Large Aspen Tortrix at the Carmacks Infestation, Yukon District, August, 1960

Tree number	Number of leaves examined	Percentage of leaves 20 - 100% devoured
1	672	44
2	831	69
3	998	36
4	571	63
5	563	53
Totals	3635	53

Two empty large aspen tortrix egg masses were found during the sample examination. Fifteen small, green first or second instar larvae of Tortricoidea were found in the same sample. They were inhabiting the leaves bound together to form pupal cells that had been occupied by the tortrix. Possibly they may have been early-instar large aspen tortrix preparing to overwinter on the ground.

Parasitism was light in the infestation. Of 24 large aspen tortrix pupae found in the sample, 20 had emerged successfully, three were dead, and one was living, perhaps parasitized.

The large aspen tortrix infestation at Mile 1205, Alaska Highway, appeared to increase slightly in 1960. Parasitism at this location was heavy. No sample was taken.

The two large aspen tortrix infestations may be expected to continue in 1961.

A Gelechiid on Trembling Aspen

Gelechiid larvae were found in the trembling aspen sample taken from the large aspen tortrix infestation north of Carmacks, August 8, 1960. These larvae, inhabiting the deserted leaf pupal cells of the large aspen tortrix, were quite numerous. In the 3635 leaves examined which contained 142 vacated tortrix pupal cells, there were 29 grey gelechiids, three of which were dead.

A Sphinx Moth, Smerinthus cerisyi Kby.

This insect was found in standard 3-tree beatings, eight larvae occurring in six trembling aspen collections, and one larva occurring in one black cottonwood collection. Larvae were found in the Whitehorse, Mayo, and Dawson areas from July 18 to August 16, 1960.

Aspen Leaf-miner, Phyllocnistis populiella Cham.

The aspen leaf-miner was found in varying degrees through much of the range of trembling aspen where the survey was conducted in the Yukon.

The aspen leaf-miner infestation increased in 1960 at the two permanent sample plots at Watson Lake and Rancheria River. Two 12-inch branches were cut from each of five trees at each plot, and the leaves examined. Tables 4 and 5 compare the results of the examination of leaf samples taken at the two plots, in 1959 and 1960.

Table 4

Percentage of Aspen Leaf Surfaces with Mines, and Number of Aspen Leaf-miner Adults Produced per Leaf Surface, August 1959, August 1960, Yukon District

Location	Percentage leaf surfaces with mines		No. of adults produced per leaf surface	
	1959	1960	1959	1960
Watson Lake	54	78	0.28	0.14
Rancheria River	28	42	0.13	0.06

The adult emergence indicates that the infestations may be expected to continue, perhaps on a lower level, in 1961.

A 100-cocoon sample was obtained at each plot to determine mortality occurring at this stage. The results are shown in Table 5.

Table 5

Percentage Mortality of Aspen Leaf-miners in Cocoons
August 1959, August 1960, Yukon District

Location	Percentage mortality			
	Parasitism		Other causes	
	1959	1960	1959	1960
Watson Lake	25	62	4	6
Rancheria River	33	58	6	8

A Leaf-miner, poss. Nepticula sp., on White Birch

White birch leaf-miner damage was evident on the Dawson Road in mid-August. At that time the insects had vacated their mines, no doubt to pupate on the ground. The mines, one per leaf on the upper surface, were of the linear type while the larvae were early instar, changing to blotch-type in latter instars. The mined leaf areas areas had browned and died.

Two samples, each of which consisted of 10 two-foot branch tips from the five to 10-foot level of white birch trees was taken on the Dawson Road. One branch was cut from the exposed and one was cut from the shaded side of five trees. The two samples from two sites were taken in in an attempt to determine the extent of damage caused by the leaf-miner.

Table 6 indicates the results of the examination of the two white birch samples taken.

Table 6

Percentage of White Birch Leaves Infested by a
Leaf-miner, poss. Nepticula sp., on Dawson Road

Locality	Date	Number of leaves examined	Percentage of leaves infested
Mile 45	Aug. 19	1003	0.1
Mile 101	Aug. 14	964	8.5

Towards the end of the 1960 field season in the Yukon District, damage caused by this insect was noticeable through the range of white birch.

A Leaf Blotch-miner, Lithocolletis sp. on Trembling aspen

This insect was quite prevalent on trembling aspen through the Yukon, especially on the Carmacks-Mayo and Dawson Roads where larvae and pupae were found August 6, at Mile 123. The insect seems to prefer the lower one-half or one-third of the trees and was heaviest on the very young aspen.

Two samples, each of which consisted of five 12-inch branch tips from five trees, were taken at two sites. All the leaves from each sample were put into a container and the 100 leaves yielding information for Table 7 were picked out at random.

Table 7

Percentage of Two 100-leaf Samples Infested by a Trembling Aspen Leaf Blotch-miner on the Carmacks-Mayo Road

Locality	Date	Percentage of leaves infested
Mile 215	Aug. 10	19.0
Mile 168	Aug. 19	1.0

Most of the insects had emerged from the 100 leaves examined at each of the two sites, although pupae and a few larvae were present.

Spruce Budworm, Choristoneura fumiferana (Clem.)

Ten spruce budworm larvae from four 3-tree beating samples were found in mid-June towards the western end of the Yukon section of the Alaska Highway. These larval collections included one taken near Carmacks.

Two vacated pupae were taken in two white spruce beatings west of Haines Junction in the latter part of August.

Birch Leaf-rollers, Rheumaptera spp.

The birch leaf-roller infestation in the Dawson area appears to have collapsed as no evidence of damage caused by this insect was observed in 1960.

Willow Leaf-miner, Lyonetia saliciella Busck.

The McKee Creek infestation, west of Atlin, B. C., continued in 1960; heavy mining of willow bush leaves was evident. The infested area remained at about 250 acres.

Black-headed Budworm, Acleris variana (Fern.)

No larvae were collected in 1960, indicating a very low population level in the Yukon.

Yellow-headed Spruce Sawfly, Pikonema alaskensis Roh.

Sixteen larvae of this insect were taken in 13 white spruce collections; one larva was taken from black spruce. Two additional larvae were hand-picked from white spruce. These collections were taken between Miles 800 to 1000, Alaska Highway, and on the Carmacks-Mayo Road. The larvae were collected from mid-July to the end of August.

Green-headed Spruce Sawfly, Pikonema dimmockii Cress.

Nine larvae were taken in five white spruce collections from mid-July to early August.

A Maggot, Probably Pegohylemyia anthracina Czermy., in White Spruce Cones

This maggot was taken in white spruce cones at four localities in the Yukon. Muscidae larvae feeding on the seeds were found in conjunction with Cecidomyiidae. A sample consisting of 50 white spruce cones from one tree was taken at each of the four localities. The degree of infestation for the four 50-cone samples ranged from 16 to 52 per cent.

A Leaf-miner, Phyllocnistis sp. on Black Cottonwood

Damage caused by this insect was very evident on black cottonwood bordering Watson Lake airport road. At Rancheria River it was abundant on the roadside cottonwood. This leaf-miner can be found on cottonwood, especially regeneration growth, in varying degrees through the tree's range in the Yukon District.

Leaf Beetles, Gonioctena notmani Schffr. and G. americana Schffr., on Willow and Black Cottonwood.

Defoliation of willow bushes was evident south-east of Dawson on the Bonanza Creek Road from Mile 11.6 to 18.3. Many leaf beetle larval skins were observed hanging from the underside of the willow leaves. Eighteen larvae and eight adults were collected within a short distance. The larvae appeared to be in the prepupal state, and many of these leaf beetles had no doubt pupated in the ground prior to inspection of the area which was carried out on July 2. The infested willow was mainly on the southwest or lower side of the Bonanza Creek Road, between the road and the creeks, forming a strip less than one-quarter mile wide at the widest point. Degree of defoliation varied from light to medium.

The following five collections were made in the Whitehorse area between June 8 and August 7, 1960. Eight *G. notmani* Schffr. adults were taken in three willow collections, and one from black cottonwood. Two *G. americana* Schffr. adults were collected from black cottonwood.

A Sawyer Beetle, *Monochamus oregonensis* Lec.

No evidence of damage caused by this beetle was found in any burns, although three beetles were taken in flight on the Mayo-Dawson Road at the end of June.

OTHER NOTEWORTHY INSECTS

LARVAE

Insect	Host	Number of collections	Remarks
Acleris pulverosana Wlk.?	W	1	Bennett, B. C.
Anoplonyx canadensis Hgtn.	Le	1	Mile 681
A. laricivorus Roh. & Midd.	Le	1	Mile 658
Aphania spinulana McD.?	Sw	1	Mile 1020
Arge clavicornis (F.)	Big, Dt, W	8	Widely distributed
Argyresthia pygmaeella Hbn.	W	2	Watson Lake, Carcross
Brephos infans Moesch.	Big, W	4	Mile 746, B.C., Mile 106, Canol Rd., Whitehorse, Mile 1221
Byrdia rossi Curt.	W	1	Dawson
Campaea perlata Gn.	Biw, W	4	Watson Lake, Mayo, Dawson

Insect	Host	Number of collections	Remarks
Cerura probably occidentalis Lint.	A, Cot, W	3	Mile 43, Carmacks Rd., Stewart River Crossing, Mile 61, Dawson Rd.
Choristoneura rosaceana Harr.	W	1	Mile 1221
Cimbex americana Leach	A, Biw, Dt, W	5	Whitehorse, Mayo, Mile 61, Dawson Rd., Mile 75, Dawson Rd.
Clepsis persicana Fitch	Cot	1	Watson Lake
Compsolechia niveopulvella Chamb.	W	1	Teslin
Dioryctria abietivorella D. & S.	Pl cones	2	Bennett, B. C., Mile 717
Dysstroma citrata Linn.	A	1	Teslin
Epicnaptera americana Harr.	Cot	1	Mile 93, Haines Rd., B. C.
Epinotia solandriana Linn.	Dt.,W	2	Bennett, B. C.
Epirrhanthis substriataria Hlst.	A, Cot, W	3	Bennett, B. C., Whitehorse, Mi. 93, Haines Rd., B. C.
Epirrita autumnata Gn.	Bio	1	Watson Lake
Eucordylea atrupictella Dietz.	W	2	Mile 23, Carmacks Rd., Mile 61, Dawson Rd.
Eupithecia annulata Hlst.	Sw, Sb	3	Watson Lake, McRae, Whitehorse
E. filmata Pears.	Sw	1	Mile 147, Haines Rd.
E. luteata bifasciata Dyar	W	1	Mile 93, Carmacks Rd.
E. niphadophilata Dyar	Jc	1	Mile 648
Hydriomena furcata Thun.	W	4	Teslin, Mayo, Bennett, B. C., Haines Jct.

Insect	Host	Number of collections	Remarks
Itame anataria Swett	Cot	1	Watson Lake
I. loricaria Evers.	A, Cot	4	Watson Lake, Teslin
Lexis *bicolor* Grt.	Sb	1	Mile 1150
Lithocolletis sp.	Cot	7	Whitehorse, Pelly R. Crossing, Dawson, Stewart R. Crossing
Lycia *ursaria* Wlk.	W	1	Mile 12, Atlin Rd.
Lygris xylina Hlst.	W	2	Mile 31, Atlin Rd., B. C., Whitehorse
Nematus mendicus Walsh	A, Dt	2	Mayo, Dawson
N. occidentalis (Marl.)	W	1	McClintock River Rd.
N. ventralis Say	W	1	Pelly River Crossing
Neodiprion sp.	H	1	Mile 41, Haines Rd., B. C.
Nycteola frigidina (Pack.)?	A	2	Mile 950, Mile 980
Pontania sp.	W	4	Whitehorse, Mile 1091
Operophtera bruceata Hlst.	Big, Dt, W	3	Whitehorse, Mile 93, Haines Rd., B.C., Mile 1072
Plemyria georgii Hlst.	A, W	6	Mile 25, Canol Rd., Whitehorse, Mile 45, Dawson Rd., Dawson, Haines Jct., Mile 123, Haines Rd.
Pyralidae	Sb "club-top" samples	3	Watson L., Mayo, Dawson
Scoliopterix libatrix Linn.	W	1	Mayo
Semiothisa hebetata Hlst.	W	1	Mile 968
S. *sexmaculata* Pack.	Le	1	Mile 681
Syngrapha selecta Wlk.?	Sw	1	Haines Jct.
Trichiosoma triangulum Kby.	A, Cot	11	Widely distributed

Insect	Host	Number of collections	Remarks
Acmaeops pratensis (Laich.)?	Sw, W	2	Mile 766, B. C., Elsa
A. *proteus* Kby.?	Pl	1	Carmacks
Adalia frigida Schn.?	A, Big, Ds, Le, Pl, W	14	Widely distributed
Agonum bembidioides (Kby.)	Sw	1	Whitehorse
Anisocalvia 14-*guttata* var.?	Sb	1	Dawson
A. 14-*guttata* Linn.	Dt, Pl	3	Mile 756, B.C., Mile 25, Canol Rd., Carmacks
Anoplodera propinqua Bland.?	A	1	Atlin, B. C.
Buprestis nuttalli Kby.	in flight	1	Mayo
Callidium subopacum Sw.?	in flight	1	Mount Haldane
Carphoborus carri Sw.	Sw	1	Mile 29, Dawson Rd.
Chrysomela falsa Brown	Cot	2	Mile 1104
Coccinella nivicola monticola Muls.?	Big, Le	2	Mile 658, Mount Haldane Rd.
C. transversoguttata Fald.?	Big	1	Mount Haldane Rd.
C. transversoguttata quin-*quenotata* Kby.?	Big	1	Mile 716
C. trifasciata L.?	Big	1	Mount Haldane Rd.
Corticeus substriatus Lec.	Pl, Sw	2	McClintock R. Rd., Annie Lake Rd.
Cryphalus nitidus (Sw.)?	W	2	Mile 105, Dawson Rd., Mile 38, Aklavik Rd.
Ctenicera aeripennis Kby.?	Jc	1	Mile 648
C. decoratus Mann.?	Sb	1	Mile 1181

Insect	Host	Number of collections	Remarks
C. hoppingi Van D.?	Sw	1	Whitehorse
C. lobata caricina (Germ.)?	Sw	1	Stewart R. Crossing
C. nigricollis Bland?	Ba	1	McKee Creek, B. C.
C. ochreipennis Lec.?	Ba, Sw, W	13	Widely distributed in B. C. and southern Yukon
Cyphon variabilis Thunb.	Le, Sw, W	6	Widely distributed
Dendroctonus engelmanni Hopk.?	Sw	1	Mile 29, Dawson Rd.
D. engelmanni Hopk.	Sw	3	Annie Lake Rd., Mile 8, Carmacks Rd., Calumet
Dicerca prolongata Lec.?	A	4	Pelly R. Crossing, Stewart R. Crossing, Mount Haldane Rd., Mile 21, Dawson Rd.
Enoclerus lecontei Wolc.	Sw	1	Mile 29, Dawson Rd.
Hippodamia lunatomaculata Mots.	A	1	Whitehorse
Hypnoidus tumescens (Lec.)?	Sb	1	Stewart R. Crossing
Ips perturbatus Eich.?	Sw, felled trees and decked logs	5	McClintock R. Rd., Mile 85, Carmacks Rd., Calumet, Mile 29, Dawson Rd., Mile 82, Dawson Rd.
Lepyrus gemellus Kby.	W	5	Mile 826, Mile 31, Atlin Rd., B. C., Carmacks, Mile 1221
Lexis bicolor Grt.	A, Sw	5	Whitehorse, Mile 13, Carmacks Rd., Minto, Mile 980
Lucidota corrusca L.?	Cot, W	2	McKee Creek, B. C. Pelly River Crossing
Magdalis spp.	A, Sw, W	4	Mile 766, B. C., Mile 894, Whitehorse, Haines Jct.

Insect	Host	Number of collections	Remarks
Melanophila acuminata DeG.?	in flight	4	Whitehorse, Pelly R. Crossing, Elsa
Mulsantina picta Rand.?	Pl	1	Mile 717
Neomysia pullata randalli Csy.?	Ba, Pl	2	McKee Creek, B. C. Carmacks
Orsodacne atra Ahr.	W	2	Mount Haldane Rd., Dawson
Pachyta lamed L.	in flight	1	Mile 976
Phratora purpurea Br.	A, Biw, W	4	Mile 21, Dawson Rd., Mile 45, Dawson Rd., Snag, Mile 1221
? Pineus sp.	Sw	4	Mile 12, Atlin Rd., Mile 932, Minto, Mile 1219
? Pityophthorus sp.	Pl	2	Watson Lake, Mile 25 Carmacks Rd.
Pityophthorus spp.	Pl, Sw	2	Bennett, B. C., McClintock R. Rd.
P. tuberculatus Eich.?	Pl	1	Mile 898
Plectrura spinicauda Mann.	Sitka mountain ash	1	Mile 41, Haines Rd., B. C.
Pogonocherus penicellatus Lec.?	Sw	1	Mile 898
P. pictus Fall.?	Pl	1	Mile 898
Polygraphus rufipennis Kby.	Sw	6	Annie Lake Rd., Mile 21, Carmacks Rd., Calumet, Mile 29, Dawson Rd., Mile 34 Aklavik Rd.
Rhabdophaga strobiloides (Walsh)	W	1	Mile 43, Carmacks Rd.
Rhyncholus sp.	Pl	1	Bennett, B. C.
Saperda moesta Lec.	Cot	1	Haines Jct.
Scolytus sp.	Sw	1	Mile 29, Dawson Rd.

Insect	Host	Number of collections	Remarks
Sericus incongruus (Lec.)?	Big	1	Mount Haldane Rd.
Sicya macularia Harr.	W	1	Mile 1051
Syneta pilosa Brown?	Ba, Le, Sw	5	Mile 658, Teslin, McKee Creek, B.C., Tagish, Mile 1048
? *Tetratoma concolor* Lec.	Pl, Sw	8	Mile 756, B.C., Teslin, Mile 876, Mile 904, Carcross, Whitehorse, Mile 932
Urocerus flavicornis Fab.?	on Sw log, in flight	3	Whitehorse, Elsa
Zaraea sp.	Ba	1	McKee Creek Rd., B. C., Mile 981

STATUS OF FOREST DISEASES

Important Diseases

Blister Rust on Lodgepole Pine

Lodgepole pine reproduction was infected by *Cronartium comandrae* Peck at Mile 904 and Mile 898, Alaska Highway, and on the Carcross Road. Four to five per cent of the young pines were infected at the localities mentioned. Mortality, apparently caused by this rust, was noted.

Needle Rust on White and Black Spruce

Witches' brooms caused by *Peridermium coloradense* (Diet.) Arth & Kern continued to cause light damage in the district.

? Climatic Injury to Lodgepole Pine

A stand of dead and dying lodgepole pine was seen at Bennett, B. C., on the White Pass-Yukon Railroad. The affected area covered about 0.75

square miles, extending about 1.5 miles in length, and about 0.5 miles in width. Most of the injured trees were located on a sandy, exposed hill with extreme drainage, south-west of Bennett. The upper four-fifths of many of the trees, averaging 17 feet in height, were dead, while the lower one-fifth was living. The fact that the lower portions of a large number of the injured lodgepole pine were living could be due to snow protection. The weakened trees appeared to have fostered a bark beetle population which caused light damage.

? Climatic Injury to Alpine Fir

What appeared to be climatic injury of alpine fir was seen at Calumet and on the Clear Creek Road. The new growth which was dead was quite evenly distributed over the affected trees. At Calumet about 200 acres were affected while on the Clear Creek Road about 1000 acres were affected. The new growth of both reproduction and mature alpine fir at the two localities was killed. Both areas were exposed, at an average of 4000 feet above sea level. At Calumet the alpine fir was growing in association with white spruce which was not affected. The alpine fir damage at Calumet and on the Clear Creek Road is on practically the same degree of latitude, approximately 63° 52'.

A sample consisting of ten 12-inch branch tips from five trees was taken at each site to determine the degree of twig mortality. The average d.b.h. of the ten trees sampled was five inches, branch samples being cut from the five to 10-foot leve. Table 8 shows the results of the examination.

Table 8

Percentage of Alpine Fir Twig Mortality
Caused by Climatic Injury, Yukon 1960

Locality	Number of twigs examined	Percentage of dead twigs
Calumet	356	45.2
Mile 11.5, Clear Creek Rd.	367	42.5

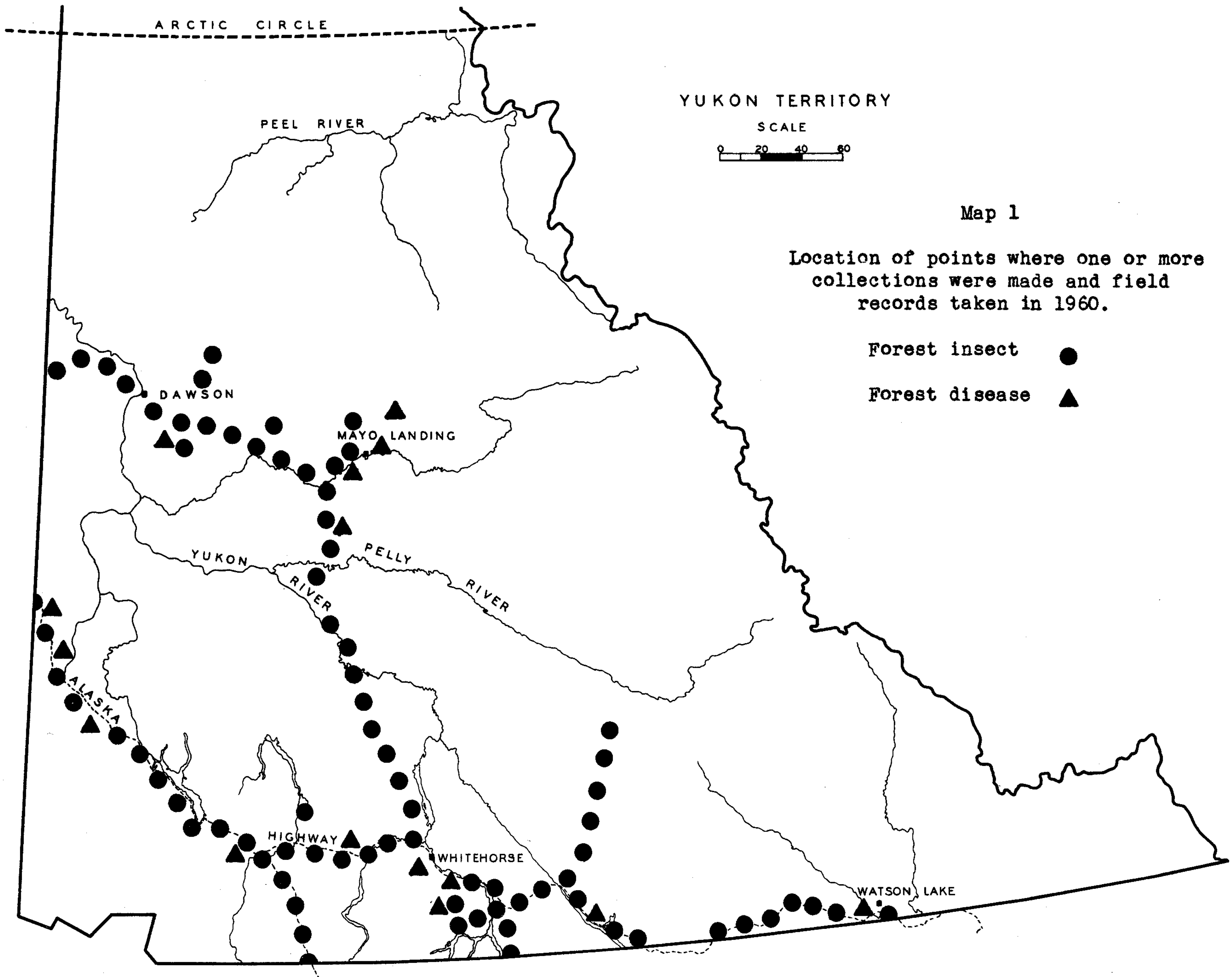
Yellowing of Lodgepole Pine Terminals

Yellow terminal discoloration was noted in quite a number of reproduction lodgepole pine stands bordering the Alaska Highway and other Yukon roads. It seems that during the winter months cone collections

OTHER NOTEWORTHY DISEASES

are made for reseeding purposes. The cones being pulled off by hand caused the terminals to die and turn yellow.

Host	Organism	Locality	Remarks
Abies lasiocarpa	Melampsorella caryophyllacearum Schroet.	Calumet, Whitehorse	Needle rust causing "witches' brooms"
Abies lasiocarpa	Cladosporium herbarum (Pers.) Link	Calumet	A mold
Arctostaphylos uva-ursi	Chrysomyxa arctostaphyli Diet.	Teslin	Leaf rust causing leaf blotches
Picea mariana	Chrysomyxa ledicola Lagerh.	Mi. 1151, Alaska Highway, Y.T.	Needle rust
Salix sp.	Melampsora epitea Thum.	Sulphur Crk. Road.	Orange rust on leaves



Map 1

Location of points where one or more collections were made and field records taken in 1960.