ANNUAL DISTRICT REPORTS

FOREST INSECT AND DISEASE SURVEY

BRITISH COLUMBIA

1966

FOREST RESEARCH LABORATORY

VICTORIA, BRITISH COLUMBIA

INFORMATION REPORT BC-X-11

DEPARTMENT OF FORESTRY AND RURAL DEVELOPMENT

MAY, 1967

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R. L. FIDDICK

FOREWORD

One of the more important developments in the Forest Insect and Disease Survey in 1966 was the formation of an appraisal group within the Section with D. G. Collis as appraisal crew supervisor, insect problems, and A. T. Foster, supervisor disease problems. This group is responsible for the appraisal and assessment of insect and disease outbreaks and development of new survey methods and techniques. This relieves the rangers of the responsibility for large scale appraisal work during the summer season and allows for greater concentration on the detection aspects of the survey.

Transfer of a number of ranger technicians to the Appraisal Crew and the Entomology Section necessitated some changes in District assignments and the training of new rangers for several districts. These changes are recorded in the introductory remarks of the Senior Ranger for each Forest District.

Field headquarters of the East Prince Rupert District was transferred from Pendleton Bay to a more central location on the Dominion Experimental Farm at Smithers. The Prince George stations were moved from a residential area of the city to a site on the Dominion Experimental Farm south of the city.

Fixed wing aircraft and helicopters were used extensively in mapping insect and disease outbreaks in the Province. Aircraft were used to advantage in the detection survey of the west coast of Vancouver Island, the northern portion of the North Vancouver District, the South Prince Rupert District, the Queen Charlotte Islands and the coastal area north of Prince Rupert.

The larch casebearer, Coleophora laricella Hbn. which has been present in larch stands in Idaho and Montana for a number of years, was found for the first time in British Columbia just north of the border in the Nelson Forest District.

Black-headed budworm infestations persisted in the Kamloops and Nelson districts and populations increased to near infestation levels in sections of the South Vancouver District.

Larch sawfly infestations increased in areas of the Nelson districts while larch budmoth infestations declined markedly in the same general areas.

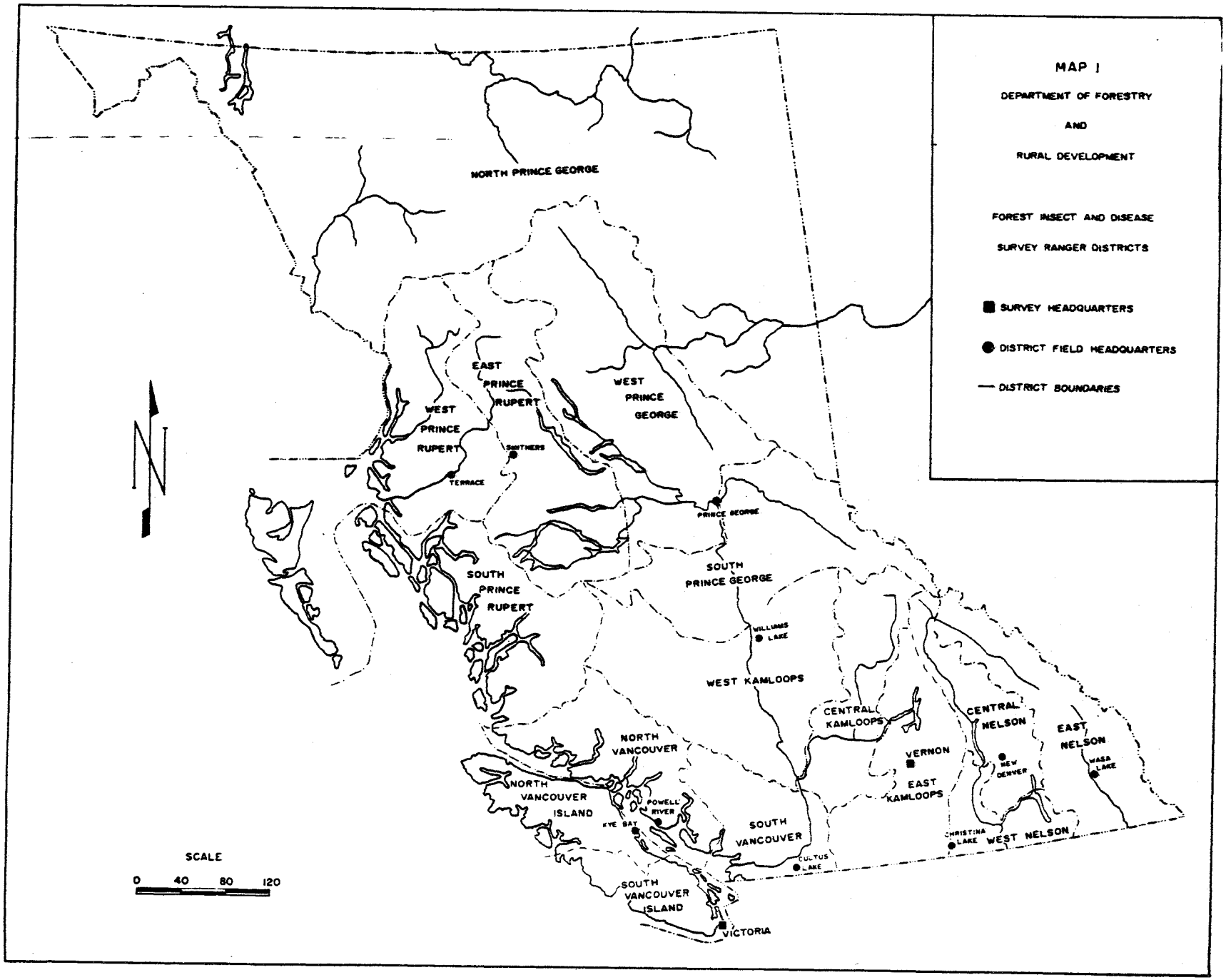
The needle miner infestation in western hemlock on northern Vancouver Island declined during 1966 and severely defoliated trees appeared to be recovering.

Except for some small increases in the number of pines killed by mountain pine beetle, tree mortality due to bark beetle attacks decreased in most areas.

A spring frost caused significant damage to Douglas-fir in the Williams Lake and Quesnel areas in the Cariboo. Studies were initiated to determine the impact of the damage on the trees and their susceptibility to beetle attack and infection by disease.

During the season Rangers submitted totals of 5,647 insect and 567 disease collections to the Victoria and Vernon Laboratories. British Columbia Forest Service personnel and other co-operators submitted a total of 650 collections to the two Laboratories.

Map 1 shows the Forest Insect and Disease Survey Ranger Districts and District Headquarters in the Province. Drainage division boundaries are shown on individual maps in the District Reports.


MAP I
DEPARTMENT OF FORESTRY
AND
RURAL DEVELOPMENT
FOREST INSECT AND DISEASE
SURVEY RANGER DISTRICTS
SURVEY HEADQUARTERS
DISTRICT FIELD HEADQUARTERS
DISTRICT BOUNDARIES
NORTH PRINCE GEORGE
EAST PRINCE RUPERT
WEST PRINCE RUPERT
WEST PRINCE GEORGE
SMITHERS
TERRACE
PRINCE GEORGE
SOUTH PRINCE RUPERT
SOUTH PRINCE GEORGE
WILLIAMS LAKE
WEST KAMLOOPS
CENTRAL KAMLOOPS
VERNON
EAST KAMLOOPS
CENTRAL NELSON
EAST NELSON
NEW DENVER
WASA LAKE
NORTH VANCOUVER
NORTH VANCOUVER ISLAND
POWELL RIVER
KYE BAY
SOUTH VANCOUVER
CULTUS LAKE
CHRISTINA LAKE
WEST NELSON
SOUTH VANCOUVER ISLAND
VICTORIA
SCALE
0 40 80 120

FOREST INSECT AND DISEASE SURVEY

BRITISH COLUMBIA

1966

VANCOUVER FOREST DISTRICT

VANCOUVER ISLAND SECTION

FOREST INSECT AND DISEASE SURVEY

BRITISH COLUMBIA

1966

VANCOUVER FOREST DISTRICT

VANCOUVER ISLAND SECTION

N. E. Alexander[1/]

Several personnel changes took place on the Island in 1966. D. G. Collis, formerly in the South Vancouver Island District, went to the newly formed Appraisal Group. N. E. Alexander moved from the North Vancouver Island District to the South, and was replaced by R. Murfitt.

There were four major forest insect and disease problems on the Island during 1966. An outbreak of a hemlock needle miner continued to defoliate trees in the Quatsino Sound area, Drainage Division 025, near Holberg, and in the Buck and Keith rivers drainages. On southern Vancouver Island the pine butterfly population rose to a high level and heavy flights of butterflies were reported in the Chemainus and Nanaimo river drainages (Drainage Division 002). Red Band Dothistroma needle blight continued to cause severe foliage loss and mortality to Monterey, Bishop, and cluster pines in exotic plantations. Intensive surveys for the balsam woolly aphid were continued through the cooperative efforts of the Department and the British Columbia Forest Service. Special crews were employed for these surveys and Ranger personnel were not involved to any great extent.

A flight was made over the north end of the Island in April with management personnel of Evergreen Helicopters (U.S.A.) during preparations for a possible Epinotia control project. A fixed-wing flight over Island holdings of MacMillan and Bloedel Co. Ltd. revealed no unusual conditions.

1/ Forest Research Technician, Forest Insect and Disease Survey Senior Ranger, Victoria, B. C.

HOST TREE ABBREVIATIONS[1/]

Abbreviation	Common Name
tA	trembling aspen
Al	alder sp.
rAl	red alder
Alnus sinuata	Sitka alder
sAl	speckled alder
Ar	arbutus
Bignonioides	catalpa
C	cedar sp.
wC	western red cedar
Ca	cascara
Ch	bitter cherry
Chamaecyparis lawsoniana	Lawson cypress
D	Douglas-fir
wDo	dogwood
F	fir sp.
aF	amabalis fir
alF	alpine fir
gF	grandis fir
eH	eastern hemlock
mH	mountain hemlock
wH	western hemlock
Ilese aquifolium	English holly
J	juniper
M	maple sp.
bM	broadleaf maple
Malus sp.	apple
gO	Garry oak
P	pine sp.
aP	Austrian pine
lP	lodgepole pine
Pinus muricata	Bishop pine
mP	Mugho pine
Pinus nigra var. *poiretiana*	Corsican pine
Pinus pinaster	cluster pine
Pinus radiata	Monterey pine
Pinus thunbergii	Japanese black pine
sP	shore pine
scP	Scots pine
wwP	western white pine
Po	poplar
lPo	Lombardy poplar
sPo	silver poplar
S	spruce sp.
cS	Colorado spruce
eS	Engelmann spruce
sS	Sitka spruce
Taxus brevifolia	western yew
W	willow sp.

1/ or correct name where no accepted abbreviation exists.

FOREST INSECT AND DISEASE SURVEY

SOUTH VANCOUVER ISLAND DISTRICT

1966

FOREST INSECT AND DISEASE SURVEY

SOUTH VANCOUVER ISLAND DISTRICT

1966

N. E. Alexander

INTRODUCTION

Routine field work in the District began on June 6 and ended on September 2. Exotic plantations were examined before and after these dates. Special surveys were made for the European pine shoot moth, pine butterfly and the silver-spotted tiger moth. Assistance was given in the hemlock needle miner survey in the North Vancouver Island District.

Observations made during the aerial survey of the West Coast did not reveal any potential problems.

Table 1 contains data on collections by host. Locations of collections and Drainage Division boundaries are shown on Map 1. Principal insect and disease problems are tabulated by Drainage Division in Table 2. Details on individual problems follow this Introduction.

The number and variety of larval defoliators in the collections increased again in 1966. A continuing increase has occurred since 1962 when 46% of the collections contained larvae to 1966 when larvae were taken in 76% of the collections.

Table 1

Collections by Hosts

South Vancouver Island District, 1966

Coniferous hosts	Forest insect	Forest diseases	Broad-leaved hosts	Forest insects	Forest diseases
Cedar species	2		Alder species	4	
Cedar, western red	31		Alder, red	15	1
Douglas-fir	148	2	Alder, Sitka	1	
Fir, species	6		Alder, speckled	1	
Fir, amabilis	29	1	Apple	4	
Fir, grand	14		Arbutus	12	
Hemlock, eastern	1		Cascara	2	
Hemlock, mountain	1		Catalpa	1	
Hemlock, western	139	2	Cherry	4	
Juniper	5		Dogwood	3	
Pine species	10	1	Holly, English	1	
Pine, Bishop		6	Maple	1	
Pine, black	2		Maple, broadleaf	2	
Pine, cluster		7	Oak, Garry	74	
Pine, Corsican		1	Poplar	2	1
Pine, lodgepole	13		Poplar, Lombardy	1	3
Pine, Monterey		3	No host	155	
Pine, Mugho	3		Poplar, silver	4	
Pine, Scots	3		Willow	12	
Pine, shore	9	7	Miscellaneous	73	
Pine, western white	3	3			
Spruce species	3				
Spruce, Colorado	1				
Spruce, Sitka	12				
Yew, western		2			
Totals	435	31	Totals	372	5
			GRAND TOTALS	807	36

Table 2

Currently Important Insect and Disease[1/]

Problems by Drainage Divisions, South Vancouver Island District, 1966

Insect and disease problems	Principal hosts[2/]	Importance by drainage divisions[3/] 001	002	003	004	005
DEFOLIATORS						
Pine butterfly	D	0	3	0	0	0
Green-striped forest looper	D, wH	2	3	2	2	2
A spruce tip moth	sS	0	0	4	0	4
Silver-spotted tiger moth	D	1	1	1	1	1
Coniferous sawflies	wH	1	3	1	1	1
SAP-SUCKING INSECTS						
Balsam woolly aphid	aF, gF	5	4	0	3	0
TERMINAL BORERS						
European pine shoot moth	Pine sp.	1	1	0	0	0
FOLIAGE DISEASES						
Dothistroma needle blight	Pines, Monterey Bishop cluster	0	4	4	0	4

1/ Includes only weather-induced and foliage diseases subject to notable annual fluctuation.

2/ Refer to host code in Forest District Introduction.

3/ High population and/or widespread outbreak in progress - 5.
Scattered high populations and/or significant damage in restricted areas - 4.
Rising population and/or moderate numbers of insects and/or potential problem - 3.
Static or falling population and/or moderate numbers of insects and/or no potential problem at present - 2.
Endemic population and/or no significant damage - 1.
Not sampled and/or no host and/or not found - 0.

FOREST INSECT CONDITIONS

Currently Important Insects

Defoliators

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

Pine butterfly populations in the Chemainus and Nanaimo river drainages increased in 1966. Frass fall and defoliation indicated a moderate larval population but very dense adult flights were observed in these areas during August and oviposition was heavy on Douglas-fir. Higher larval populations, which did not result in such massive flights, have been recorded in this area and the Nimpkish (Drainage Division 024). This suggests that larval and pupal survival in 1966 was very high.

Adult and egg stages of this insect (Figs. 1 & 2) are the best indicators of its abundance. The larval stage feeds high in the crowns of mature trees and is evidenced only by frass fall and defoliation, neither of which are sufficient for detection at low population levels. Pupal habits are little understood. Flights commence in August and are usually complete by September, although they may extend into October. Adults are best observed fluttering around the tree crowns during the full heat of the day.

Relative abundance of adults is measured by counts in which one starts at the top of the tree and counts steadily down to the bottom of the crown and back to the top, averaging the results. It is normal to see adults in any year and up to 10 per crown gives no cause for concern. From 20 to 50 indicates a noteworthy population and a possible increase in larval numbers the following season. Over 50 indicates a high population with the possibility of greatly increased larval populations the next year and noticeable, if not serious, defoliation. By these counts, relative abundance can be judged from year to year and future egg sampling points can be determined.

Overwintering occurs in the egg stage. These are laid in linear masses of about 10 eggs (Fig. 2), mostly on current foliage. Egg sampling consists of taking 3 - 18" tips from the upper crown and one tip each from the mid and lower crown of 3 dominant and co-dominant trees at each sample location. Area of the foliage is measured ($\frac{1}{2}$ length x greatest width) and eggs counted, giving eggs per sq. ft. of foliage. Allowing for overwintering egg mortality, this figure is the best indication of what next year's larval population will be and where it will be located.

The eggs hatch in late May and the gregarious larvae feed on the old foliage until mid-July. Current foliage is rarely consumed. There are 5 instars (larval stages) and as they feed the pellets of excrement (frass) fall to the ground, indicating feeding activity. During heavy feeding the frass fall may sound like fine rain and pellets accumulate on flat surfaces in the forest such as stump tops, devil's club leaves, etc. The presence of frass serves to confirm the insect's presence, its progress through the instars (pellet sizes increase with larval sizes), and locations which should be checked for defoliation and adult flights. No sampling has been done in the larval stage because of the mechanical difficulty of obtaining samples from the upper crown of mature Douglas-fir. The larvae pupate in July on needles, bark, or understory, and the adults emerge in August.

Adult counts made from Aug. 19 to 23, 1966 were high (Table 3) and apparently preceded the main flight by a few days as industry personnel, then viewing the flight from a helicopter, reported that the crowns of the trees were whitened and adults were abundant in the air high above the trees. These aerial observations confirmed ground observations that the insect was most abundant in a "band" running approximately from the Chemainus River northwest across the Rheinhart country to Dunsmuir Creek.

Egg counts throughout this and adjacent areas were generally high with some exceptionally high counts (Table 4) (Map 2). Table 5 compares similar counts made in 1964 and 1965. There were signs of defoliation in some areas but nothing serious or extensive.

Based on adult flights and egg counts, there is likely to be a high larval population in 1967 when there may be obvious defoliation. From previous experience with this insect on Douglas-fir in coastal forests, however, it is unlikely that mortality would result from a single year of heavy feeding. A continued high population, which will be watched for in next year's sampling, could indicate a problem in some areas.

Table 3

Pine Butterfly Adult Counts, South Vancouver Island,

D. D, 002, 1966

Location	Adults per crown[1/]
<u>Chemainus River</u>	
South Road	25
Ondzie Creek	80
Branch M	40
Branch C 16	20
Howe Creek	60
Branch C 29	80
Branch F 2 F	2
East of Rheinhart Creek	60
<u>Nanaimo River</u>	
Chemainus Road	70
Dunsmuir Crk. Blk. 830	4
<u>Cameron River</u>	
MacMillan Park	5

1/ Counting method described in text.

Table 4

Pine Butterfly Egg Counts, South Vancouver Island,

D. D. 002, 1966

Location	Sq. ft. foliage sampled	Eggs per sq. ft.			Range of eggs per 18" tip
		Viable[1]	Unviable	Total	
Chemainus River					
M side	11.9	10.3	0.5	10.8	0.0 - 60.4
Howe Creek	12.8	16.6	2.6	19.1	0.0 - 96.7
Branch F 1	11.1	26.5	6.9	33.4	0.0 - 95.6
Branch C 21	13.7	31.3	12.4	43.6	0.0 -143.3
Rheinhart Rd.	12.9	3.5	0.8	3.6	0.0 - 14.6
Nanaimo River					
Chemainus Rd.	13.6	40.3	1.6	41.6	0.0 -105.1
Branch D 11	5.0	2.0	3.2	5.2	0.0 - 8.3
Branch R 12 E	13.1	1.6	0.0	1.6	0.0 - 26.6
Branch R 10 E	13.2	2.5	0.0	2.5	0.0 - 18.9
Nanaimo Lakes					
Branch K 32	12.7	5.3	0.0	5.3	0.0 - 57.4
Branch M	13.9	2.4	0.7	2.4	0.0 - 27.7
Branch J 14	11.4	0.4	0.0	0.4	0.0 - 4.8
Cameron River					
Branch E 10	5.1	0.0	0.0	0.0	---

[1] The most significant figure.

Table 5

Comparison of Number of Pine Butterfly Eggs,

South Vancouver Island District

Location	Eggs per sq. ft. of foliage	
	1965	1966
Chemainus River		
M	2.6	—
S - 3	7.0	—
C - 35	7.2	—
M side	—	10.3
Howe Creek	—	16.6
F - 1	—	26.5
C - 21	—	31.3
Rheinhart Rd.	—	3.5
Nanaimo River		
R - 5	3.1	—
D - 16	0.0	—
Chemainus Rd.	—	40.3
D - 11	—	2.0
R 12 E	—	1.6
R 10 E	—	2.5
Nanaimo Lakes		
K 32	—	5.3
M	—	2.4
J 14	—	0.4

Green-striped Forest Looper, Melanolophia imitata Wlk.

Green-striped forest looper populations continued to rise in 1966 and in Drainage Division 002 the figures were in the "alert" range, the point when 45% of the collections in a District or Drainage contain larvae[1/]. Collections for the entire District fall just below this point (Table 6). A careful watch will be maintained in 1967 for localized population buildups which could reach the infestation stage.

Mortality plots, established in Drainage Division 005 in 1961 to study the effects of the 1960 infestation, were re-examined in 1966 with no material change in their status.

1/ Silver, G. T. 1962. A review of some forest insect survey records associated with defoliator infestations in coastal British Columbia. Dep. Forest Can., Forest Entomol. and Pathol. Lab., Victoria. Interim Rep.

Table 6

Summary of Green-striped Forest Looper Collections by

Drainage Divisions, South Vancouver Island District

Drainage divisions	Number of samples taken during larval period			% samples containing larvae			Average number of larvae per positive sample		
	1964	1965	1966	1964	1965	1966	1964	1965	1966
001	5	17	25	0.0	29.4	28.0	--	2.0	1.6
002	154	155	138	6.5	17.4	46.4	1.0	1.7	4.2
003	63	74	34	0.0	8.0	34.0	--	1.4	1.4
004	32	50	24	0.0	30.0	54.0	--	1.7	3.4
005	69	84	64	7.2	13.0	31.3	1.0	1.2	2.6
Totals	323	380	285	4.6	16.8	40.0	1.0	1.6	3.4

A Spruce Tip Moth, Zeiraphera spp.

Sitka spruce on the West Coast were again damaged by tip moth feeding. A combination of Zeiraphera and Epinotia sp. mined and presumably killed 98% of the new shoots at Wickaninnish Park and 94% at Port Renfrew. This is an increase over 1965 when 76% and 60% of the shoots were mined, respectively. As in previous years, most of the defoliation occurred in the lower crowns. Lesser amounts of feeding were noted at various other spots on the coast.

These insects do not appear to pose a serious threat except in locations such as Wickaninnish Park where individual trees in a very restricted area have a high value.

Damage typical of these insects is shown in Figure 3.

Silver-spotted Tiger Moth, Halisidota argentata Pack.

Populations of this insect declined during 1966 as shown in Table 7. While not a serious defoliator of its host, Douglas-fir, in this region, the silver-spotted tiger moth has been the object of a continuing population and behaviour study.

Table 7

Roadside Web Counts of Silver-spotted Tiger Moth Colonies,

South Vancouver Island District

Areas surveyed	Total no. webs recorded					Average no. webs per mile				
	1962	1963	1964	1965	1966	1962	1963	1964	1965	1966
Victoria to Duncan	1592	200	75	51	17	49.0	5.7	2.2	1.5	0.5
Duncan to Nanaimo	743	9	16	130	36	23.4	0.2	0.5	3.9	1.1
Nanaimo to Parksville	940	39	24	125	94	40.3	1.7	1.3	5.6	4.3
Parksville to Cameron Lk.	416	53	12	44	76	28.5	3.6	0.8	3.0	5.4
Duncan to Cowichan	181	23	33	5	5	10.4	1.2	1.8	0.3	0.2
Cowichan to Youbou	170	14	6	1	0	17.7	1.3	0.7	0.1	0.0
Totals	4042	338	166	356	238	31.3	2.4	1.3	2.7	0.57

Coniferous Sawflies, Neodiprion spp.

Neodiprion spp. larvae continued to be common throughout the District in 1966. Of 349 collections taken during the larval period, 71 were positive averaging 10.4 larvae each.

A small spot infestation occurred in the upper Blakeney Creek drainage (D. D. 002). Many colonies of larvae were feeding on regeneration hemlock. A check of this area in December did not reveal any extensive defoliation.

Sap-sucking Insects

Balsam Woolly Aphid, Adelges piceae (Ratz.)

Intensive surveys were carried out on Vancouver Island in 1966 to obtain further information on the distribution of the balsam woolly aphid. Most of this work was done by B. C. Forest Service crews under advice of the Survey. There were two major changes in the situation. In July the aphid was found on amabilis fir in the area west of Deerholme. (Previously it was hoped that the infestation was confined to the low elevation grand fir which would have made control measures more feasible.) In January 1967, the aphid was found on amabilis fir in the Valentine Mountain area of Sooke, increasing the known area of infestation by many square miles.

A number of imported predacious insects were released at Thetis Lake, near Victoria, in 1965 and 1966, but these releases have not yet been assessed. A program of studies is planned for 1967. Intensive surveys were carried out at Thetis Lake and near Duncan. A number of plots were established to study infestation trends over the next few years.

Terminal borers

European Pine Shoot Moth, Rhyacionia buoliana Schiff.

The European pine shoot moth was again the subject of intensive surveys on Vancouver Island and other parts of British Columbia.[1] The insect was found at Sidney, Wellington, and Victoria. All occurrences were on nursery and ornamental stock. There were no records in native pine stands.

1/ Holms, J. C., C. A. Gibson, G. W. Miller and J. W. E. Harris, 1966. European pine shoot moth survey, south coastal British Columbia. Dep. For. & Rural Dev. Can., For. Res. Lab., Victoria, B. C. Info. Rep. BC-X-8. 4p.

Other Noteworthy Insects

Table 8

Other Insects of Current Minor Significance

Insect	Hosts	Locality	Remarks
Acleris variana (Fern.) Black-headed budworm	wH, D, wC, gF, aF, sS, lP	All drainages	Defoliator, 5.6% of 196 collections, averaged 1.9 larvae each. Slight increase from 1965.
Choristoneura fumiferana (Clem.) Spruce budworm	wH, D, gF, lP	Drainages 001, 002, 004	Defoliator, increase from 1965. 10% of 75 collections, averaged 1.6 larvae each.
Ectropis crepuscularia (Schiff.) Saddle-backed looper	wH, wC, sS	Drainages 002, 003, 004, 005	Defoliator, scattered small numbers. Sixteen positive collections averaged 4.2 larvae each. Increase from 1965.
Lambdina fiscellaria lugubrosa (Hulst) Western hemlock looper	wH	D. D. 002	Defoliator, one collection contained 3 larvae.
Lecanium coryli Linn. A scale insect	sPo	Victoria, Port Alberni	A sucking insect, no sign at Crofton and Cowichan rivers where previously numerous.
Malacosoma spp. Tent caterpillars	Deciduous	General	Defoliators, very scarce in 1966.
Mindarus abietinus Roch A balsam twig aphid	aF, gF	All drainages	Sucking insects, heavy feeding evidenced by profusion of "honeydew" on ground cover. No apparent damage.
Nyctobia limitaria (Wlk.) Green balsam looper	D, gF, wH, wC, aF	All drainages	Defoliator, 51 positive collections averaged 1.6 larvae each. Increase from 1965.

FOREST DISEASE CONDITIONS

Currently Important Diseases

Foliage Diseases

Dothistroma Needle Blight, Scirrhia pini Funk and Parker.

This needle cast fungus, previously recorded under the same of the imperfect state, Dothistroma pini Hulbary, continued to severely defoliate exotic pine species in plantations. Mortality continued. Results of annual examinations are shown in Table 9.

Table 9

Per Cent Defoliation and Tree Mortality

Caused by Dothistroma Needle Blight in Plots in Exotic Plantations

In South Vancouver Island District

Host	Plantation number	Average % foliage loss				No. of living trees			
		1963	1964	1965	1966	1963	1964	1965	1966
Monterey pine	112	61.2	99.0	100.0	—	50	14	0	—
	151	44.0	78.0	84.0	—	46	43	6	6
	158	72.0	92.1	100.0	—	50	36	0	—
	175	3.3	8.7	45.2	—	50	50	50	—
	177	8.6	16.6	55.1	54.2	50	47	39	37
	178	9.8	8.6	37.3	43.4	50	50	45	45
	189	63.2	86.7	91.5	95.0	47	29	4	2
	190	49.0	68.0	86.6	100.0	50	50	13	0
Bishop pine	112	28.9	59.3	70.0	54.7	50	46	35	33
	151	1.3	9.6	11.6	51.6	50	50	49	6
	158	0	18.9	47.3	52.3	47	46	46	44
	175	0	3.0	6.0	—	50	50	50	—
	177	2.0	10.5	25.1	29.5	50	50	49	46
	178	0	4.8	14.1	24.3	50	50	49	45
Cluster pine	75	—	—	—	0	—	—	—	15
	112	0	11.7	20.9	21.7	50	(46)	36	33
	151	—	—	—	31.2	—	—	—	50
	158	0	±50.0	50.0	49.8	50	50	±38	25
	155	—	—	0	0	—	—	(5)	(3)
	175	—	—	—	—	—	—	50	—
	176	—	—	5	0	—	—	50	50
	177	—	—	5	9.0	—	—	50	50
	178	—	—	—	2.6	—	—	—	26
	189	—	—	50.0	1.2	—	—	50	50
	194	—	—	—	0	—	—	—	50
	195	—	—	—	—	—	—	—	25

Exotic Plantations

Exotic plantations were examined again in 1966. With the exception of the plantations infected by Scirrhia pini, described earlier in this report, the only significant damage was from snow press. It is doubtful that many of these species will ever recover from the repeated bending and breakage which they have suffered. Results of the 1966 examinations are shown in Table 10.

Table 10

Exotic Plantation Examinations, 1966

XP Number	Location	Exotic species	Remarks
28B	Robertson River	Larix decidua	This species formerly recorded as L. europaea. No problems.
28C	Robertson River	Larix decidua	Minor sapsucker damage.
29	Robertson River	Picea glauca	96% surviving. Many snow-pressed.
30	Sutton Creek	Pinus sylvestris	Snow press, otherwise steady growth.
32	Sutton Creek	Pinus resinosa	Continues badly snow pressed.
53	San Juan River	Chamaecyparis lawsoniana	Strong competition from more vigorously growing native species.
Several	Various	Pinus radiata Pinus muricata Pinus pinaster	Details given in preceding table.
112	Kennedy River	Pinus muricata	Light infection (18.2% incidence) Cronartium comptoniae Arth.
		Pinus pinaster	An infection of Peridermuium harknessii J. P. Moore recorded.
158	Kennedy Lake	Pinus pinaster	" " "

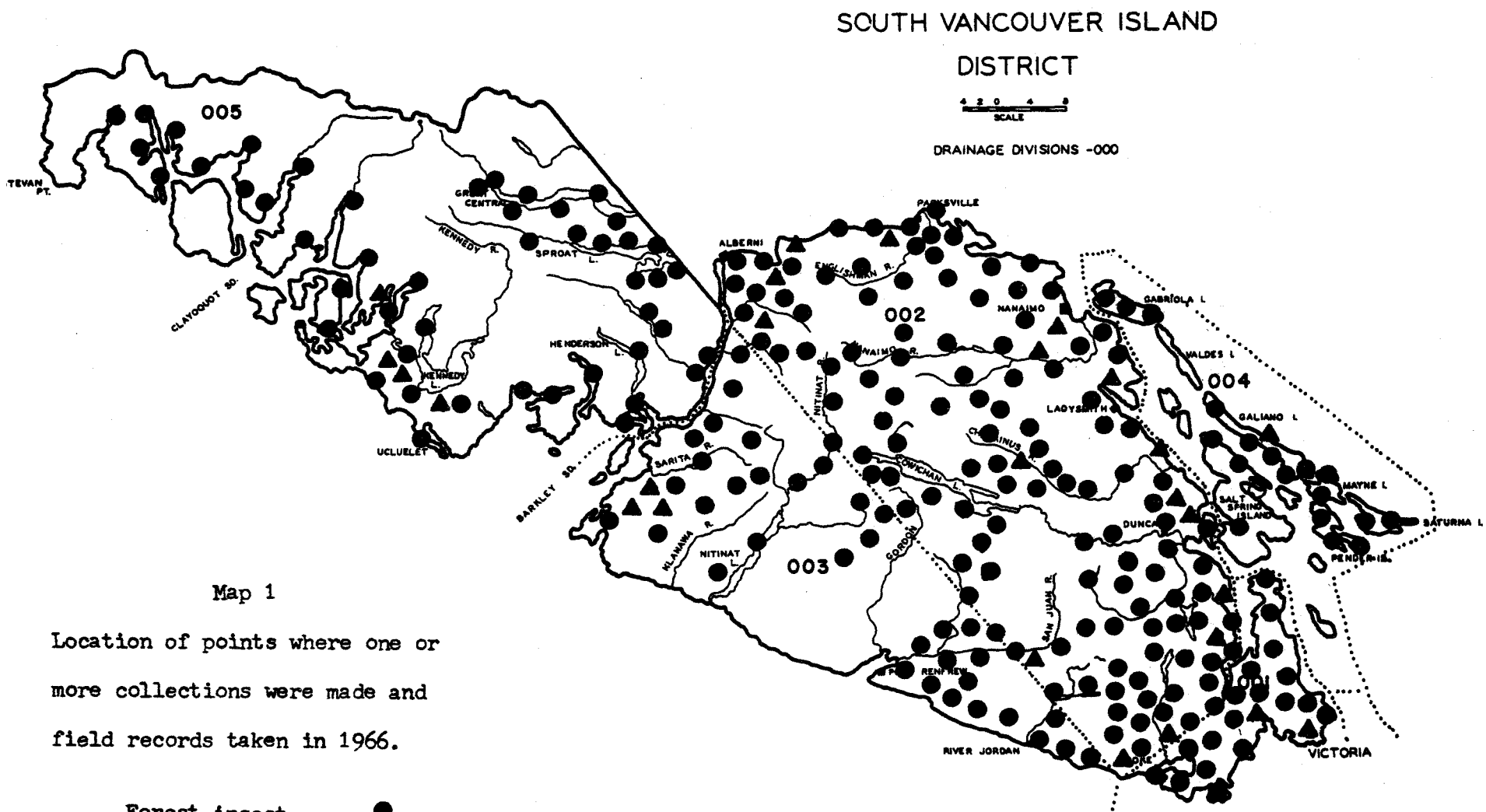
Other Noteworthy Diseases

Table 10

Other Diseases of Current Minor Significance

Organism and disease	Hosts	Locality	Remarks
Hendersonia pinicola Wehm. A needle cast fungus	1P	Sooke, Errington	A mildly beneficial fungus which inhibits fruiting of the virulent Hypodermella concolor, (below)
Hypodermella ampla (J. J. Davis) Dearn. Needle cast fungus	1P	Sooke, Alberni	A severe parasite which can cause loss of all old foliage. Previously only recorded on Pinus banksiana.
Hypodermella concolor (Dearn.) Darker Needle cast fungus	1P	Sooke, Errington	A serious needle cast. Foliage retention may be reduced from 8 years to 1 year.
Hypodermella montivaga (Petr.) Dearn. Needle cast fungus	1P	Sooke	Damage potential of this fungus as yet undetermined.

Note: The above needle cast fungi are found in association on lodgepole pine in several locations on S. Vancouver Island. While it is not possible to identify these causal agents in the field, it is reasonable to ascribe heavy defoliation to them.

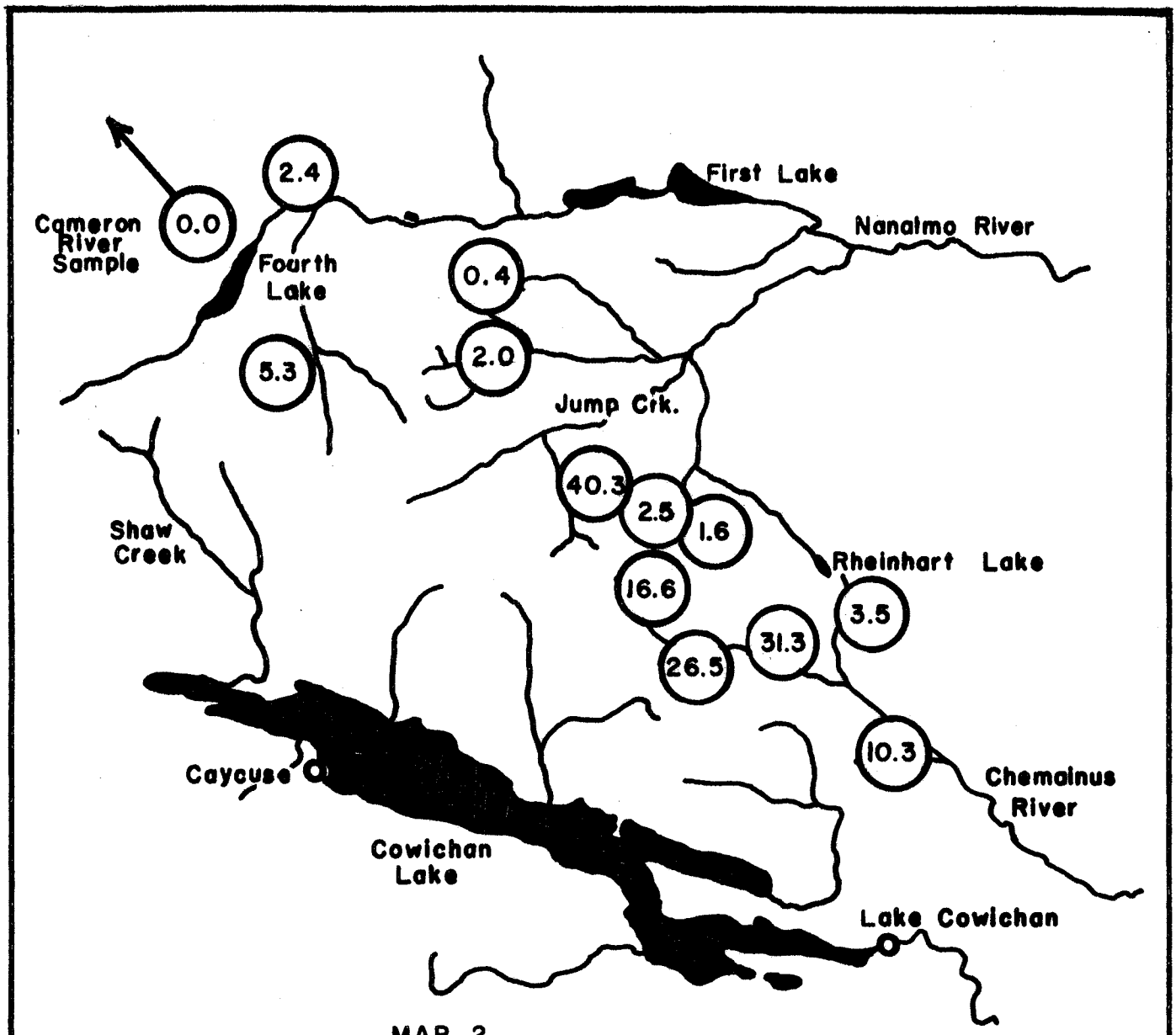


Map 1

Location of points where one or more collections were made and field records taken in 1966.

Forest insect ●

Forest disease ▲



MAP 2

LOCATION OF PINE BUTTERFLY EGG SAMPLES
SOUTH VANCOUVER ISLAND DISTRICT
1966

Eggs per sq. ft. foliage (1.0)

Figure 1. Pine butterfly adult, Neophasia menapia (F. & F.), (X 2). Flight period August to October. E. J. Chatelle

Figure 2. Pine butterfly egg masses (X 3) on Douglas-fir needles. South Vancouver Island District, October 1966. A. Craigmyle

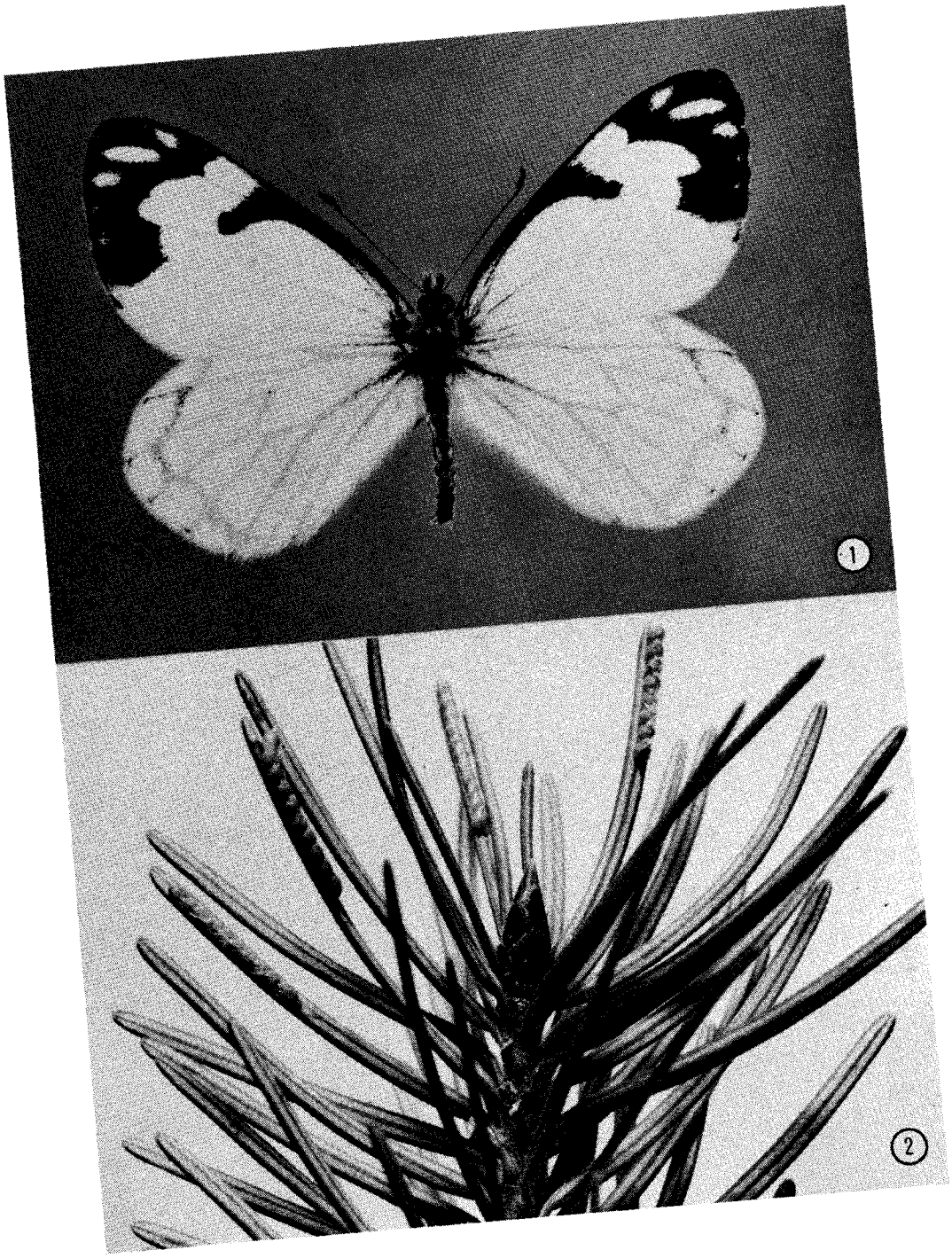

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Figure 3. Shoot damage caused by Zeiraphera sp. on Sitka spruce (X 4), Port Renfrew. South Vancouver Island District, 1966. N. Alexander

FOREST INSECT AND DISEASE SURVEY

NORTH VANCOUVER ISLAND DISTRICT

1966

FOREST INSECT AND DISEASE SURVEY

NORTH VANCOUVER ISLAND DISTRICT

1966

R. Murfitt[1/]

INTRODUCTION

Regular field work in the District began on May 27th and ended on August 31st. There was one special survey within the District, for a hemlock needle miner, Epinotia sp. Most of the work associated with this outbreak in the Quatsino Sound area was handled by a Survey appraisal crew. The writer spent one week assisting in an egg survey of this insect. A summary of the outbreak will be found in the text of this report.

Insect and disease collections made in the District are shown by host in Table 1; collection localities and Drainage Divisions are shown on Map 1. The principal problems are shown by Drainage Division in Table 2. Details on individual insect and disease problems follow this Introduction.

Numbers of larval defoliators found in field collections, excluding hand-picked samples, increased slightly this year; 68.0% of beating collections contained larvae in 1966 compared with 64.1% in 1965 and 50.7% in 1964.

1/ Forest Research Technician, Forest Insect and Disease Survey Ranger, Victoria.

Table 1

Collections by Hosts

North Vancouver Island District, 1966

Coniferous hosts	Forest insects	Forest diseases	Broad-leaved hosts	Forest insects	Forest diseases
Cedar, western red	24	1	Alder species	1	-
Douglas-fir	113	10	Alder, red	9	2
Fir species	2	1	Aspen, trembling	1	-
Fir, alpine	1	-	Cherry, bitter	1	-
Fir, amabilis	45	3	Dogwood, western	1	-
Fir, grand	9	1	Maple, broad leaf	-	1
Hemlock, western	190	8	Maple, Douglas	1	-
Hemlock, mountain	6	-	Oak, Garry	1	-
Pine species	1	8	Poplar species	3	2
Pine, Austrian	1	2	Poplar, Lombardy	1	2
Pine, lodgepole	11	4	Poplar, silver	1	1
Pine, Scots	1	-	Willow species	4	1
Pine, shore	1	-	Miscellaneous	2	2
Pine, western white	5	1	No host	6	-
Spruce species	1	1			
Spruce, Colorado	1	1			
Spruce, Engelmann	1	-			
Spruce, Sitka	22	1			
Totals	435	42	Totals	32	11
			GRAND TOTALS	467	53

Table 2

Currently Important Insect and Disease[1] Problems by Drainage Divisions

North Vancouver Island District, 1966

Insect and disease problems	Principal hosts[2]	Importance by drainage divisions[3]					
		021	022	023	024	025	026
DEFOLIATORS							
A hemlock needle miner	wH	0	0	0	0	5	0
Pine butterfly	D	0	3	0	3	0	0
Green-striped forest looper	D, wH, aF	3	3	3	3	3	3
A white-striped forest looper	wH, aF	1	1	1	1	5	1
Pacific willow leaf beetle	W	5	5	1	1	1	1
WEATHER DAMAGE							
Frost damage to Douglas-fir	D	5	5	0	0	0	0

1/ Includes only weather-induced and foliage diseases subject to notable annual fluctuation.

2/ Refer to host code in Forest District Introduction.

3/ High population and/or widespread outbreak in progress - 5.
Scattered high populations and/or significant damage in restricted areas - 4.
Rising population and/or moderate numbers of insects and/or potential problem - 3.
Static or falling population and/or moderate numbers and/or no problem at present - 2.
Endemic population and/or no significant damage - 1.
Not sampled and/or no host and/or not found - 0.

FOREST INSECT CONDITIONS

Currently Important Insects

Defoliators

A Hemlock Needle Miner, Epinotia sp.

An infestation of a previously unknown needle miner, Epinotia sp., on western hemlock, Tsuga heterophylla (Raf.) Sarg., was first observed on northern Vancouver Island in May 1965. Surveys subsequently disclosed appreciable defoliation around the western end of Holberg Inlet and south of Quatsino Sound in the Buck Creek and Keith River drainages.

Development of the insect varied considerably at different locations. In general, however, eggs hatched in August and September, and larvae fed within the needles through winter and completed development by April or May. Cocoons occurred from April to July; adults emerged and laid eggs in July and August.

Egg samples taken in 1965 suggested that the infestation would continue and extensive needle mining was found subsequently on branch samples sent to Victoria by personnel of Rayonier (Canada) Ltd. later in the fall.

A more detailed appraisal of the problem was undertaken in 1966. The first ground surveys were initiated in February. In mid-May, both infestations were mapped using a fixed-wing aircraft to determine the extent of the infestation and a helicopter for more detailed observations. In late May and June, ground strips and plots were established to determine the intensity of defoliation and its impact on the trees. An egg survey was completed in the first week of August. Two 18-inch branch tips were removed from the top, mid and lower crown levels of each of 3 trees felled at 38 sample points.

In February, many trees were found heavily defoliated due to the 1964-65 feeding and current needle mining. At Holberg, trees in 15 of 51 plots were more than 50% defoliated with a high of 76%. In the Buck Creek area, trees in four of eight plots were more than 50% defoliated. Average defoliation was 58% with a high of 72%.

In the aerial survey in May, defoliation in the Buck Creek infestation was estimated to cover 26,300 acres, of which 11,900 were classed as heavy, 7,900 acres as medium and 6,500 acres as light. At Holberg, defoliation was less extensive than anticipated, with 3,200 acres classed as heavy, 9,000 as medium and 8,900 as light, for a total of 21,100 acres.

In June, defoliation was heaviest on the overstory trees and was usually most severe on the top one-third of the crowns. One exception was on the Stranby River, northwest of Holberg, where defoliation was heaviest on the lower third of the crown and became progressively lighter towards the top. Average defoliation by crown level and crown class on 12 strips in June 1966 is shown in Table 3.

Table 3

Average Defoliation by Crown Level of Western Hemlock on 12 Strips

North Vancouver Island, June 1966

Crown Class	% Defoliation by Crown Level		
	Upper	Mid	Lower
Dominant	57	53	42
Co-dominant	55	50	41
Intermediate	47	43	34
Suppressed	31	28	25

Defoliation by % classification of all hemlocks tallied on the 12 strips was as follows:

% Defoliation	Number Trees	% of Total
80+	19	3
21-79	563	91
1-20	35	6

Egg populations at Holberg in 1965 ranged from an average low of 34 to a high of 82 eggs per sample. In 1966, there was an overall average of 3.7 eggs per 18-inch branch sample; the three highest sample points averaged 16.4, 12.6 and 9.4 per sample or 20, 15 and 11%, respectively, of the 1965 high.[1/] At Buck Creek, egg samples in August from 15 trees averaged 1.07 eggs per 18 inch branch, with a maximum of 10 eggs from one branch. Based on the above information in relation to the amount of defoliation which resulted in 1965, mining in 1966-67 was predicted to be light and a planned control operation was cancelled.

The major change in the infestation over that of 1965 occurred in the Buck Creek area. Defoliation spread southwest towards Lawn Point and east into the Mahatta River Valley (Map 2) but egg samples did not indicate a continuation of heavy feeding in this area of new infestation.

1/ Status of Hemlock Needle Miner, Holberg-Buck Creek Area and Recommendations Based on August 1966 Egg Survey, A. C. Molnar, August 15, 1966.

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

Pine butterfly populations remained relatively low in the District in 1966. Egg samples taken in 1965 from mature Douglas-fir in the Nimpkish Valley (D. D. 024) indicated there were sufficient eggs laid to maintain a population into 1966 with no serious threat to the trees. In 1966, ground checks were made during the larval period of this insect, particularly in the locations where 1965 egg counts were high. Larval feeding was light as evidenced by lack of frass fall and defoliation. Egg samples made in December 1966 by Canadian Forest Products Co. personnel at Vernon Lake, Nimpkish Mile 10 and Schoen Lake, were negative. At Nimpkish Branch 3 and Patway Road egg counts were low with an average of 2.1 and 1.3 eggs per sq. foot of foliage.

Counts of adults in flight were made in the Sayward Forest at White River, Branches F 100, 198 and 200, where butterfly flights were reported. The highest count of 30 adults per tree crown at Branch F 198 is considered below a dangerous level.

Green-striped Forest Looper, Melanolophia imitata Wlk.

There was a sharp increase in the number of samples containing this insect in 1966, although the numbers of insects per sample remained relatively low (Table 4).

Table 4

Summary of Green-striped Forest Looper Collections by Drainage Divisions

North Vancouver Island District

Drainage divisions	Number of samples taken during larval period			% samples containing larvae			Average number of larvae per positive sample		
	1964	1965	1966	1964	1965	1966	1964	1965	1966
021	77	70	107	2.6	10.0	12.0	1.0	2.4	3.1
022	72	48	60	0.0	27.0	15.0	-	5.2	2.9
023	63	73	58	4.8	23.2	46.0	2.7	2.0	3.5
024	35	41	41	0.0	12.2	17.0	-	1.0	3.4
025	48	53	58	0.0	3.8	36.0	-	2.3	2.6
026	8	7	5	0.0	28.6	100.0	-	2.3	3.9
Totals	303	292	329	1.6	15.7	24.9	2.0	2.9	3.3

A White-striped Forest Looper, Epirrita pulchraria Tayl.

A localized outbreak of this looper occurred in mature western hemlock and amabilis fir in the area of Kwokwesta Creek near Jeune Landing around 2,800 feet elevation. Samples taken from understory hemlock and amabilis fir contained 134 and 70 larvae, respectively. No defoliation of the mature trees was observed and no larvae were found in samples from reproduction in the area.

In the past, this insect was widely distributed and found usually in small numbers. Larvae normally appear in May and feed until late August. A foliage feeder, it is a potentially damaging insect.

Pacific Willow Leaf Beetle, Gallerucella carbo (Lec.)

The infestation of Pacific willow leaf beetle continued in D. D. 021 and D. D. 022 in a wide band from Kelsey Bay south to Parksville. The intensity of the infestation depended on the incidence of the preferred host, Salix spp. This tended to concentrate the defoliation in localized areas where willow was abundant. On many trees, 100% of the leaves were skeletonized. Reproduction alder, Alnus rubra Bong., within heavily infested willow stands was virtually untouched.

Other Noteworthy Insects

Silver-spotted Tiger Moth, Halisidota argentata Pack.

Populations of this insect increased slightly in the area surveyed (Parksville to Campbell River) during 1966. Following is a summary of web counts made since 1961:

Table 5

Roadside Web Counts of Silver-spotted Tiger Moth Colonies

North Vancouver Island District

Area surveyed	Year	Total number of webs recorded	Average number of webs recorded per mile
Parksville	1961	441	5.6
	1962	3,466	37.4
to	1963	87	1.0
	1964	32	0.4
Campbell River	1965	211	3.8
	1966	289	4.2

Table 6

Other Insects of Current Minor Significance

Insect	Hosts	Locality	Remarks
Acleris variana (Fern.) Black-headed budworm	D, wH	D.D. 021, 024, 025	Defoliator, 2.6% of 213 collections averaged 1.3 larvae.
Choristoneura fumiferana (Clem.) Spruce budworm	D	D.D. 021	Defoliator, 4.5% of 110 collections averaged 1.4 larvae.
Lambdina fiscellaria lugubrosa (Hulst) Western hemlock looper	D, wH	D.D. 021, 022, 023, 024	Defoliator, 3.4% of 294 collections averaged 1.4 larvae.
Nyctobia limitaria (Wlk.) Yellow-lined forest looper	D, wC, wH, mH, bF, gF	All drainages	Defoliator, 62 positive samples averaged 2.7 larvae each.
Neodiprion sp. Coniferous sawflies	Conifers	All drainages	Defoliator, 93 positive collections averaged 3.9 larvae each.

FOREST DISEASE CONDITIONS

Currently Important Diseases

Weather damage

Frost Damage on Douglas-fir.

A frost in late May damaged the current growth on regeneration in valley bottoms of D. D. 021 and D. D. 022. Spot checks were made in various areas and 100% of the trees had from 50% to 100% of the new shoots killed. Subsequent examinations of specific trees at the same locations in August showed from 10% to 25% recovery; in all cases only the lateral buds had flushed.

Foliage diseases

Dothistroma Needle Blight of Pine, Scirrhia pinii Funk and A. K. Parker.

This disease, the perfect state of Dothistroma pini Hulbary commonly found on native lodgepole pine, has caused severe mortality in exotic pine plantations on Vancouver Island. The infection continued in the various pine species in XP188 at the Arrowsmith Arboretum at Coombs. Of 109 pines examined in 1966, 95% were heavily infected and 3 were dead.

Stem diseases

Sweet Fern Blister Rust, Cronartium comptoniae Arth.

This disease has been prevalent on Pinus radiata in XP74 since 1961. Of 50 trees tagged in 1963, mortality occurred at the rate of 14% in 1964, 19% in 1965, and 42% in 1966. Four of 8 remaining live trees were infected in 1964 and 4 in 1965 and 1966.

Exotic Plantations

Three exotic plantations suffered heavy losses in the North Vancouver Island District. Populus regenerata at XP85 Gold River were destroyed by road construction. Pinus radiata, P. pinaster and Picea sitchensis at XP191, Ash River, were killed by unknown causes prior to examination. Pinus radiata at XP74 Ash River, which had been severely damaged by Sweet Fern Blister Rust Cronartium comptoniae Arth., was completely destroyed by unknown causes, perhaps following predisposition by the rust.

Table 7

Summary of Disease Conditions on Exotic Plantations

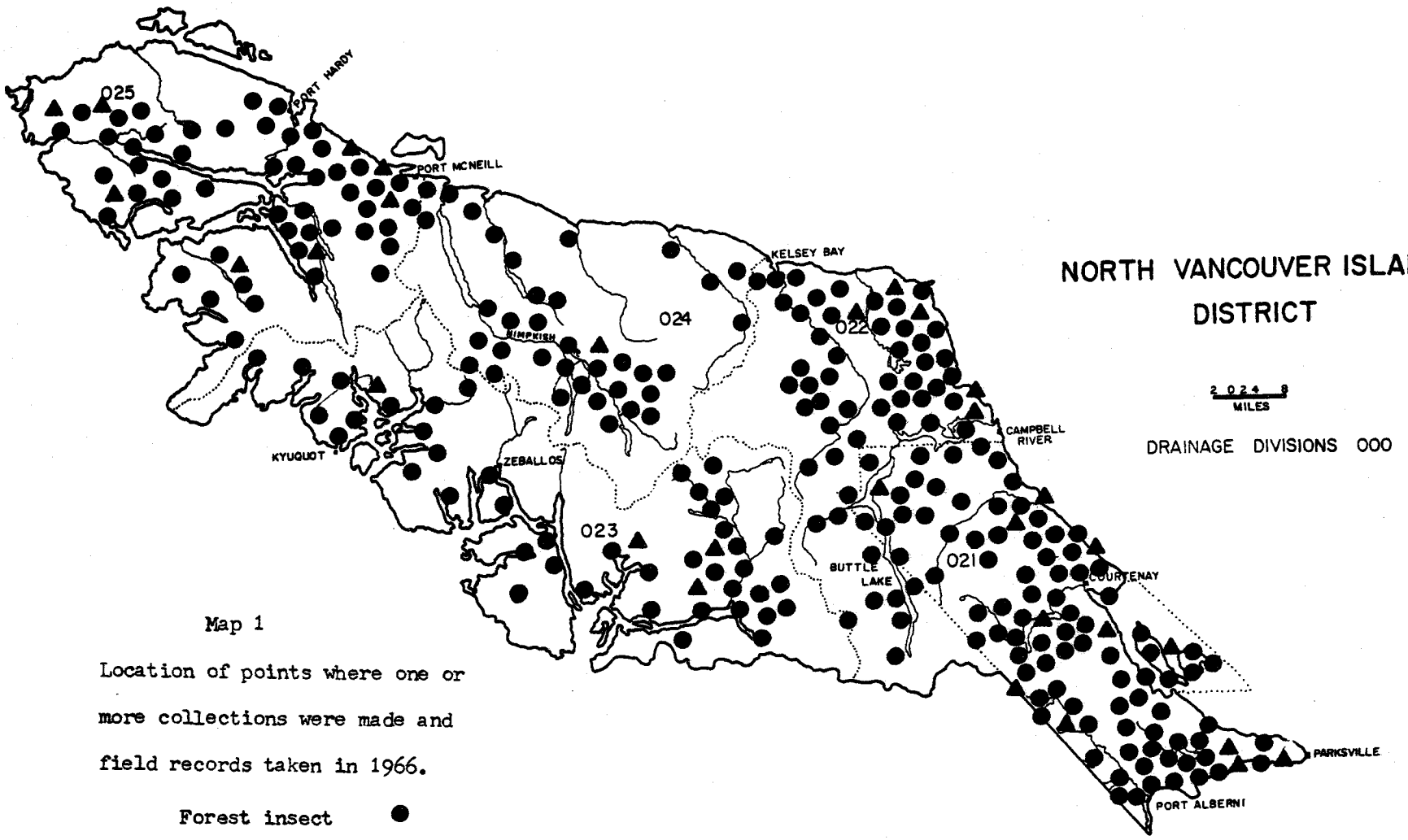
XP Number	Location	Exotic species	Remarks
13	Tsolum	Pinus sylvestris	The Adelges sp. infestation found in 1965 has disappeared.
17	Tsolum	Chamaecyparis lawsoniana	20% of trees broken by snow.
18A	Tsolum	Picea abies	No further incidence of bud necrosis. 30% of trees were infested by an Adelgid, 14% of the infested trees showed less than 10% twig galling.
18B	Tsolum	Pinus sylvestris	Numerous broken branches and tops.
57	Spirit Lake	Larix decidua	Appears thrifty.
74A	Ash River	Pinus radiata	See under Currently Important Diseases.
74B	Ash River	Pinus pinaster	Heavy snow damage.
83	Gold River	Larix decidua	Heavy snow press.
173	Quinsam Forest Nursery	Pinus spp.	All Pinus spp. have been removed by B.C.F.S.
188	Coombs	Pinus pinaster Pinus nigra V. poiretiana Pinus echinata X murrayana Pinus resinosa	Lophodermium pinastre (Schaad. ex. Fr.) Chev. A needle disease present on these hosts. Associated with foliage discolouration. Damage potential of this fungus undetermined.
191	Ash River	Pinus pinaster Pinus radiata Picea sitchensis	Only 12 badly broken trees remain of the pines. Spruce survival poor.

Other Noteworthy Diseases

Table 8

Other Diseases of Current Minor Significance

Organism and disease	Hosts	Locality	Remarks
Caliciopsis pseudotsugae Fitz. Branch canker	D	Sayward	100% of trees examined infected but damage negligible.
Didymascella thujina (Durrand) Maire Leaf blight	wC	Port McNeill	Light infection on regeneration.
Discocainia treleasei (Sacc.) J. Reid and Funk Branch cankers	wH	Mahatta River	Associated with twig dieback.
Erysiphales sp. Powdery mildew	bM	Parksville to Campbell River	90% of all leaves affected on most trees.
Hypodermella concolor (Dearn.) Darker Needle cast	lP	Muchalet Inlet and Sayward	Causes loss of all but the current foliage.
Lophodermium macrosporum (Hartig) Rehm. A European needle cast	sS	San Josef Bay	Only found on a single tree.
Peridermium harknessii J. P. Moore Gall rust	Hybrid pine	XP188 Coombs	Common on lodgepole pine. A new host record on this hybrid, *Pinus contorta* var. *murrayana* x*P. banksiana*.



NORTH VANCOUVER ISLAND DISTRICT

2 0 2 4 8 MILES

DRAINAGE DIVISIONS 000

Map 1

Location of points where one or more collections were made and field records taken in 1966.

Forest insect ●

Forest disease ▲

FOREST INSECT AND DISEASE SURVEY

BRITISH COLUMBIA

1966

VANCOUVER FOREST DISTRICT

MAINLAND SECTION

FOREST INSECT AND DISEASE SURVEY

BRITISH COLUMBIA

1966

VANCOUVER FOREST DISTRICT

MAINLAND SECTION

E. G. Harvey[1/]

There was one change of Forest Insect and Disease Survey personnel in the Mainland Section of the Vancouver Forest District. The writer remained in the South Vancouver District and A. K. Jardine was assigned to the North Vancouver District.

The balsam woolly aphid infestation remained the most important forest problem in the District, with the known boundaries of the infested area being extended considerably beyond those of 1965.

European pine shoot moth surveys were continued but there was no evidence of an increase over last year's infested area.

Black-headed budworm larvae showed a marked increase in numbers and were more widespread. Populations were nearing outbreak levels in some areas. Egg counts indicated this infestation may be on the increase.

The green-striped forest looper was found in numbers ranging close to outbreak levels throughout most of the coastal areas in the District.

There was a general increase in numbers of defoliating insects in the southern areas. No beetle problems were encountered in 1966.

No new tree disease problems showed up in the District during the past season.

1/ Forest Research Technician, Forest Insect & Disease Survey Senior Ranger, Victoria, B. C.

Host Tree Abbreviations

Abbreviations	Common Name
Al	Alder, red
tA	Aspen, trembling
bCo	Cottonwood, black
wCh	Chokecherry, western
wC	Cedar, western red
D	Douglas fir
wDo	Dogwood, western
F	Fir sp.
aF	Fir, amabalis
alF	Fir, alpine
gF	Fir, grand
mH	Hemlock, mountain
wH	Hemlock, western
J	Juniper sp.
L	Larch sp.
M	Maple sp.
vM	Maple, vine
P	Pine sp.
aP	Pine, Austrian
lP	Pine, lodgepole
mP	Pine, Mugho
pP	Pine, ponderosa
rP	Pine, red
scP	Pine, Scots
wwP	Pine, western white
Po	Poplar sp.
lPo	Poplar, Lombardy
S	Spruce sp.
sS	Spruce, Sitka
W	Willow

FOREST INSECT AND DISEASE SURVEY

SOUTH VANCOUVER DISTRICT

1966

FOREST INSECT AND DISEASE SURVEY

SOUTH VANCOUVER DISTRICT

1966

E. G. Harvey

INTRODUCTION

The Forest Insect and Disease Survey in this District started on May 19 and ended on August 29. After that date special egg sampling surveys were carried out, extending the field season into late October.

Special crews of British Columbia Forest Service and Department of Forestry personnel did an extensive and intensive survey of the District for balsam woolly aphid, and personnel of the Plant Protection Division of the Department of Agriculture co-operated with the Insect and Disease Survey in an intensive examination of pines for European pine shoot moth.

Totals of 557 insect and 28 tree disease collections were made during the season. These are shown by host in Table 1; collection localities are shown in Map 1. The principal problems in each Forest Insect and Disease Survey Drainage Division are shown in Table 2. These Drainage Divisions are shown in Map 1. Details on individual insect and disease problems follow this introduction.

Numbers of larval defoliators found in field collections increased markedly this year; 95% of beating collections contained larvae.

Table 1

Collections by Hosts

South Vancouver District, 1966

Coniferous hosts	Forest insects	Forest diseases	Broad-leaved hosts	Forest insects	Forest diseases
Cedar, western red	49	1	Alder, red	6	
Douglas-fir	127	4	Aspen, trembling	1	1
Fir, alpine	3	1	Beech	2	
Fir, amabilis	47	3	Birch	7	
Fir, grand	15	2	Chokecherry		1
Fir, species	3		Cottonwood, black	4	
Hemlock, mountain	4		Crab, Pacific	1	
Hemlock, western	148	3	Dogwood		2
Larch	1		Hazelnut	1	
Pine, Austrian	2		Holly, English	1	
Pine, lodgepole	43	3	Maple, vine	2	
Pine, mugho	15	1	Maple, species	1	
Pine, ponderosa	5		Poplar, Lombardy	1	
Pine, red	2	1	Poplar, species	2	
Pine, Scots	9	1	Willow, species	10	
Pine, western white	10	1	Miscellaneous	5	1
Pine, species	8		No host	10	
Spruce, Sitka	8				
Spruce, species	4	1			
Yew, western		1			
Totals	503	23	Totals	54	5
			GRAND TOTALS	557	28

Table 2

Currently Important Insect and Disease[1] Problems by Drainage Divisions

South Vancouver District, 1966

Insect and disease problems	Principal hosts[2]	Importance by drainage divisions[3]					
		040	041	042	043	044	045
DEFOLIATORS							
Black-headed budworm	wH, mH, D, aF, gF, wC, sS, lP	3	4	2	4	4	2
Green-striped forest looper	wH, wC, D, mH, gF, aF, wP, lP	3	2	4	3	2	2
Western hemlock looper	wH, D, wC, aF, gF	1	1	2	2	1	1
Spruce budworm	D, wH, aF, sS	1	2	1	1	1	2
Saddle-backed looper	wH, D, wC, aF, gF, wP	1	1	3	2	1	1
SUCKING INSECTS							
Balsam woolly aphid	aF, gF, F	5	0	5	1	0	1
TERMINAL BORERS							
European pine shoot moth	lP, -P, wP, pP	2	0	4	0	0	0

[1] Includes only weather-induced and foliage diseases subject to notable annual fluctuation.

[2] Refer to host code in Forest District Introduction.

[3] High population and/or widespread outbreak in progress -5.
Scattered high populations and/or significant damage in restricted areas -4.
Rising population and/or moderate numbers of insects and/or potential problem -3.
Static or falling population and/or moderate numbers of insects and/or no potential problem at present -2.
Endemic population and/or no significant damage -1.

FOREST INSECT CONDITIONS

Currently Important Insects

Defoliators

Black-headed Budworm, Acleris variana (Fern.)

Black-headed budworm populations increased markedly from the previous year (Table 3). Almost 50% of the collections taken from host trees during the larval period in Drainage Divisions 041, 043 and 044 were positive, averaging 25 larvae each (Map 2). An infestation occurred on a small area in the vicinity of the Hope Slide, on the Hope-Princeton Highway, in D.D. 041. More than 300 larvae per collection were taken there. Egg counts, taken in the fall, of up to 18.5 eggs per 10-inch twig, indicate there will be a large population in 1967. The results of egg sampling done in Drainages 041 and 044 are shown in Table 4.

Table 3

Summary of Black-headed Budworm Collections by Drainage Divisions, South Vancouver District, 1966

Drainage divisions	Number of samples taken during larval period			% samples containing larvae			Average number of larvae per positive sample		
	1964	1965	1966	1964	1965	1966	1964	1965	1966
040	11	9	18	0.0	33.3	38.9	—	1.7	6.0
041	41	22	24	12.2	13.6	75.0	8.3	5.3	26.3
042	76	86	95	1.3	12.8	30.5	1.0	17.4	7.3
043	40	27	38	0.0	0.0	36.8	—	—	25.6
044	65	32	44	15.4	9.4	40.9	2.3	2.3	23.9
045	56	60	60	3.6	6.6	11.7	1.0	1.5	8.7
Total	289	236	279	6.2	10.2	33.3	3.7	9.4	16.0

Table 4

Summary of Black-headed Budworm Egg Counts

South Vancouver District, September-October, 1966

Locality	Area	Number of eggs per 10" tip	Rating
Hope Slide	Mile 10	13.9	medium
	11 Mile Creek	11.3	medium
	Mile 11.5	18.5	heavy
	Mile 13	17.9	heavy
	Mile 14	9.7	medium
	Mt. Coulter at 4000'	1.9	light
Coquihalla River	Coquihalla	2.3	light
	Romeo	3.5	light
	Iago	4.4	light
	Boston Bar Creek	2.2	light
North Bend	Scuzzy Creek at 2100'	9.1	medium
	Scuzzy Creek at 3000'	4.0	light
Boston Bar	Stoyoma Creek at 3500'	2.0	light
	Spius Creek at 3200'	3.5	light

Green-striped Forest Looper, Melanolophia imitata Wlk.

The green-striped forest looper has shown a consistent increase in both incidence and number of larvae per collection for the past several years (Table 5). Collections of 20 to 100 larvae were taken from Harrison Lake to Squamish in 1966. The largest collection, 112 larvae, was made at Ruskin, in the center of the most heavily infested area. Smaller numbers of larvae were found throughout the District (Map 3).

One collection, from Britannia Beach, was infected with a virus disease. In past outbreaks viruses spread rapidly and quickly reduced the population. If the disease does not control the population there could be a widespread infestation on the lower mainland in 1967.

Table 5

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

Drainage divisions	Number of samples taken during larval period			% samples containing larvae			Average number of larvae per positive sample		
	1964	1965	1966	1964	1965	1966	1964	1965	1966
040	10	17	17	0.0	23.5	76.5	--	1.5	8.8
041	39	26	26	17.9	11.5	69.2	1.7	2.3	4.1
042	75	100	94	45.3	60.0	76.6	3.1	7.2	24.5
043	38	27	41	23.7	48.1	65.8	2.1	7.0	13.2
044	60	42	42	21.7	45.2	54.8	3.0	3.5	4.0
045	79	70	81	12.7	42.9	25.9	1.9	5.0	5.0
Totals	301	282	301	24.3	45.7	54.5	2.7	5.8	14.0

Western Hemlock Looper, Lambdina fiscellaria lugubrosa (Hulst)

Western hemlock looper populations have been at a low level for several years. In 1966 the percentage of collections containing larvae dropped from 21.8% to 16.9%, but the average number of larvae per collection increased from 2.5 to 4.9.

The largest collections, from Chehalis River, contained 33 and 18 larvae, from western hemlock and western red cedar respectively. Other significant collections were Nahatlatch River 16, Stave Lake 15, Rolley Lake 12, all from western hemlock, and at Pemberton 14 larvae were taken from Douglas-fir.

Spruce Budworm, Choristoneura fumiferana (Clem.)

Spruce budworm populations remained at a low level in 1966. Only 19.1% of the total collections taken from host trees during the larval period contained larvae, as compared to 31.6% in 1965, but the average number of larvae per collection increased from 2.6 to 4.2.

Most of the larvae were taken in three areas: Queens Park in New Westminster, D'Arcy, and Hope Municipal Park, where up to 16, 12 and 11 larvae were found, respectively, in collections.

Saddleback Looper, Ectropis crepuscularia (Schiff.)

The saddleback looper was found in 68 collections throughout the District. Preferred hosts were western hemlock, western red cedar and Douglas-fir, but they were found on nearly all hosts, including deciduous trees and underbrush.

The largest collections, up to 16 larvae, were taken on Grouse and Seymour Mountains. Such numbers do not appear to be significant but in the initial stages of a population increase this looper is usually more plentiful on the underbrush than on the trees. This fact, along with its high biotic potential, means an outbreak can occur very quickly, as happened at Kitimat in 1960.

Fall Webworm, Hyphantrea cunea (Drury)

The fall webworm infestation in the Fraser Valley, although still light, has shown a substantial increase in all areas (Table 6).

In the Boundary Bay area, where there was a heavy population in 1965, the numbers of colonies per mile decreased from 58.9 to 3.9.

Table 6

Fall Webworm Colonies in the Fraser Valley and Boundary Bay on Various Deciduous Hosts as Determined by Roadside Counts, South Vancouver District

Location	Miles travelled	No. of webs			Av. no. of webs per mile		
		1964	1965	1966	1964	1965	1966
Pierdonville, west	3.0	14	2	8	4.7	0.7	2.7
Pierdonville, east	3.0	2	5	14	0.7	1.7	4.7
Rosedale, north	2.8	1	1	6	0.4	0.4	2.1
Chilliwack, Camp Rd.	7.4	2	26	53	0.3	3.5	7.2
Cultus L., SE side	3.8	2	2	8	0.5	0.5	2.1
Yarrow, east	3.6	1	0	4	0.3	0.0	1.1
Boundary Bay	1.8	-1/	106	7	-	58.9	3.9

1/ No counts made.

Sucking Insects

Balsam Woolly Aphid, Adelges piceae (Ratz.)

The British Columbia Forest Service Protection Division, advised by the Forest Insect and Disease Survey, again undertook an extensive survey for this important pest of true firs. In 1965 the mainland infestation was known to include Salmon Inlet, Howe Sound, Burrard Inlet, Indian Arm and Coquitlam Lake drainages. Eastward extensions were discovered this year in the Pitt River drainage at Widgeon Creek and in the University of British Columbia Research Forest at Haney, at Langley, Agassiz and Popkum on the Lower Fraser River and at Tretheway Creek near the northern end of Harrison Lake.

Biological control was attempted in 1960 and 1963 when 17,653 specimens of five species of predaceous insects imported from Germany and Australia were released at Seymour Mountain. Studies since then showed that only one species, Laricobius ericsonii Rosen, has been successfully established. It has been found up to 2.4 miles from the release site.

A crew of students, employed by the British Columbia Forest Service and directed by a member of the Survey appraisal staff, established permanent plots and strips for intensive study of the aphid in infested areas. Aerial Ektrachrome and aerial infra-red Ektrachrome 70 mm photographs of some of the plots were taken with the co-operation of the B. C. Forest Service Surveys Division.

Terminal Borers

European Pine Shoot Moth, Rhyacionia buoliana Schiff.

The special survey of pine shoot moth was conducted in a similar manner to 1965. Personnel of the Forest Insect and Disease Survey appraisal crew and the District Ranger examined home gardens, municipal plantings and natural stands; Plant Protection Division personnel examined nurseries.

It was found that the infestation continues unabated in approximately the same areas as in 1965. Practically all exotic pines planted as ornamentals and native pines transplanted to urban locations seem to be vulnerable to attack. No native pines growing in natural stands were found to be infested. Heaviest attacks occurred in Greater Vancouver but infested trees were found as far east as Mission City and Yarrow. Of 37 nurseries visited on the Lower Mainland, infested trees were found in seven located in Richmond, Burnaby, Langley, Pitt Meadows, Sumas and Chilliwack municipalities. See the special report prepared in October, 1966.[1/]

1/ Holmes, J. C., C. A. Gibson, G. W. Miller and J. W. E. Harris, 1966. European Pine Shoot Moth Survey South Coastal British Columbia, 1966. Department of Forestry and Rural Development Information Report BC-X-8, For. Res. Lab. Victoria, 4 pp.

OTHER NOTEWORTHY INSECTS

Table 7

Other Insects of Current Minor Significance

Insect	Hosts	Locality	Remarks
Dendroctonus ponderosae Hopk. mountain pine beetle	wP, lP	Scuzzy Creek, Anderson R., Skagit R.	Bark beetle, no aerial survey in 1966, so estimates of current damage are not available.
Caripita d[illegible]ata Wlk. gray spruce looper	D, wH	Widespread	Foliage feeders found in late summer. Up to 20 per collection in Stanley Park. 17 collections.
Epirrita autumnata Gn. green velvet looper	wH, aF, alF, -P	Fraser Valley	Defoliator, populations low, decrease from 1965. 10 collections.
Epirrita pulchraria (Tayl.)	wH, D, aF, sS	Fraser Valley	Defoliator, low population, up to 6 larvae per collection at Boston Bar. 12 collections.
Gabriola dyari Tayl.	wH, D, wC	Widespread	Defoliator, slight increase over 1965, 17 collections.
Neodiprion species sawflies	wH, lP, D, aF, gF, alF	Widespread	Defoliator, average 12.5 larvae per collection, up to 300 at Britannia Mine and 100 at Boston Bar, 116 collections.
Nepytia phantasmaria (Stkr.) phantom hemlock looper	wH, D, wC, gF	Widespread	Defoliator, slight decrease from 1965, largest collections Hope Park (21), Central Park (12). 32 collections.
Nyctobia limitaria (Wlk.) green balsam looper	wH, D, wC, aF, gF, alF	Widespread	Defoliator, up to 24 larvae per collection at Whonnock. 64 collections.
Orgyia antiqua badia (Hy. Ed.) rusty tussock moth	wH, wC, gF, Al, huckle-berry	Vancouver	Defoliator, largest collections, up to 10 larvae, from Stanley Park. 14 collections.

Other Insects of Current Minor Significance - Continued

Insect	Hosts	Locality	Remarks
Stilpnotia salicis (L.) satin moth	Po	Vancouver	Defoliator of poplars, heavy defoliation throughout Vancouver.
Adelges nusslini C.B.	F	Burnaby	Sucking insect on bark, seven trees infested where only one found in 1965.
Aspidiosis britannicus Newst.	Holly	Chilliwack	Scale insect on leaves, twigs and branches, causing heavy defoliation to 24 trees.
Neomyzaphis abietina Wlk. spruce aphid	sS	Fraser Delta	Sucking insect on spruce needles. Trees throughout region heavily defoliated, some mortality due to recurring attacks.
Pineus abietinus Underwood & Balch	aF,	Stave Lake	Sucking insect on bark of trees. Three infested trees found.

FOREST DISEASE CONDITIONS

Currently Important Diseases

Fume Damage

Fumes from a chemical plant on the beach at Squamish, which went into operation recently, are suspected of being the cause of considerable damage to a wide variety of plants. Lodgepole pine is the tree which has suffered most damage. A pine covered rocky hill just to the south-east of the plant appeared brown from the dead and dying needles on the trees.

Tip Wilt of Hemlock

Wilted tips from an unknown cause were common on western hemlock from Stave Lake and Chehalis River to Seymour River.

Exotic Plantations

Two of the exotic plantations examined in 1966 are in such poor condition that they could be considered a complete failure. One more is in poor condition at present but may recover. Others have suffered some loss or damage in the past. Damage and loss can be blamed on three main reasons:

1. Site - One plantation was planted beneath overstory trees and has been literally smothered out by native trees, bushes and bracken.

2. Snow - In some plantations the young trees grew vigorously but were bent over, and/or broken by heavy snow. Many of these could recover. One plantation with trees around eight inches dbh has suffered very severe breakage.

3. Deer browsing - Most pine plantations are suffering from the effects of deer browsing. Many small trees appear bunchy with multiple or no leaders.

Some plantations were not found, possibly because the small number of surviving trees were hidden among the native trees which have taken over.

Table 8

Exotic Plantation Examinations, 1966

XP no.	Location	Exotic species	Remarks
43	Green Timbers	Scots pine	Bark beetles taken from one dying tree, identified only as Scolytidae. Trees mostly in very poor shape. Many broken by snow, or dead. Only 28% of total in fair shape.
45	Green Timbers	Red pine	All trees healthy and doing well. Five have developed multiple leaders.
77	Green Timbers	Red pine	It is unlikely this plantation will ever amount to anything, due to suppression; 25% of the trees are dead and the rest are in very poor condition.
99	Haney, U.B.C. Forest	Scots pine	Of 50 trees examined, 17 were in good condition. The remainder were suffering from browsing, past and recent, and snow damage, with some leaders missing and many multiple.

Exotic plantation Examinations, 1966 - Continued

XP no.	Location	Exotic species	Remarks
100	Haney, U.B.C. Forest	Norway spruce	All trees doing well, with good growth, but approximately 10% have many dead buds. No pathogen could be found.
103	Haney, U.B.C. Forest	Poplar hybrid (Regenerata)	Sixty-eight percent of trees in plot doing well. Others dead and down or missing. No disease found.
106	Haney, U.B.C. Forest	Red pine	One tree missing. All others alive and vigorous, but 10% are bent by snow.
162	Haney, U.B.C. Forest	Douglas-fir	Six trees missing out of 50. Seven trees lightly infected with Rhabdocline. Others all doing well.
164	Haney, U.B.C. Forest	Scots pine	Eighty percent of trees in plot are browsed and 15% are damaged and bent by snow.

OTHER NOTEWORTHY DISEASES

Table 9

Other Diseases of Current Minor Significance

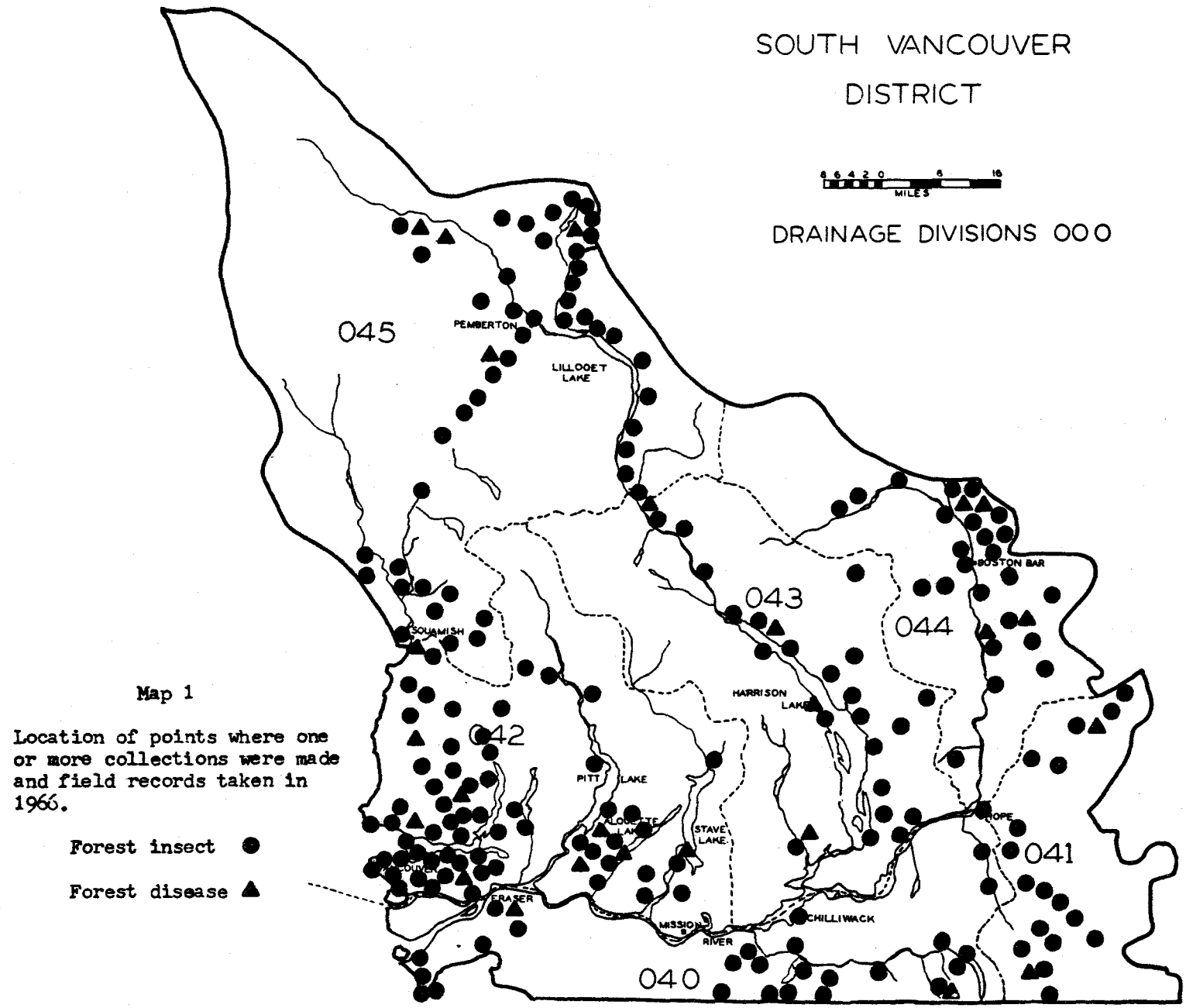
Organism and disease	Hosts	Locality	Remarks
Arceuthobium campylopodum Englm. f. tsugensis (Rosendahl) Gill, Dwarf mistletoe	wH	Alice Lake	Most trees in the area are heavily infected, resulting in poor form and heavy witches brooms.
Atropellis piniphila (Weir) Lohm. & Cash Twig die-back	lP	Port Douglas	Light infection on some trees.
Biatorella resinae (Fr.) Mudd, Canker	lP	Harrison Lake	Associated with twig die-back.

Other Diseases of Current Minor Significance - Continued

Organism and disease	Hosts	Locality	Remarks
Coryneum thujinum Dearn	wC	Pemberton	First Canadian record of this needle disease
Hypodermella ampla (J. J. Davis) Dearn Needle Cast	lP	East Delta	Defoliation noticeable in small area.
Hypodermella punctata Darker, Needle cast	aF	Stave Lake	Light infection common in area.
Lophodermium decorum Darker, Needle cast	gF	Boston Bar	Several regeneration trees in area affected.
Lophodermium nitens Darker, Needle cast	wP	Pemberton	Associated with flagging. Common on young trees in area.
Lophodermium pinastri (Schrad. ex Fr.) Chev. Needle cast	rP, scP	Green Timbers	Two new host records in exotic tree plantations.
Lophodermium uncinatum Darker, Needle cast	alF	Boston Bar	Associated with flagging at 3800' elevation.
Melampsora medusae Thuem., rust on leaves	tA	D'Arcy	Light infection over small area.
Melampsorella caryophyllacearum Schroet., rust broom	aF	Romeo	Broom caused by rust. Only one found.
Naematoloma sp.	aF	Squamish	Conks on cat-face of living tree. New host record.
Nectria fuckeliana Booth, Canker	aF	North Vancouver	Canker on balsam woolly aphid weakened tree, causing die-back.
Peridermium harknessii J. P. Moore, Gall-forming rust	mP	West Vancouver	Rust galls found on one small tree.
Pholiota destruens (Brand.) Quel. Mushroom	D	Devine	Found on old log. New host record for this fungus.
Sclerophoma pithyophila (Corda) Hoehn., Needle cast	lP	Harrison Lake	New host record for this needle disease.

Other Diseases of Current Minor Significance - Continued

Organism and disease	Hosts	Locality	Remarks
Taphrina populina Fr. Leaf spots	Po	Haney	Leaves heavily infected with this disease in exotic plantations.
Uredinopsis sp. Needle rust	aF	Mt. Slesse	All young trees in the area were heavily infected and had a brown appearance.

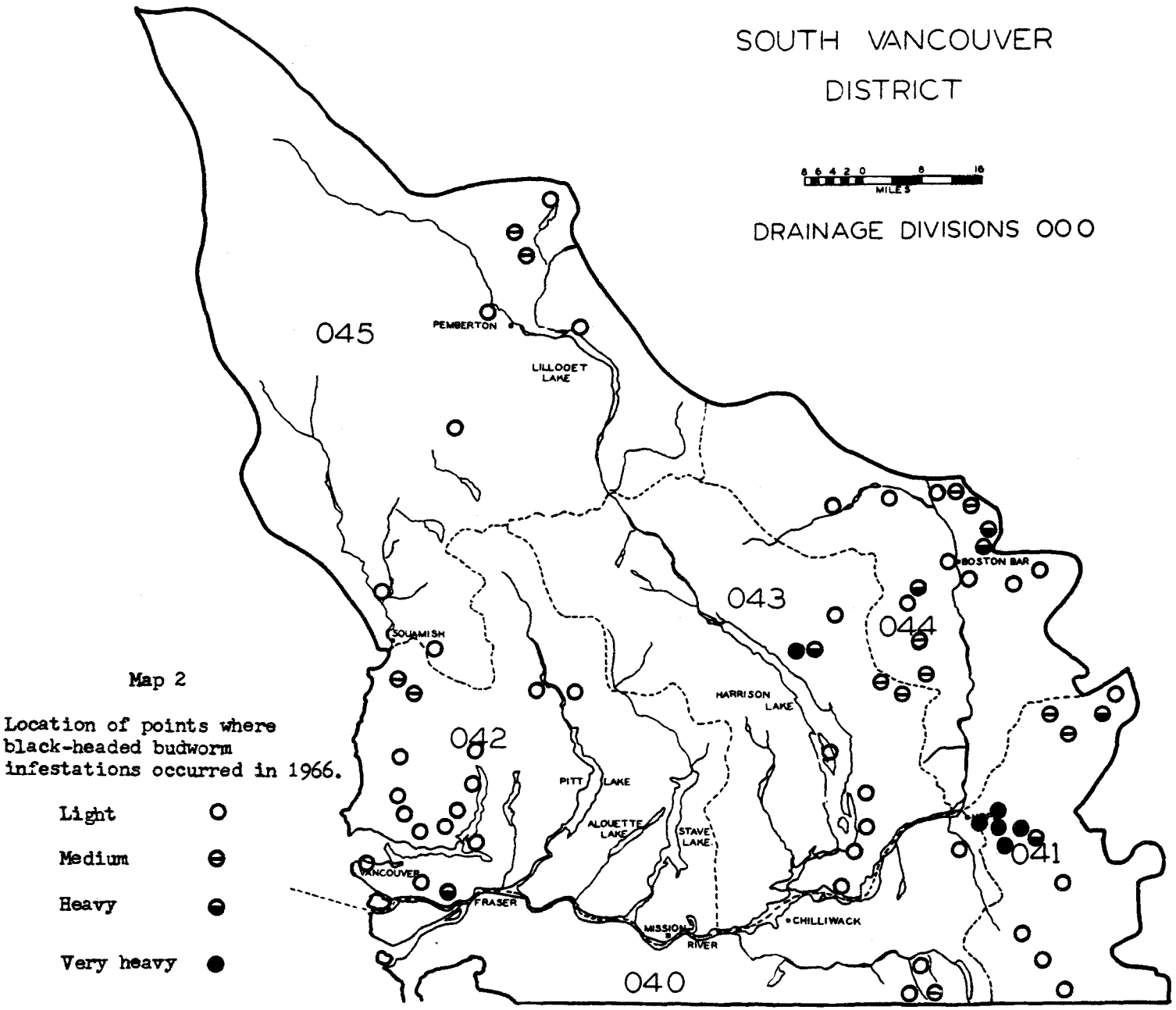


Map 1

Location of points where one or more collections were made and field records taken in 1966.

Forest insect ●

Forest disease ▲



Map 2

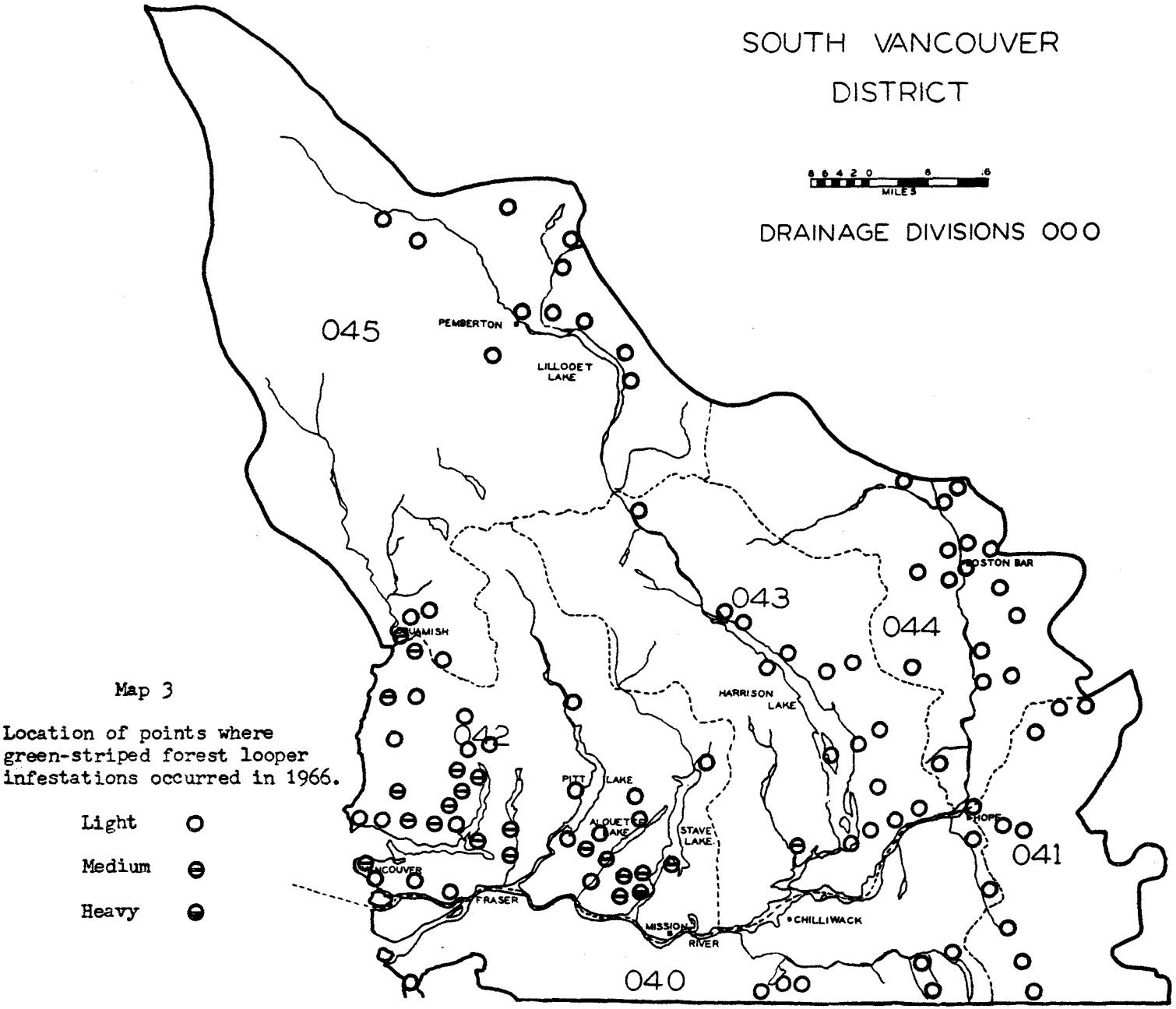
Location of points where black-headed budworm infestations occurred in 1966.

Light

Medium

Heavy

Very heavy



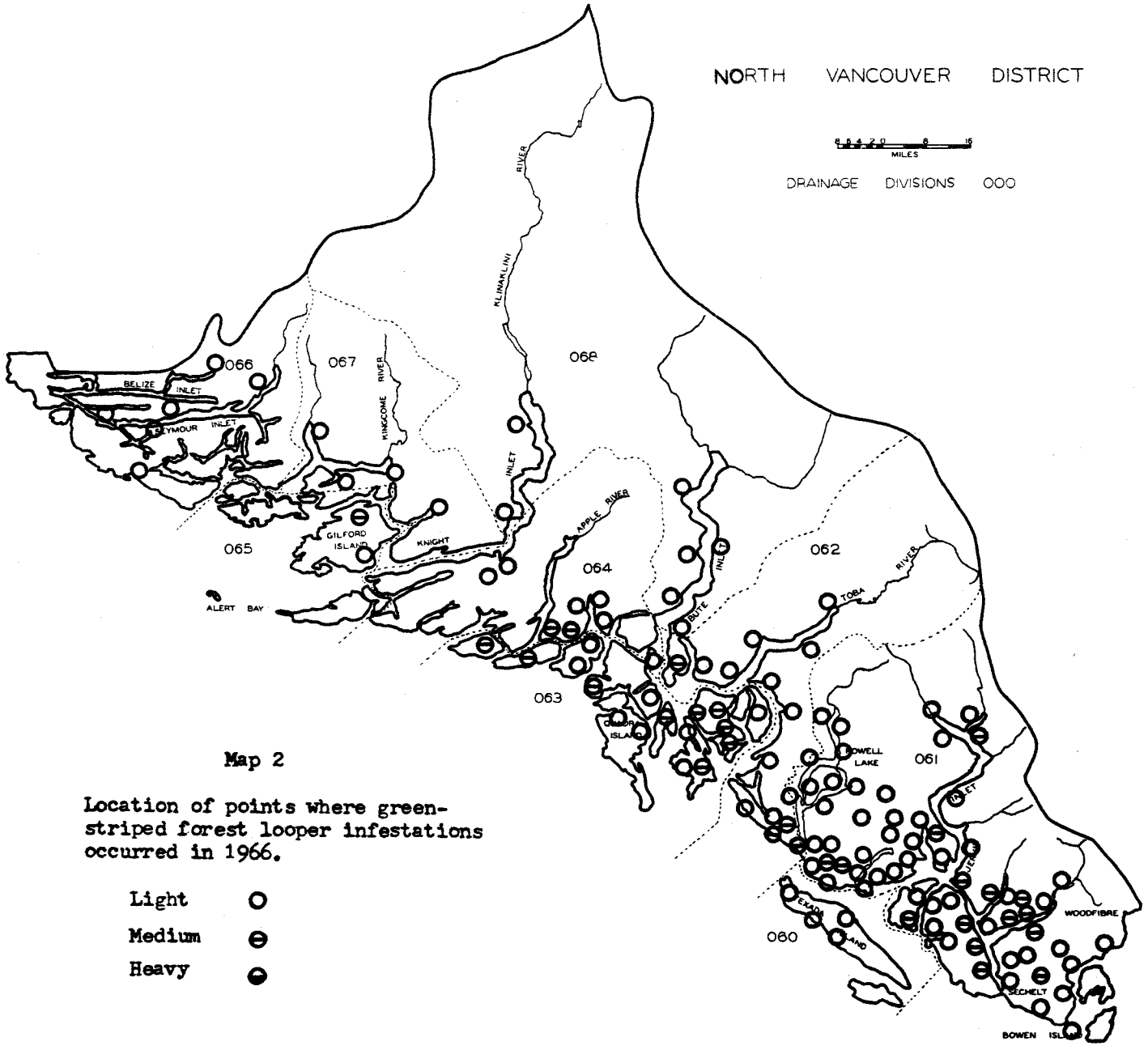
Map 3

Location of points where green-striped forest looper infestations occurred in 1966.

Light

Medium

Heavy



Map 2

Location of points where green-striped forest looper infestations occurred in 1966.

Light O

Medium ⊖

Heavy ◒

FOREST INSECT AND DISEASE SURVEY

NORTH VANCOUVER DISTRICT

1966

FOREST INSECT AND DISEASE SURVEY

NORTH VANCOUVER DISTRICT

1966

A. K. Jardin

INTRODUCTION

Field work in the North Vancouver District commenced on May 11 and terminated on August 25. The northern portion of the District was surveyed by aircraft with the assistance of E. G. Harvey, Senior Ranger for the Vancouver Forest District. Special work in connection with the balsam woolly aphid was carried out by crews of the British Columbia Forest Service under the direction of Department of Forestry personnel.

Totals of 549 insect and 24 tree disease collections were made during the field season. Collections are listed by hosts in Table 1. Map 1 shows the location of points where collections were made and information taken. The principal current problems for each Forest Insect and Disease Survey Drainage Division are shown in Table 2.

The population of several species of geometrids continued an upward trend, especially the green-striped forest looper which reached near infestation proportions at some locations. Larvae were found in 89% of the beating collections made in 1966.

A needle cast on lodgepole pine and an unidentified dieback of western hemlock were common at endemic levels throughout the range of the hosts in the southern portion of the District.

1/ Forest Research Technician, Forest Insect and Disease Survey, Victoria, B. C.

Table 1

Collections by Hosts

North Vancouver District, 1966

Coniferous hosts	Forest insects	Forest diseases	Broad-leaved hosts	Forest insects	Forest diseases
Cedar, western red	140	2	Alder, red	5	
Cedar, yellow	2		Chokecherry, western	1	
Douglas-fir	150	4	Dogwood	1	
Fir, amabilis	19	1	Maple, broadleaf	1	
Fir, grand	2	1	Miscellaneous	2	1
Fir, species	2		No host	14	
Hemlock, mountain	1				
Hemlock, western	166	8			
Hemlock, species	2				
Juniper, species	1	1			
Pine, lodgepole	21	5			
Pine, western white	7				
Spruce, Sitka	10				
Spruce, species	2				
Yew, western		1			
TOTALS	525	23	TOTALS	24	1
			GRAND TOTALS	549	24

Table 2

Currently Important Insect and Disease[1] Problems by Drainage Divisions, North Vancouver District, 1966.

Insect and disease problems	Principal hosts[2]	Importance by drainage divisions[3] 060	061	062	063	064	065	066	067	068
DEFOLIATORS										
Green-striped forest looper	wH, D, wC, aF, sS	2	4	3	3	3	3	3	3	3
Green balsam looper	wH, D, wC, aF	1	3	2	2	3	3	3	3	3
Saddleback looper	wC, wH, D, sS	1	2	1	1	1	1	3	1	1
Conifer sawflies	wH, aF	1	3	1	1	2	1	1	1	1
Black-headed budworm	aF, D, wH	1	1	1	1	1	1	1	1	1
Western hemlock looper	wH, D, wC	1	1	1	1	1	1	1	1	1
SUCKING INSECTS										
Balsam woolly aphid	aF, gF	0	5	0	0	0	0	0	0	0
FOLIAGE DISEASES										
Needle cast of lodgepole pine Hypodermella ampla (J. J. Davis) Dearn.	lp	0	3	3	0	0	0	0	0	0

1/ Includes only weather-induced foliage diseases subject to annual fluctuation.

2/ Refer to host code in Forest District Introduction.

3/ High population and/or wide spread outbreak in progress - 5. Scattered high populations and/or significant damage in restricted areas - 4. Rising population and/or moderate numbers and/or no potential problem at present -- 2. Endemic population and/or no significant damage - 1. Not sampled, no host, not found -- 0.

FOREST INSECT CONDITIONS

Currently Important Insects

Defoliators

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

There has been a gradual increase in the populations of the green-striped forest looper in the North Vancouver District for the past three years. During the 1966 season a sharp increase occurred throughout much of the District and approached damaging levels at some localities (Table 3). The number of collections containing larvae increased from 43.1% in 1965 to 65% in 1966. The largest collection, 81 larvae, was made on western hemlock at Redonda Bay on West Redonda Island. Slightly smaller samples of 72 and 60 larvae, respectively, were found on Douglas-fir at Misery Creek in Salmon Inlet and at Sliamon Lake north of Powell River (Map 2).

A virus disease and light parasitism appeared in last instar larvae, but neither was effective in reducing the 1966 population. If natural controls do not reduce the population there will likely be heavy feeding in some areas in 1967.

Table 3

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

Drainage divisions	Number of samples taken during larval period			% samples containing larvae			Average number of larvae per positive sample		
	1964	1965	1966	1964	1965	1966	1964	1965	1966
060	15	21	24	0	24.0	23.0	—	2.5	3.4
061	166	193	267	13.2	45.1	66.0	2.0	3.5	10.1
062	39	64	29	17.9	31.2	67.0	1.7	2.5	11.1
063	43	44	36	25.6	77.3	78.0	2.1	3.2	13.0
064	49	37	19	6.1	43.3	84.0	1.8	2.1	12.0
065	29	22	4	13.8	18.2	75.0	1.0	1.6	32.1
066	17	9	11	0	33.3	72.0	—	3.5	3.5
067	29	12	6	6.9	50.0	66.0	1.0	2.2	4.6
068	30	16	10	40.0	25.0	50.0	1.6	2.2	5.3
TOTAL	417	418	406	14.6	43.1	65.0	1.8	3.1	10.8

Green Balsam Looper, Nyctobia limitaria (Wlk.)

The population of this looper continued to increase in 1966 in most drainages (Table 4). The largest collection, 80 larvae, was made on western hemlock at Kwalate Bay in Knight Inlet.

Table 4

Summary of Green Balsam Looper Collections by Drainage Divisions, North Vancouver District

Drainage division	Number of samples taken during larval period			% samples containing larvae			Average number of larvae per positive sample		
	1964	1965	1966	1964	1965	1966	1964	1965	1966
060	0	0	0	1/	1/	1/	1/	1/	1/
061	131	178	124	7.6	17.4	53.2	1.7	1.5	2.1
062	24	26	21	16.7	34.6	23.7	1.0	1.6	3.5
063	43	37	48	28.0	56.8	41.6	1.5	3.1	2.7
064	52	38	17	21.2	44.7	94.1	1.9	2.4	4.5
065	39	23	2	2.6	17.4	100.0	2.0	1.5	2.5
066	19	19	11	15.8	0	72.7	1.0	1/	2.3
067	29	12	6	3.4	33.3	66.6	1.0	1.7	2.2
068	31	16	10	25.8	31.3	70.0	1.5	2.2	13.0
TOTAL	368	349	239	13.6	27.5	54.3	1.6	2.1	3.4

1/ Samples not taken.

Conifer Sawflies, Neodiprion spp.

Light feeding occurred in a localized area on regeneration western hemlock and amabilis fir in the Mahood logging operation east of Haslam Lake between 1400 and 2600 feet elevation. The largest samples taken in this area on hemlock contained 450 larvae. This number of sawfly larvae do not ordinarily cause serious defoliation.

Population increases occurred in a number of areas and significant collections from hemlock were taken in Frederick Arm, 100 larvae, Phillips Arm, two collections of 100 and 90 larvae, Princess Royal Reach, Jervis Inlet, 150 larvae, and Loughborough Inlet, 60 larvae. Elsewhere collections contained endemic numbers of larvae.

Black-headed Budworm, Acleris variana (Fern.)

There was an increase in the incidence of this insect in the North Vancouver District in 1966 but numbers remained consistently low:

Number of samples taken during larval period			% samples containing larvae			Average sample of larvae per positive sample		
1964	1965	1966	1964	1965	1966	1964	1965	1966
386	341	343	2.3	1.7	4.0	1.0	1.0	1.8

Western Hemlock Looper, Lambdina fiscellaria lugubrosa (Hulst)

A slight decrease was noted in the number of samples containing hemlock looper larvae in the District in 1966 but there was a slight increase in the average number of larvae per sample:

Number of samples taken during larval period			% samples containing larvae			Average sample of larvae per positive sample		
1964	1965	1966	1964	1965	1966	1964	1965	1966
412	353	423	10.4	11.3	9.2	1.3	1.6	2.1

Saddleback Looper, Ectropis crepuscularia (Schiff.)

There was a two-fold increase in both population and distribution of this looper in the North Vancouver District over 1965. A total of 113 collections averaged 2.1 larvae per sample.

SUCKING INSECTS

Balsam Woolly Aphid, Adelges piceae (Ratz.)

An intensive survey of balsam woolly aphid was carried out by special crews of the B. C. Forest Service. No new outbreaks were found and the boundary of the known infested area did not change from 1965.

OTHER NOTEWORTHY INSECTS

Table 5

Other Insects of Current Minor Significance

Insect	Hosts	Locality	Remarks
Caripeta divisata Wlk. Gray spruce looper	D, wH, aF, wC	Sechelt Peninsula, Powell River	Defoliator. Average 2.4 larvae per positive collection. Reduction in numbers and distribution from 1965.
Epinotia sp.	wH	Lund	Needle miner. Evidence of an endemic population in some areas.
Epirrita autumnata Gn. Green velvet looper	wH, D, aF, wC	Sechelt Peninsula, Texada Island	Defoliator, continuing low population.
Eupithecia unicolor Hulst Green cedar looper	wC, D, wH	Widespread	Defoliator. Increase in population and distribution. Average 1.4 larvae per positive collection.
Hyphantria cunea (Drury) Fall webworm	Al	Sechelt	Only one colony found.
Semiothisa sp.	wH, D, wC, lP	Powell River, Texada Island, Sechelt Peninsula	Defoliator. Decrease in distribution. Average 3.0 larvae per positive collection.

FOREST DISEASE CONDITIONS

Currently Important Diseases

FOLIAGE DISEASES

Needle Cast of Lodgepole Pine, Hypodermella ampla (J. J. Davis) Dearn.

Heavy infections of this disease were found in localized areas of young lodgepole pine in the vicinity of Saltery Bay, along the Chapman Creek road, near Porpoise Bay and at Lund on the Malaspina Peninsula. At each location one year old needles were infected causing them to die and drop, resulting in a considerable loss of foliage. The only damage to the trees should be a slight retardation of growth.

Needle Cast of Lodgepole Pine, Scirrhia pini Funk and A. K. Parker

A small area of young lodgepole pine along the Mahood logging road near Stillwater showed light to medium damage resulting from infection by this disease.

Douglas-fir Needle Cast, Rhabdocline pseudotsugae Syd.

A light infection of this disease was found on one year old needles of young Douglas-fir near Roberts Creek on the Sechelt Peninsula.

STEM DISEASES

An Unidentified Dieback of Hemlock

Widespread damage caused by an unidentified pathogen was found throughout the southern portion of the district on western hemlock of all ages in 1966. Approximately four to six inches of branch tips were dying. The infection in most cases was limited to the lower crown.

Exotic Plantations

The North Vancouver District has only one exotic plantation, at Powell River. Heavy mortality has occurred among the various species of conifers and hardwoods over past years. Part of the mortality is due to fire and mechanical damage but the majority results from the inability of the trees to compete with the native species. Diseases encountered in 1966 are as follows.

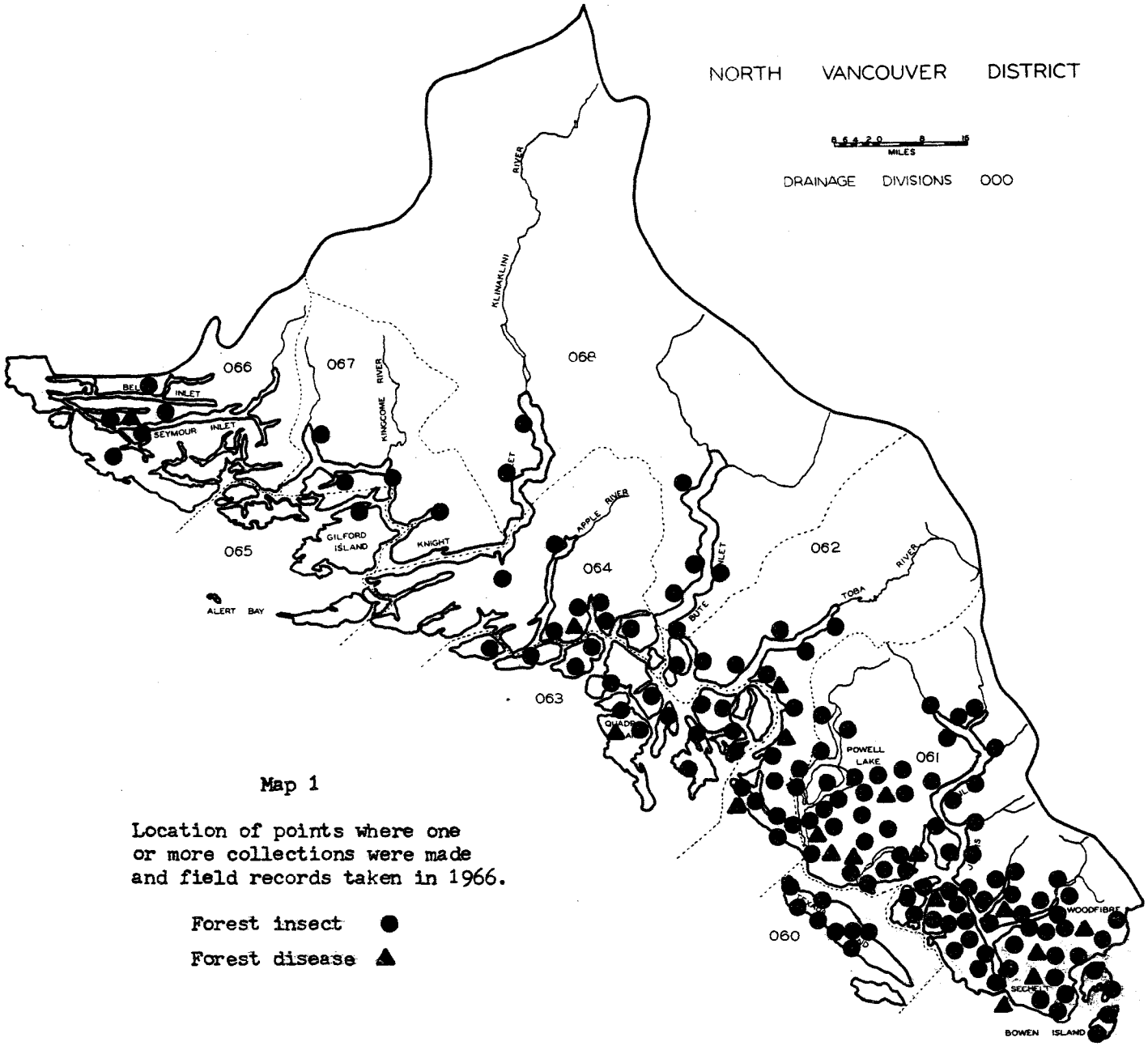
Number	Location	Exotic species	Remarks
12	Powell River	grand fir	Unidentified foliage rust caused heavy infection of several young trees (on current needles).
		black locust	A single infection of an unknown branch disease. Forwarded to Ottawa.

OTHER NOTEWORTHY DISEASES

Table 6

Other Diseases of Current Minor Significance

Organism and disease	Host	Locality	Remarks
Asteridiella taxi (Sawada) Hansford	w Yew	Charlotte Bay D. D. 066	Needle blight causing heavy loss of foliage.
Dasyscyphus pseudotsugae Hahn.	D	Desolation Sound D. D. 062	Branch cankers resulting in dieback.
Lophodermium juniperinum (Fr.) de Not	ro J	Powell Lake D. D. 061	Needle blight causing heavy shedding of needles.
Sclerophoma sp.	D	Saltery Bay D. D. 061	Causing branch dieback on young trees.



Map 1

Location of points where one or more collections were made and field records taken in 1966.

Forest insect ●

Forest disease ▲

FOREST INSECT AND DISEASE SURVEY

BRITISH COLUMBIA

1966

PRINCE RUPERT FOREST DISTRICT

S. J. Allen[1/]

There was a complete changeover of personnel in the Prince Rupert District in 1966. S. J. Allen replaced D. H. Ruppel in West Prince Rupert District, J. S. Monts replaced A. K. Jardine in the East Prince Rupert District and M. Bedford took over the survey of the South Prince Rupert District.

Aircraft were used to assist in the detection survey of the South Prince Rupert District and inaccessible areas north of Prince Rupert and Queen Charlotte Islands.

East and West Prince Rupert rangers collaborated in aerial surveys, damage appraisal plot examinations and for the survey of Tweedsmuir Park lakes in early August.

Field headquarters of the East Prince Rupert District was moved from Babine Lake to a more central and convenient location on the Experimental Farm near Smithers.

Spruce beetle attacks were at a low level and balsam mortality decreased noticeably in 1966 in East Prince Rupert District although some activity was still evident.

Spruce tip moth attacks on Queen Charlotte Islands were very light in 1966.

Western hemlock mortality from an unknown cause was recorded on an area at Kleanza Creek near Terrace.

1/ Forest Research Technician, Forest Insect and Disease Survey, Senior Ranger, Victoria, B. C.

HOST TREE ABBREVIATIONS

Abbrev.	Common name
A or Po	aspen or poplar - general
tA	trembling aspen
b Co	black cottonwood
Al	alder
B	birch - general
wB	white birch
C	cedar - general
wC	western red cedar
yC	yellow cedar
	Douglas-fir

Abbrev.	Common name
F	fir - general
alF	alpine fir
aF	amabilis fir
H	hemlock - general
wH	western hemlock
mH	mountain hemlock
L	larch - general
-L	miscellaneous larch
P	pine - general
lP	lodgepole pine
sP	shore pine
whP	white bark pine
pP	ponderosa pine
-P	miscellaneous pines
S	spruce - general
wS	white spruce
sS	Sitka spruce
-S	miscellaneous spruce

FOREST INSECT AND DISEASE SURVEY

WEST PRINCE RUPERT DISTRICT

1966

FOREST INSECT AND DISEASE SURVEY

WEST PRINCE RUPERT DISTRICT

1966

S. J. Allen

INTRODUCTION

Survey work in the West Prince Rupert District commenced on June 7 after the new field station at Smithers was prepared for occupancy. There were no serious outbreaks of insects or diseases in the District in 1966 but appraisal of plots in recent outbreaks was continued.

Totals of 327 forest insect and 56 forest disease collections were taken during the season. Table 1 lists collections by host and Maps 1 and 2 show locations where collections were taken. Table 2 lists insect and disease problems.

Table 1

Collections by Hosts

West Prince Rupert District, 1966

Coniferous hosts	Forest insects	Forest diseases	Broad-leaved hosts	Forest insects	Forest diseases
Cedar, western red	17		Alder, mountain	1	
Douglas-fir	2	7	Alder, red	3	3
Fir, alpine	26	2	Alder, Sitka	1	
Fir, amabilis	23	4	Apple species	1	
Hemlock, mountain	4		Aspen, trembling		2
Hemlock, western	150	8	Birch, western white		2
Larch, European		2	Cottonwood, black	3	
Pine, lodgepole	5	1	Dogwood, redosier	1	
Pine, ponderosa		1	Poplar, miscellaneous	1	6
			Willow	1	1
Spruce, Sitka	71	6	No host	3	
Spruce, western white	10		Miscellaneous	3	11
Totals	308	31	Totals	18	25
			GRAND TOTALS	326	56

Defoliators

Green-striped Forest Looper, Melanolophia imitata Wlk.

Green-striped forest looper populations in the District remained at a low level in 1966 (Table 3). No larvae were found on the Queen Charlotte Islands. Seven study plots established on the Queen Charlotte Islands during the infestation of 1964 were examined for defoliation and top-kill during September, 1966 (Table 4). Top-kill and mortality were present in plot 1 and trees in the other six plots showed vigourous recovery in the form of new foliage growth.

Table 2

Currently Important Insect and Disease[1] Problems

by Drainage Divisions

West Prince Rupert District

1966

Insect and disease problems	Principal host(s)[2]	Importance by drainage divisions[3] 100	101	102	103	104	105	106
DEFOLIATORS								
Green-striped forest looper	wH, wC, D, sS, aF, alF	2	2	1	1	1	1	1
Western hemlock looper	wH, wC, sS, aF, alF, D	0	0	2	1	2	2	2
Black-headed budworm	wH, sS, aF, alF	1	2	2	1	1	2	2
FOLIAGE DISEASES								
Melampsora rusts on Douglas-fir XPs	D	0	0	0	0	4	0	0

[1] Includes only weather-induced and foliage diseases subject to notable annual fluctuation.

[2] Refer to host code in Forest District Introduction.

[3] High population and/or widespread outbreak in progress - 5
Scattered high population and/or significant damage in restricted areas - 4
Rising population and/or moderate numbers of insects and/or potential problem - 3
Static or falling population and/or no potential problem - 2
Endemic population and/or no significant damage - 1

Table 3

Summary of Green-striped Forest Looper Collections by Drainage Divisions, West Prince Rupert District

Drainage division	Number of samples taken during larval period			% samples containing larvae			Average number of larvae per positive sample		
	1964	1965	1966	1964	1965	1966	1964	1965	1966
100	27	24	31	3.7	0	0	1.0	-	-
101	31	42	31	29.0	0	0	133.7	-	-
102	14	9	13	64.3	11.1	15.4	3.0	1.0	1.0
103	7	20	26	0	0	0	-	-	-
104	5	12	13	0	0	7.7	-	-	1.0
105	8	9	9	37.5	22.2	11.1	1.7	1.0	1.0
106	43	15	45	7.0	6.7	2.2	1.7	3.5	1.0
Totals	135	131	168	18.5	3.1	3.0	49.6	1.6	1.0

Table 4

Ocular Estimate by Crown Classes, of Defoliation, Top-kill, and Mortality Caused by Green-striped Forest Looper, Queen Charlotte Islands

Plot	Crown class	Tree sp.	No. trees	Defoliation 1964	1965	1966	Top-killed '66 No.	Av.ft.	Dead/'66 insects	other
1	D	wC	34	98	91	33	5	8	18	0
Port Clements		wH	27	91	81	25	10	13	7	0
west end of	CD	wC	18	98	93	33	2	8	9	0
Lot 1828		wH	16	97	89	32	6	14	6	0
	I	wC	23	97	93	56	1	12	10	0
		wH	15	90	83	27	3	15	2	0
	S	wC	33	92	90	52	2	20	12	0
		wH	18	85	78	23	0	—	1	0
Totals			184	94	86	36	29	12	65	0
2	D	wH	15	60	44	2	0	—	0	0
Port Clements	CD	wC	1	63	63	0	0	—	0	0
Masset Road		wH	17	51	37	1	0	—	0	0
Lot 412	I	wH	12	39	25	3	0	—	0	0
	S	wC	4	46	33	0	0	—	0	0
		wH	7	43	30	5	0	—	0	0
Totals			56	50	36	2	0	—	0	0

Table 4 - Cont'd

Plot	Crown class	Tree sp.	No. trees	Defoliation 1964	1965	1966	Top-killed'66 No.	Av.ft.	Dead/'66 insects	other
3	D	wC	11	49	41	3	0	—	0	0
Port Clements		wH	7	57	52	23	2	12.5	0	0
Masset Road	CD	wC	2	55	50	0	0	—	0	0
Lot 424		wH	9	69	57	22	2	12	0	0
	I	wC	1	30	25	0	0	—	0	0
		wH	7	55	50	13	0	—	0	0
	S	wC	1	50	45	0	0	—	0	0
		wH	25	47	45	17	1	4	1	1
Totals			63	53	47	10	5	10.6	1	1
4	D	wC	4	37	21	0	0	—	0	0
Port Clements	CD	wC	5	57	42	7	0	—	0	0
Masset Road		wH	8	51	34	0	0	—	0	0
Lot 404	I	wC	4	42	35	6	0	—	0	0
		wH	42	45	32	3	0	—	0	0
	S	wC	1	75	46	0	0	—	0	0
		wH	19	48	36	2	0	—	0	0
Totals			83	47	33	3	0	—	0	0
5	D	wC	3	37	28	0	0	—	0	0
Port Clements		wH	1	40	32	2	0	—	0	0
Masset Road	CD	wC	6	46	38	0	0	—	0	0
E. end		wH	7	43	36	3	0	—	0	0
Lot 1828	I	wC	13	45	36	5	0	—	0	0
		wH	45	39	38	2	0	—	0	1
	S	wC	4	40	31	3	0	—	0	0
		wH	25	34	31	6	0	—	0	0
Totals			104	39	35	3	0	—	0	1
6	D	wC	7	30	21	7	0	—	0	0
Port Clements		wH	5	30	13	2	0	—	0	0
Tlell Road,	CD	wH	17	29	18	0	0	—	0	0
approx. 2½ mi.	I	wC	6	36	29	5	0	—	0	0
SE./Port		wH	28	32	20	2	0	—	0	0
Clements	S	wH	29	23	17	2	0	—	0	1
Totals			92	29	18	2	0	—	0	1
7	D	wC	14	26	0	0	0	—	0	0
		wH	13	16	0	0	0	—	0	0
S. end of	CD	wC	13	26	0	0	0	—	0	0
Mayer Lake		wH	10	25	0	0	0	—	0	1
	I	wC	20	29	0	0	0	—	0	0
		wH	5	23	0	0	0	—	0	1
	S	wC	12	24	0	0	0	—	1	0
		wH	4	25	0	0	0	—	0	0
Totals			91	25	0	0	0	—	1	2

Western Hemlock Looper, Lambdina fiscellaria lugubrosa (Hulst)

The hemlock looper population increased slightly in 1966 in the Terrace-Kitimat area and Skeena and Nass River valleys (Drainage Divisions 102, 105 and 106) (Table 5). A total of 21 positive collections contained 36 larvae compared to 9 collections containing 14 larvae in 1965.

Table 5

Summary of Western Hemlock Looper Collections by Drainage Divisions, West Prince Rupert District

Drainage division	Number of samples taken during larval period			% samples containing larvae			Average number of larvae per positive sample		
	1964	1965	1966	1964	1965	1966	1964	1965	1966
100	27	24	31	0	0	0	—	—	—
101	31	40	31	0	2.5	0	—	1.0	—
102	14	30	13	7.1	3.3	30.8	1.0	1.0	2.9
103	7	42	27	0	0	3.7	—	—	1.0
104	6	55	36	0	5.5	11.1	—	2.7	1.6
105	8	70	53	12.5	4.3	3.8	1.0	1.0	2.3
106	45	49	70	4.4	2.0	14.3	1.0	1.0	1.5
Totals	138	310	261	2.9	2.9	8.1	1.0	1.6	1.8

Black-headed Budworm, Acleris variana (Fern.)

The black-headed budworm population increased slightly over the 1965 population in Drainage Divisions 101, 102, 105 and 106 (Table 6).

Table 6

Summary of Black-headed Budworm Collections by Drainage Divisions, West Prince Rupert District

Drainage division	Number of samples taken during larval period			% samples containing larvae			Average number of larvae per positive sample		
	1964	1965	1966	1964	1965	1966	1964	1965	1966
100	27	24	37	0	0	0	—	—	—
101	32	42	37	3.1	0	5.4	1.0	—	2.3
102	14	9	30	7.1	11.2	3.3	1.0	1.0	3.5
103	7	6	29	0	0	0	—	—	—
104	2	8	22	0	0	0	—	—	—
105	0	0	18	—	—	5.5	—	—	1.0
106	30	15	62	13.5	0	4.8	1.5	—	1.8
Totals	112	104	235	5.4	1.0	3.0	1.3	1.0	2.1

Other Noteworthy Insects

Balsam Mortality Caused by Dryocoetes-Ceratocystis Complex

No sign of current balsam mortality was recorded in the Bell-Irving River Valley where extensive mortality was recorded during 1965 air surveys. Balsam mortality has been recorded in this area for two decades and has resulted from a number of factors including attack by insects and disease following predisposition by overmaturity, drought or winter damage.

Spruce Terminal Damage

During 1966 terminal damage on Sitka spruce reproduction at Sandspit was reduced to a minimum with only an occasional leader showing damage. Lateral damage caused by Zeiraphera sp., Rhabdophaga sp. and bud damage from late frost in April was more noticeable in 1966. However, new buds flushed and resumed normal lateral growth.

Similar damage occurred in the Juskatla area where about 5% of the 1966 terminals had been snipped off with a clean cut between the node and the tip by an unknown agent.

The tendency of this tree species to outgrow leader damage and to develop new leaders and laterals has been evident in advanced reproduction stands at Sandspit, Skidegate Lake and Juskatla. Former terminal damage calloused over and the trees maintained good form. Plots at Skidegate Narrows, Maude Island and Skidegate Lake were dropped in 1966 since the trees had grown to large to examine properly.

Aspen leaf miner Phyllocnistis populiella (Chamb.)

In most areas there was a decline in the number of aspen leaf surfaces infested on individual trees but a marked increase in the number of insects per leaf (Table 7). Cocoon parasitism and adult emergence varied little from last year (Table 8).

Table 7

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

Plot location	Total number of leaves			Percentage of leaf surfaces mined			No. of cocoons per 100 leaf surfaces		
	1964	1965	1966	1964	1965	1966	1964	1965	1966
Cedarvale	624	390	456	16.1	65.0	22.4	10	55	47
Oliver Cr.	579	484	509	55.8	81.7	33.0	5	58	61
Terrace	636	454	344	93.2	38.9	36.3	45	7	121
Beam Stn. Rd.	669	645	521	41.0	49.5	9.4	47	2	34
Averages	627	494	457	51.5	64.0	24.3	27	30	66

Table 8

Mortality of Aspen Leaf Miner in 100-cocoon Samples at Four Locations, West Prince Rupert District

Plot location	% Emerged			% Parasitized			% Dead		
	1964	1965	1966	1964	1965	1966	1964	1965	1966
Cedarvale	19	48	44	45	36	42	36	16	21
Oliver Cr.	36	49	38	23	20	58	41	31	4
Terrace	64	18	17	16	55	55	20	27	7
Beam Stn. Rd.	63	6	32	14	57	38	23	37	27
Averages	45.5	30.2	32.8	24.5	42.2	48.2	30.0	27.7	14.2

Table 9

Other Insects of Current Minor Significance

Insect	Hosts	Locality	Remarks
Choristoneura fumiferana (Clem.) spruce budworm	alF, wH, sS	Kitimat and Cedarvale	Defoliator, drop from 1965, found singly in three samples.
Epirrita autumnata (Gn.) Green velvet looper	wH, aF, alF	Throughout District	Defoliator, light population found in 31 collections.
Malacosoma disstria Hbn. Western tent caterpillar	---	None	Defoliator, none seen in 1966, one web seen in 1965.
Neodiprion spp. Sawflies	wH, aF, alF, sS, lP	Throughout West Prince Rupert District	Defoliator, small numbers, similar to 1965.
Neomyzaphis abietina (Wlk.) Spruce aphid	sS	Queen Charlotte Islands, Nass R.	Sucking insect, very light attack, some association with foliage disease Lophodermium sp.
Nyctobia limitaria (Wlk.) Yellow-lined forest looper	wH, aF, alF, sS, wC	Throughout District	Defoliator, small numbers, slight increase over 1965.
Pikonema alaskensis Roh. Yellow-headed spruce sawfly	sS, wS	Coastal areas and Queen Charlotte Islands	Defoliator, very light population similar to 1965.
Pikonema dimmockii Cress. Green-headed spruce sawfly	sS, wS	Throughout District	Defoliator, very light population similar to 1965.
Pineus spp. Aphids	sS	Erlandsen Cr. and Juskatla	Sucking insect, similar appearance to Balsam woolly aphid, Adelges piceae Ratz., on bark, -(stem attack).
Zeiraphera sp. A spruce tip moth	sS, wS	Terrace-Skeena Crossing	Defoliator, small numbers, None found on Queen Charlotte Islandsin 1966.

FOREST DISEASE CONDITIONS

Currently Important Diseases

Hemlock Mortality

Dying hemlock reported by the Rayonier Company Forester in the Sewell Inlet - Tasu Sound area was checked from the air during September. Many snags in the area indicated that the timber had been dying for some time, probably from decadence and weakening by black-headed budworm attacks from 1954 to 1958. There was a small amount of dying hemlock and some western red cedar with reddening foliage. Trees along the drier ridges appeared to be suffering from drought conditions. A ground check of the area was not made.

At Kleanza Creek near Terrace, 27% of the western hemlock on a small area had been killed as a result of unknown causes. Of 78 trees checked, 21 were dead and 20 had lost all but their upper crown foliage. Some of the trees which were 100% defoliated still had living moist sapwood and phloem. Old mycelial fans of Armillaria mellea (Fr.) Kummer were present on the roots and stem. Branch cankers associated with Caliciopsis pseudotsugae Fitzp. and Botryosphaeria tsugae Funk were found on branches of living and dead trees. These latter two fungi are secondary agents which reflect the non-vigorous condition of the host.

Exotic Plantations

Twenty-eight exotic plantations were examined in 1966 for symptoms of disease. Ten plantations were Douglas-fir, six European larch, one Japanese larch, seven hybrid poplars, two yellow pine, two red pine and one western white spruce. The species most subject to attack by disease were Douglas-fir and the hybrid poplars planted throughout Erlandsen Creek, Nelson River and Nass River plantation areas. In 1966, Douglas-fir plantations showed a marked recovery from dieback caused by Sclerophoma sp. in 1964 and 1965. Trees in these plantations showed good form and growth in 1966. No signs of new attack were found. During the early part of August, the 1966 foliage of 90% of the Douglas-fir saplings in the Nelson River and Erlandsen Creek plantations was infected with rusts caused by Melampsora occidentalis Jacks. and M. medusae Theum. The alternate host of M. medusae, trembling aspen, Populus tremuloides, was also infected in the Nelson River area.

Exotic hybrid poplars were attacked by wilt and dieback diseases as in previous years and although their lineal growth normally is greater than that of the native black cottonwood, they were killed back so often that their growth rate was seriously retarded and about 5% of the stems were killed.

Both European and Japanese larch plantations appeared in good condition, especially where willow and aspen formed a shield against the elements. Where the latter tree species were scarce, the larch saplings suffered from whipping, snow bending and some breakage. No harmful organisms were found on Larix species plantations this year.

Table 10 shows the diseases found in exotic plantations.

Table 10

Exotic Plantation Examinations, West
Prince Rupert District, 1966

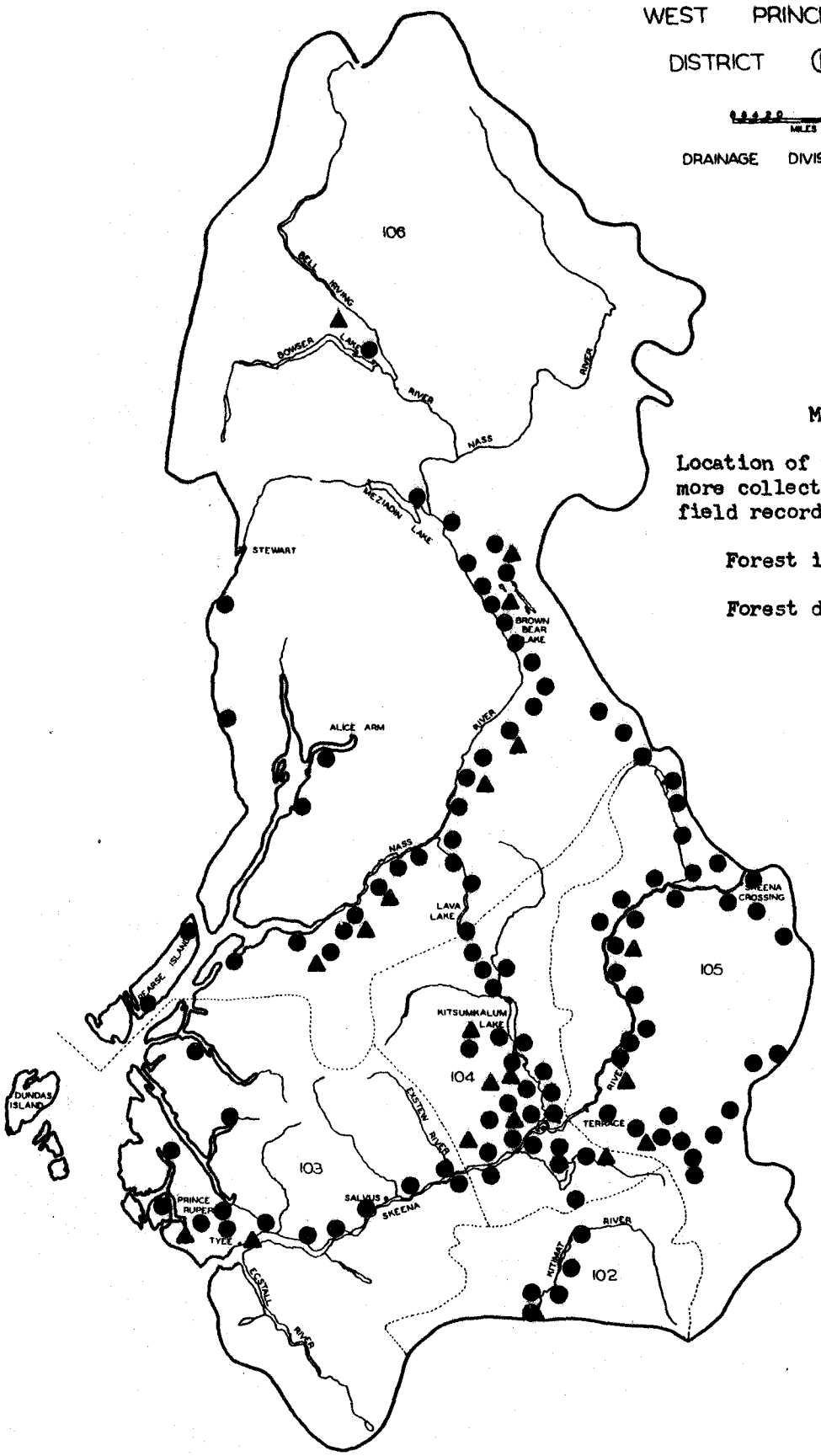
XP no.	Location	Exotic Species	Remarks
124	W. Kalum Nursery	*Populus 'Regenerata'*	24% of trees infected by *Cryptosporium* sp.
126A	Nelson R.	Douglas-fir	90% of trees infected by *Melampsora medusae* Thuem.
126B	Nelson R.	Douglas-fir	94% of trees infected by *M. medusae*
127	Erlandsen Cr.	Douglas-fir	90% of trees infected by *M. occidentalis* Jacks.
128	Nelson R.	Douglas-fir	90% of trees infected by *M. medusae*
160	Nelson R.	Douglas-fir	Dieback and infection by *M. medusae*
209	Nass R.	*Populus 'Regenerata'*	Dieback caused by *Melanconium* sp.
210	Nass R.	*P. 'Regenerata'*	Dieback caused by *Cryptosporium* sp.
211	Nass R.	*P. 'Robusta' Bachelieri*	Dieback caused by *Melanconium* sp.
212	Nass R.	*P. 'Robusta Issendorf'*	Canker caused by *Cytospora* sp.
232	Nelson R. (bridge)	*Populus* sp.	Dieback caused by *Melanconium* sp.

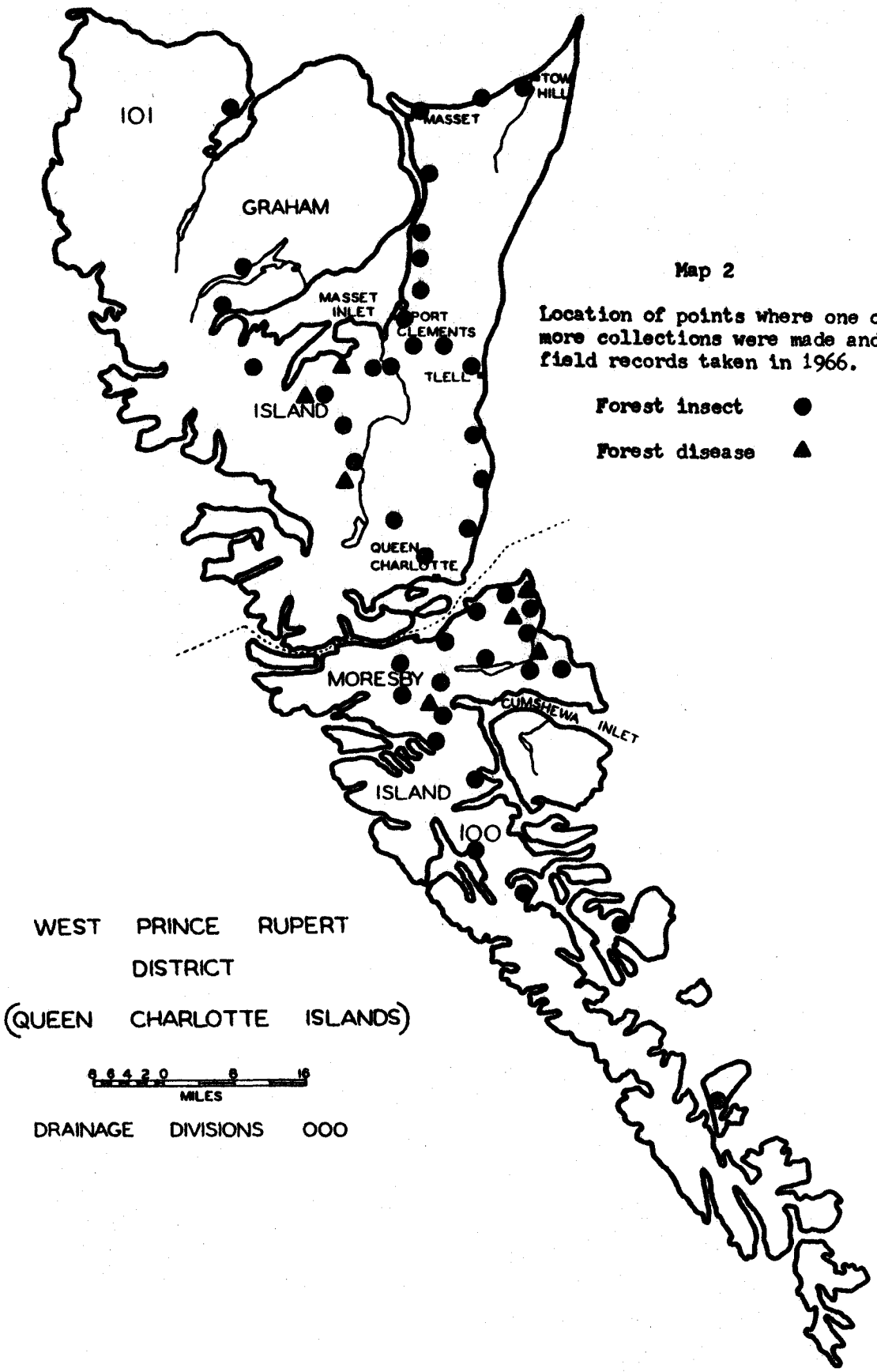
Other Noteworthy Diseases

Table 11

Other Diseases of Current Minor Significance

Organism and disease	Hosts	Locality	Remarks
Chrysomyxa ledicola Lagerh. Rust disease	sS	Sandspit and Prudhomme L.	Alternate host Labrador tea, light occurrence.
Gymnosporangium nootkatense Arth. Rust disease	Mountain ash	Skeena Station	Also found on yellow cedar, light occurrence
Hypoderma robustum Tub. A needle cast	aF	Shames R.	Associated with defoliation of 1965 needles.
Lophodermium macrosporum (Hartig) Rehm Twig dieback	sS	Juskatla and Yakoun R.	Found in association with spruce aphid feeding.
Melanconium sp. dieback of branches	wB	Coyote Cr.	Dieback on main stem and branches, (new host record).
Pucciniastrum goeppertianum (Kuehn) Kleb. ?Dieback of branches	wH	Ishkheenickh R.	Associated with yellowing of foliage on under-branches.


WEST PRINCE RUPERT
DISTRICT (MAINLAND)
MILES
DRAINAGE DIVISIONS 000
106
BELL IRVING
BOWSER LAKE
RIVER
NASS
RIVER
KWINAMASS
LAKE
STEWART
BROWN BEAR LAKE
ALICE ARM
RIVER
NASS
LAVA LAKE
KITSUMKALUM LAKE
KEENA CROSSING
105
104
DUNDAS ISLAND
LARSEN ISLAND
EXSTEW RIVER
TERRACE
RIVER
103
PRINCE RUPERT
TYEE
SALVUS
SKEENA
RIVER
KITIMAT
102
LEGATT
RIVER
Map
Location of points where one or more collections were made and field records taken in 1966.
Forest insect
Forest disease



Map 2

Location of points where one or more collections were made and field records taken in 1966.

Forest insect ●

Forest disease ▲

FOREST INSECT AND DISEASE SURVEY

SOUTH PRINCE RUPERT DISTRICT

1966

FOREST INSECT AND DISEASE SURVEY

SOUTH PRINCE RUPERT DISTRICT

1966

M. R. Bedford[1/] and D. S. Ruth[2/]

INTRODUCTION

The 1966 Forest Insect and Disease Survey of the District was carried out between July 6 and July 20. A float-equipped aircraft was used to cover the coastal area and a truck for the Bella Coola Valley.

The insect population generally was at a low level throughout the District. A total of 191 forest insect and 15 forest disease collections was submitted to the Victoria Laboratory.

Insect and disease collections by hosts are shown in Table 1. The location of collections and Drainage Division boundaries are shown on Map 1. Principal insect and disease problems in each Drainage Division are shown in Table 2.

1/ Forest Research Technician, Forest Insect and Disease Survey Ranger, Victoria.

2/ Forest Research Technician, Entomology Section, Victoria.

Table 1

Collections by Hosts

South Prince Rupert District, 1966

Coniferous hosts	Forest insects	Forest diseases	Broad-leaved hosts	Forest insects	Forest diseases
Cedar, western red	32	1	Alder, green	2	
Cedar, yellow	2		Alder, red	4	2
Douglas-fir	22	3	Ash, western mountain	1	
Fir, alpine	2				
Fir, amabilis	10	3	Cottonwood, black	2	
Fir, grand	1		Crabapple, Pacific	1	
Hemlock, western	57	1	Maple, species	1	
Pine, lodgepole	7	1	Willow, species	5	
Pine, whitebark	1	1	Miscellaneous	1	1
Pine, shore	1	1	No host	2	
Spruce, Sitka	36	1			
Spruce, white	1				
Totals	172	12	Totals	19	3
			GRAND TOTALS	191	15

Table 2

Currently Important Insect and Disease[1] Problems

by Drainage Division

South Prince Rupert District, 1966

Insect and disease problems	Principal hosts[2]	Importance by drainage divisions[3]			
		080	081	082	083
DEFOLIATORS					
Green-striped forest looper	wC, D, wH	-	3	2	3
Spruce budworm	sS	-	-	-	3
Western hemlock looper	wC, wH, S	-	3	3	-
TERMINAL BORERS					
Spruce weevil	S	-	-	3	-
WEATHER DAMAGE					
Frost damage	wC	-	-	4	-

1/ Includes only weather-induced and foliage diseases subject to notable annual fluctuation.

2/ Refer to host code in Forest District introduction.

3/ High population and/or widespread outbreak in progress - 5.
Scattered high populations and/or significant damage in restricted areas - 4.
Rising population and/or moderate numbers of insects and/or potential problem - 3.
Static or falling population and/or moderate numbers and/or no problem at present - 2.
Endemic population and/or no significant damage - 1.
Not sampled and/or no host and/or not found - 0.

FOREST INSECT CONDITIONS

Currently Important Insects

Defoliators

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

There was a slight increase in the population of the green-striped forest looper over the previous year. The majority of larvae were found in D. D. 082. Forty larvae were taken in 21 positive collections.

Spruce Budworm, *Choristoneura fumiferana* (Clem.)

The population of spruce budworm remained low in 1966. Eight larvae were collected from one positive sample of Sitka spruce west of Bish Creek, south-west of Kitimat on the north-west side of Douglas Channel.

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

The population of western hemlock looper increased slightly compared with 1965. Eight larvae were taken in thirty-one positive collections, mostly in Drainage Division 082.

Terminal Borers

Spruce Weevil, *Pissodes sitchensis* (Hopk.)

Approximately 40% of the Sitka spruce regeneration near Hagensborg and in the lower Salloomt Valley near Bella Coola were attacked by the spruce weevil in 1966. Some of the larger trees which had been attacked in previous years had grown multiple leaders.

Table 3

Other Noteworthy Insects

Other Insects of Current Minor Significance

Insects	Hosts	Locality	Remarks
Acleris variana (Fern.) Black-headed budworm	H, lP, W	South Bentinck Arm and Bella Coola Valley	Defoliator, population at low level in 1966. Seven larvae were collected from 3 positive samples.

Table 3 - Continued

Other Insects of Current Minor Significance - Continued

Insects	Hosts	Locality	Remarks
Adelges cooleyi (Gill) Cooley spruce gall aphid	D, S	Bella Coola Valley	Sucking insect prevalent on needles of Douglas-fir. Causes galls on alternate host spruce.
Ectropis crepuscularia (Schiff.) Saddle-backed looper	wC, bF, wH, S	Smith Inlet, Salloomt Valley	Defoliator, 11 larvae collected from 6 positive samples.
Lithocolletis salicifoliella (Cham.) Willow leaf-miner	W spp.	Bella Coola Valley	The leaf-miner infestation between Firvale and Stuie subsided to a moderately low level in 1966.
Neodiprion spp. Hemlock sawfly	C, D, F, wH, lP, S	Widespread	Defoliator, common in all drainages in small numbers.
Neophasia menapia (F and F) Pine butterfly	lP	Noosgulch River Valley	Defoliator, one larva collected.
Nyctobia limitaria (Wlk.) Green balsam looper	wC, yC, D, bF, wH, S	Widespread	Defoliator, 53 larvae collected from 24 positive samples. Maximum of 15 larvae in one collection.
Orgyia antiqua badia (Hy. Edw.) Rusty tussock moth	wC, bF, wH, S	Noosatsum Creek	Defoliator, 10 larvae collected from 5 positive samples.
Pikonema alaskensis (Roh.) Yellow-headed spruce sawfly	S	Widespread	Defoliator, common in small numbers throughout District.
Pikonema dimmockii (Cress.) Green-headed spruce sawfly	S	Widespread	Defoliator, common in small numbers throughout District.
Zeiraphera spp.	sS	Kitlope Lake	Defoliator, moderate feeding on current terminals of spruce in coastal areas.

FOREST DISEASE CONDITIONS

Currently Important Diseases

Fifteen disease collections were made in the District. Two collections were new host records, and are listed under "Other Noteworthy Diseases".

Weather Damage

Frost Damage

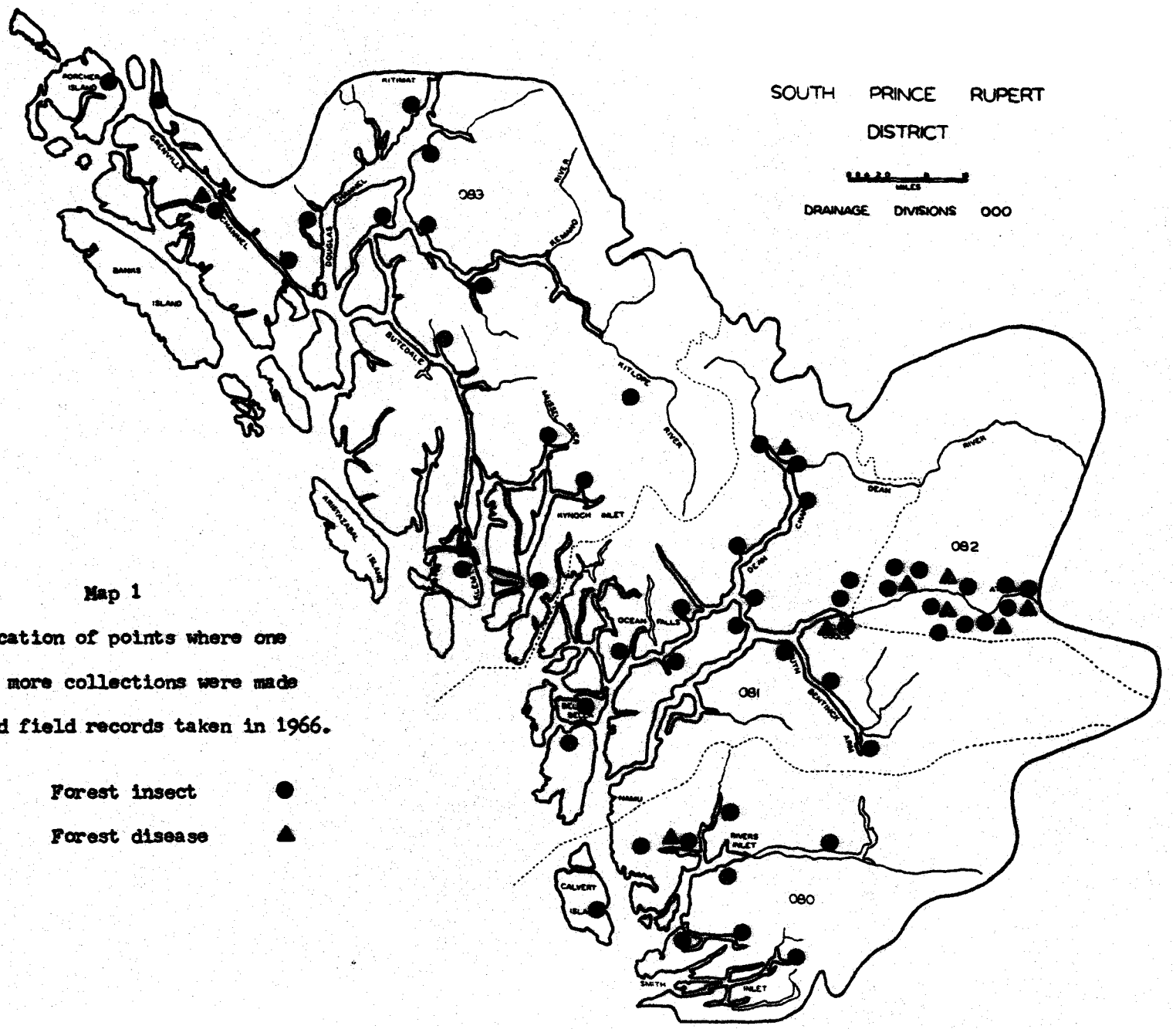
Western red cedar in the Salloomt River Valley appeared to have been damaged by early spring frost. The needles of the trees had turned brown, especially on the exposed side of the valley. Alder and willow trees in the Bella Coola Valley were also affected by the frost.

Table 4

Other Noteworthy Diseases

Other Diseases of Current Minor Significance

Organism and Disease	Hosts	Locality	Remarks
Bifusella n. sp. Needle cast	alF	Young Creek	Needle cast, occurring on alpine fir.
Hypodermella abietis- (Mayr) Dearn. Needle cast	alF	Young Creek	Needle cast, causing damage to true firs in this area.
Sclerophoma pithyophila (Corda) Fungus	whP	East of Young Creek	New host record. Fungus found on needles of white-bark pine. Under observation.
Coryneum thujinum Dearn. Fungus	wC	Nusatsum Valley	Fungus causing needle blight, potentially damaging.



Map 1

Location of points where one or more collections were made and field records taken in 1966.

Forest insect ●

Forest disease ▲

FOREST INSECT AND DISEASE SURVEY

EAST PRINCE RUPERT DISTRICT

1966

FOREST INSECT AND DISEASE SURVEY

EAST PRINCE RUPERT DISTRICT

1966

J. S. Monts[1/]

INTRODUCTION

The forest insect and disease survey of the East Prince Rupert District commenced in late May and was completed in early September. Due to a late spring, annual spruce budworm plot examinations were carried out in mid-June in conjunction with general sampling. Defoliator populations increased in all drainages in 1966.

A four hour bark beetle aerial survey over the Babine Lake, Chapman Lake and Goosley Lake areas indicated only light new attacks by spruce beetles in several small areas.

The Tweedsmuir Park lakes were surveyed in mid-August by boat with the assistance of S. J. Allen.

A total of 331 forest insect and 40 forest disease collections are listed by hosts in Table 1. Map 1 indicates the location of points where one or more collections were made and the boundaries of the Drainage Divisions referred to in the text of this report.

1/ Forest Research Technician, Forest Insect and Disease Survey, Victoria, B. C.

Table 1

Collections by Hosts

East Prince Rupert District, 1966

Coniferous hosts	Forest insects	Forest diseases	Broad-leaved hosts	Forest insects	Forest diseases
Cedar, western red	11		Maple, species		1
Douglas-fir	3		Poplar, species	1	
Fir, alpine	76	12	Aspen, trembling	2	
Fir, amabilis	4	2	Willow	1	
Fir, species	1		Miscellaneous	3	8
Hemlock, mountain	7	1	No host	7	
Hemlock, western	25				
Pine, lodgepole	56	7			
Pine, Scots	1				
Pine, whitebark	2	1			
Spruce, white	128	8			
Spruce, species	3				
Totals	317	31	Totals	14	9
			GRAND TOTALS	331	40

Table 2

Currently Important Insect and Disease[1] Problems by Drainage Divisions

East Prince Rupert District

Insect and disease problems	Principal hosts[2]	Importance by drainage divisions[3]			
		120	121	122	123
BARK BEETLES					
Spruce bark beetle	wS	2	2	2	1
Mountain pine beetle	lP	0	0	1	0
Dryocoetes - Ceratocystis complex	alF	1	2	2	1
DEFOLIATORS					
Black-headed budworm	wS, alF	3	4	1	2
Western hemlock looper	alF, wH	1	3	2	1
Two-year-cycle spruce budworm	alF, wS	1	1	1	1
LEAF MINERS					
Aspen leaf miner	tA	2	2	2	2
TERMINAL BORERS					
Engelmann spruce weevil	wS	1	2	1	0
WEATHER DAMAGE					
Frost damage to alpine fir	alF, wS	1	2	2	1
CONE DISEASES					
A cone rust	wS	3	3	2	0
STEM DISEASES					
Branch canker of alpine fir	alF	1	2	1	1

1/ Includes only weather-induced and foliage diseases subject to notable annual fluctuation.

2/ wS - white spruce, Decid. - deciduous species, alF - alpine fir (etc.). Refer to host code in Forest District introduction.

3/ High population and/or widespread outbreak in progress - 5. Scattered high populations and/or significant damage in restricted areas - 4. Rising population and/or moderate numbers and/or potential problem - 3. Static or falling population and/or moderate numbers and/or no potential problem at present - 2. Endemic population and/or no significant damage - 1. Not sampled and/or no host and/or not found - 0.

FOREST INSECT CONDITIONS

Currently Important Insects

Bark Beetles

Spruce Beetle, Dendroctonus obesus (Mann.)

The spruce bark beetle population remained at a low level in 1966 as determined by aerial observations, ground checks, and trap-tree felling. During aerial surveys in late August only light attacks were observed west of Babine Lake and north of Goosley Lake; no new attacks occurred along the Morice River. Trap logs were felled at Smithers Landing, Taltapin and Goosley lakes in late May and examined for beetle attacks in mid-September. Beetle populations and development at these three locations are shown in Table 3.

Table 3

Spruce Beetle Development in Trap Logs,

East Prince Rupert District

Location	Position of log	Total number of insects			% living adults			% living larvae		
		1964	1965	1966	1964	1965	1966	1964	1965	1966
Smithers Landing	open	853	-[1]	55	9.4	—	11.5	90.6	—	88.5
	shade	471	-	153	17.8	—	6	82.2	—	94
Taltapin Lake	open	214	55	44	43.4	90.9	10	56.6	9.1	90
	shade	409	31	58	35.2	90.3	20.8	64.8	9.7	79.2
Morice Access Road	open	305	50	*[2]	32.8	22.0	*	67.2	78.0	*
	shade	343	76	*	16.3	8.0	*	83.7	92.0	*
Goosley Lake	open	*[2]	*	171	*	*	9.2	*	*	90.8
	shade	*	*	185	*	*	10	*	*	90
Totals		2,595	212	666	21.5	52.0	94.4	78.5	47.2	88.7

-[1] Logs not attacked.

*[2] Logs not established at these points.

Mountain Pine Beetle, Dendroctonus ponderosae Hopk.

The number of lodgepole pine attacked by the mountain pine beetle decreased in the areas of the former infestation. A few recently attacked trees were observed in the Wright Bay area during aerial surveys. Salvage logging in the Wright Bay and Hagan Arm areas of Babine Lake during 1964-65 helped to reduce the infestation that had reached a peak in 1962-63. Mountain pine beetle populations are expected to remain at a low level in 1967.

Balsam Mortality Caused by the Dryocoetes-Ceratocystis Complex

Balsam mortality was recorded again in 1966 in conjunction with spruce beetle aerial surveys in late August. Current mortality in balsam stands appeared to be somewhat reduced. Light to medium mortality occurred in concentrated areas at Chapman Lake, Nadina Lake, Cronin Mine Road, and southwest of Old Fort. The appraisal crew examined the recently established plots and strips but found only very light attacks in the areas of the former infestation.

Defoliators

Black-headed Budworm, Acleris variana (Fern.)

A marked increase in the occurrence of this defoliator was found throughout the District in 1966, (Table 4). Collections of 52 and 47 larvae were taken from alpine fir and white spruce respectively in the Morice Forest at Gosnell Creek. Samples of 10 to 15 larvae were common along the Morice West Forest Development Road. More than 12% of collections taken in Drainage Division 120 contained larvae of this insect. Indications point toward a rising population in 1967, (Table 4).

Table 4

Summary of Black-headed Budworm Collections by Drainage Divisions,

East Prince Rupert District

Drainage division	Number of samples taken during larval period			% samples containing larvae			Average number of larvae per positive sample		
	1964	1965	1966	1964	1965	1966	1964	1965	1966
120	80	87	82	12.5	16.1	12.2	3.6	3.4	1.7
121	28	19	47	25.0	5.3	31.9	4.8	1.0	9.9
122	11	34	55	18.1	20.6	0.0	2.2	2.7	—
123	0	0	13	—	—	15.3	—	—	2.2
Totals	119	140	197	15.9	15.7	12.6	3.9	3.1	6.3

Western Hemlock Looper, Lambdina fiscellaria lugubrosa (Hulst)

There was no appreciable increase in the population of this insect in the East Prince Rupert District in 1966 (Table 5). Larvae were present in small numbers in collections made in Drainage Divisions 121 and 122. The largest sample of 18 larvae was collected from alpine fir north of Sealy Lake in Drainage Division 122.

Table 5

Summary of Western Hemlock Looper Collections by Drainage Divisions, East Prince Rupert District

Drainage division	Number of samples taken during larval period			% samples containing larvae			Average number of larvae per positive sample		
	1964	1965	1966	1964	1965	1966	1964	1965	1966
120	50	79	35	0	0	0	—	—	—
121	31	60	52	1.9	5.0	7.5	2.9	4.2	5.1
122	35	122	68	0	1.6	13.2	—	1.0	1.5
123	2	19	11	0	10.5	0	—	2.3	—
Totals	118	280	166	4.8	2.5	7.8	2.9	2.7	2.6

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

No larvae were found and no current defoliation occurred on any of the branch samples examined at the five established plot locations in 1966. Because of late bud development plot work was postponed until late June and early July and only a trace of larval activity was noted during the larval period (Table 6). The largest random sample contained three larvae collected from alpine fir at Milk Creek (Drainage Division 121). No egg masses were found in late summer at the five plots. White spruce and alpine fir trees, heavily stunted from continuous defoliation since 1950, have made excellent recovery during the past three years and are again putting on good terminal and lateral growth.

Table 6

Summary of Two-year-cycle Spruce Budworm Collections by Drainage Divisions, East Prince Rupert District

Drainage division	Number of samples taken during larval period			% samples containing larvae			Average number of larvae per positive sample		
	1964	1965	1966	1964	1965	1966	1964	1965	1966
120	88	10	11	1.1	0.0	9.1	1.0	0.0	1.0
121	57	90	59	3.5	1.1	3.4	1.0	1.0	2.2
122	75	109	81	40.0	6.4	11.1	11.0	3.4	1.5
123	12	27	11	8.0	3.7	0.0	1.0	1.0	0.0
Totals	232	236	162	14.6	3.8	7.4	10.0	2.9	1.6

Leaf Miners

Aspen Leaf Miner, Phyllocnistis populiella Cham.

The aspen leaf miner infestation in the East Prince Rupert District continued wherever the host tree, trembling aspen, was found. The four study plots established in 1963 were again examined in 1966 (Table 7). The infestation will probably remain widespread at varying levels of intensity in 1967.

Table 7

Aspen Leaf Surfaces Mined and Number of Aspen Leaf Miner Adults Produced per 100 Leaf Surfaces, East Prince Rupert District

Plot location	Total No. of leaves		% leaf surfaces mined		Average No. of cocoons per 100 leaf surfaces	
	1965	1966	1965	1966	1965	1966
Priestly Station Road	447	434	38.9	29.9	78	68
Babine Lake	597	524	93.2	63.3	130	86
Moricetown	452	451	81.4	52.8	99	74
2 miles west of Telkwa	476	525	82.7	56.1	83	67
Average	493	483.5	75.7	50.5	97	73.7

Table 8

Mortality of Aspen Leaf Miner in 100 Cocoon Samples at Four Locations

East Prince Rupert District

Location	% emerged		% parasitized		% dead	
	1965	1966	1965	1966	1965	1966
Priestly Stn. Rd.	38	65	49	24	13	10
Babine Lake	60	77	32	15	8	8
Moricetown	41	44	30	39	29	17
2 Mi. W. of Telkwa	39	58	41	28	20	14
Average	44.5	61	38	26.6	17.5	12.4

Terminal Borers

Engelmann Spruce Weevil, Pissodes engelmanni Hopk.

Weevils attacked about 10% of the leaders of Engelmann spruce, in a stand of reproduction, for a distance of 4 miles in the Telkwa River Valley. Lighter damage occurred in the Morice River Valley and at Buck Flats where 5% of the leaders were attacked on two 2-mile check strips.

Other Noteworthy Insects

Table 9

Other Insects of Current Minor Significance

Insect	Hosts	Locality	Remarks
Epirrita autumnata Gn. Green velvet looper	alF, wS	Moricetown	Defoliator, 7 larvae from one sample on alpine fir.
Epirrita pulchraria (Taylor) A white-striped Forest Looper	aF, mH	Tahtsa Lake	Defoliator, 12 positive collections averaged 2.6 larvae.
Melanolophia imitata Wlk. Green-striped forest looper	alF, wS	Bulkley Valley	Defoliator, low population. 14 positive collections contained an average of 3.2 larvae.

Table 9 - Continued

Other Insects of Current Minor Significance

Insect	Hosts	Locality	Remarks
Pikonema alaskensis Roh. Yellow-headed spruce sawfly	wS, lP	Burns Lake	Common defoliator, collected in small numbers. 23 positive collections contained 32 larvae.
Pikonema dimmockii (Cress.) Green-headed spruce sawfly	wS, lP	Francois Lake	Defoliator, common in DD 120. 38 positive collections contained an average of 1.7 larvae.
Neodiprion sp. Sawflies	wS, alF, lP	Kispiox River	Defoliator, widespread distribution in DD 123. No population increase.
Nyctobia limitaria (Wlk.) Green balsam looper	alF, wH	Hazelton	Defoliator, low populations. 2 positive collections averaged 4 larvae, in DD 122.
Ectropis crepuscularia Schiff. Saddleback looper	alF, S	North Skeena	Defoliator, continued low populations. 7 positive collections averaged 1.5 larvae.
Caripeta divisata Wlk. Grey spruce looper	alF, wS	Tweedsmuir Park	Defoliator, low level. 6 positive collections averaged 1.3 larvae.
Feralia sp. A cutworm	alF, wH	North Skeena	Defoliator, scattered occurrence; 11 positive collections contained 14 larvae.
Eupithecia sp. A looper	lP, wS	Babine Lake, North Skeena	Defoliator, scattered occurrence; 4 positive collections contained 3 larvae.
Adelges cooleyi Gill. Cooley spruce gall aphid	wS	Smithers, Telkwa	Sap-sucking insect, common in regeneration stands and private arboretums.

FOREST DISEASE CONDITIONS

Currently Important Diseases

Weather Damage

Winter Injury

Foliage on laterals of alpine fir and white spruce were discoloured as a result of winter injury at Cronin Mine Road, Glacier Gulch and Telkwa River. Below zero temperatures in mid-March preceded by a two week period of mild weather may have caused this flagging condition. Injury to white spruce was light but in some cases 10 to 15% of alpine fir foliage was discoloured.

Cone Diseases

A Cone Rust, Chrysomyxa pirolata Wint.

An otherwise good cone crop on white spruce was heavily attacked by rust at Ootsa Lake, Francois Lake and Buck Flats (Drainage Divisions 120 and 121). Forty percent of the cones on exposed regeneration trees at Buck Flats and from 15 to 20% of the cones in regeneration stands at Ootsa Lake and Francois Lake were infected. Wintergreen, Pyrola spp., the alternate host of this rust, was present in all the stands infected by Chrysomyxa pirolata.

Stem Diseases

A Branch Canker on Alpine Fir

Red flagging caused by a canker disease Scleroderris abieticola Zeller and Goodd. occurred on 15% of the laterals in roadside alpine fir stands from Nadina Lake south of Tahtsa Reach. Light damage was observed for a distance of 30 miles in roadside stands on the Morice Access Road. This canker occurs about 18 inches from the branch tip, causing mortality of the outer portion of the branch.

Other Noteworthy Diseases

Table 10

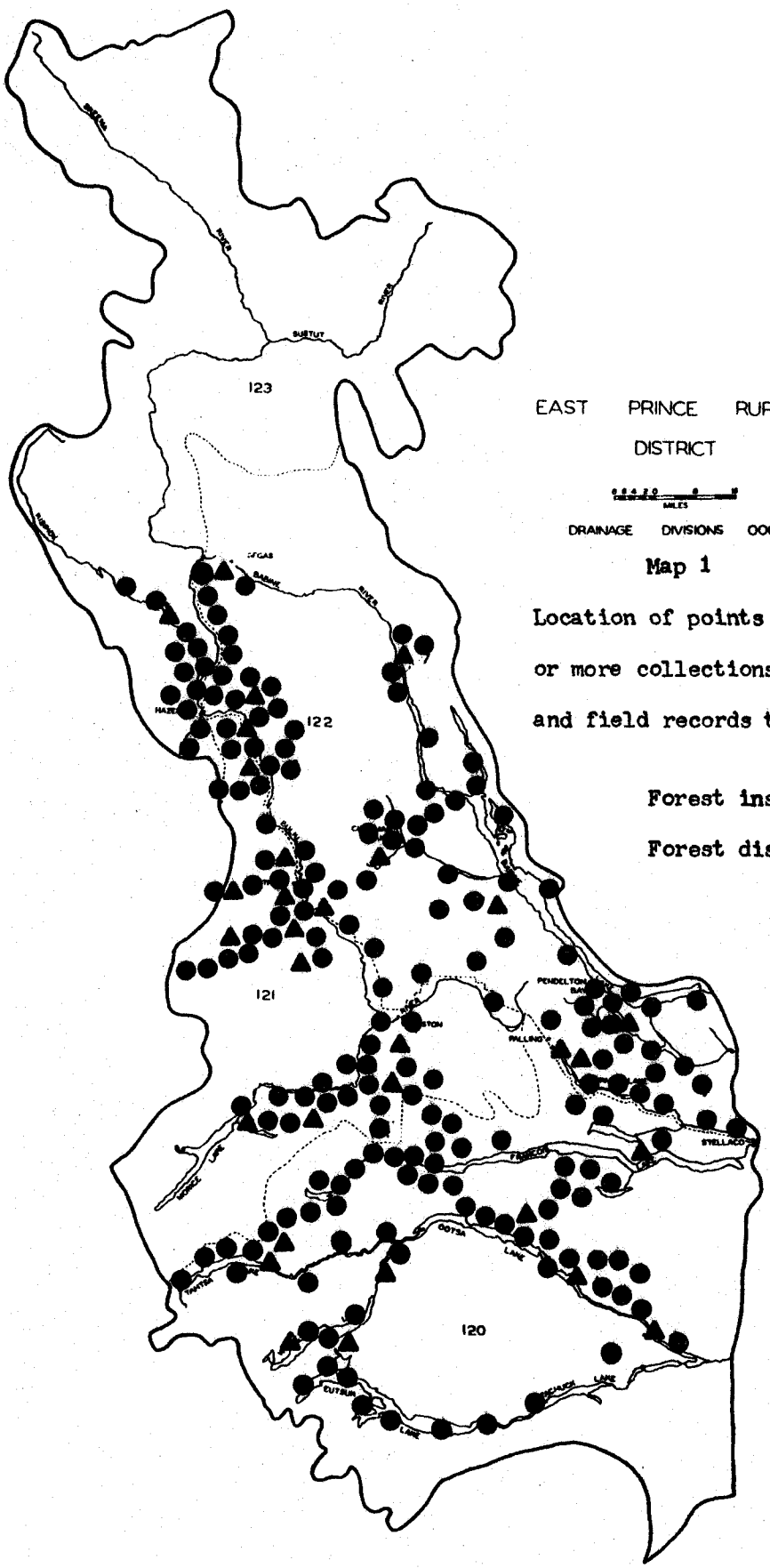
Other Diseases of Current Minor Significance

Organism and Disease	Hosts	Locality	Remarks
Arceuthobium americanum Nutt. ex Engelm. Lodgepole pine dwarf mistletoe	lP	Telkwa River	Common dwarf mistletoe with the hyperparasite, Wallrothiella arceuthobii (Peck) Sacc.

Table 10 - Continued

Other Diseases of Current Minor Significance

Organism and Disease	Hosts	Locality	Remarks
Chrysomyxa arctostaphyli Diet. Spruce broom rust	wS	Burns Lake	Causes witches broom; common in DD 122.
Cronartium ribicola J. C. Fisch. ex Rab. White pine blister rust	whP	Tahtsa Lake	Several trees infected with rust galls.
Hyalopsora aspidiotus (Magn.) Magn. A needle rust	aF alF	Telkwa, Whitesail Lake	Light infections of an orange rust on previous needles.
Hypoderma robustum Tub. A needle cast	aF	Whitesail Lake	Light discolouration of foliage.
Hypodermella abietis-concoloris (Mayr) Dearn. A needle cast	alF	Telkwa River	Light infections on 2 year and older needles.
Hypodermella punctata Darker. A needle rust	aF	Eutsuk Lake	Found in one collection.
Peridermium harknessii J. P. Moore. Western gall rust of pines	lP	Burns Lake	Rust galls prevalent on regeneration trees.
Puccinia dioicae Magn. A plant rust	Epilobium angusti-folium	Owen Lake	Alternate host - Carex spp. (First record on this host for B. C.)
Tuberculina maxima Rostr. A hyperparasite	lP	Smithers	Purple mould inhibiting the fruiting of Cronartium comandrae Peck. (New host record.)



Map 1

Location of points where one or more collections were made and field records taken in 1966.

Forest insect ●

Forest disease ▲

FOREST INSECT AND DISEASE SURVEY

BRITISH COLUMBIA

1966

KAMLOOPS FOREST DISTRICT

FOREST INSECT AND DISEASE SURVEY

BRITISH COLUMBIA

1966

KAMLOOPS FOREST DISTRICT

C. B. Cottrell 1/

Ranger personnel assigned to the Kamloops Forest District in 1966 were, N. J. Geistlinger, West Kamloops; R. O. Wood, Central Kamloops and C. B. Cottrell, East Kamloops. R. O. Wood co-ordinated the European pine shoot moth survey in the Okanagan Valley and Kamloops area.

Bark beetle populations remained at a relatively low level in 1966. The mountain pine beetle caused little damage with the exception of an infestation in lodgepole pine north-east of Williams Lake and infestations in ponderosa pine in the Hat Creek Valley and on the Douglas Lake Plateau. Tree mortality caused by the Douglas-fir beetle was negligible.

Populations of black-headed budworm, larch sawfly and larch bud moth remained at a high level. An estimated 16,000 acres of western hemlock were defoliated by the black-headed budworm in the eastern part of the Kamloops Forest District. The larch sawfly and larch bud moth caused moderate to severe defoliation of western larch in the Vernon and Lumby Ranger districts. Important defoliators such as spruce budworm, western hemlock looper, a looper on Douglas-fir, Nepytia sp., and the Douglas-fir tussock moth were scarce in 1966.

Over 300,000 acres of mature Douglas-fir suffered needle loss and bud mortality as a result of April frosts. During the summer many trees partially recovered and no bark beetle attacks were found on the weakened trees.

A needle cast disease of ponderosa pine was again prevalent and continued to cause significant damage.

HOST TREE ABBREVIATIONS

Abbrev.	Common name	Abbrev.	Common name
tA	Aspen, trembling	wL	Larch, western
bCo	Cottonwood, black	lP	Pine, lodgepole
wC	Cedar, western red	pP	Pine, ponderosa
D	Douglas-fir	wwP	Pine, western white
alf	Fir, alpine	eS	Spruce, Engelmann
wH	Hemlock, western	W	Willow
roJ	Juniper, Rocky Mtn.		

1/ Forest Research Technician, Forest Insect and Disease Survey Senior Ranger, Vernon, B. C.

FOREST INSECT AND DISEASE SURVEY

EAST KAMLOOPS DISTRICT

1966

FOREST INSECT AND DISEASE SURVEY

EAST KAMLOOPS DISTRICT

1966

C. B. Cottrell

INTRODUCTION

Regular field work in the District began on May 24 and ended on September 16. Black-headed budworm egg counts, larch sawfly cocoon sampling and pole blight plot establishment was done between September 20 and October 18. Assistance was given in the spruce beetle mortality studies in the Prince George Forest District from May 16 to 20.

Populations of two larch foliage-feeding insects, larch sawfly and larch bud moth, remained at a high level as did black-headed budworm on western hemlock. Bark beetle populations were unusually small.

Ten hours flying time was used to map bark beetle, black-headed budworm and larch sawfly infestations.

A special survey of exotic and native pines in the Okanagan Valley was carried out in May and June by R. O. Wood and D. G. Lund in co-operation with the Plant Protection Division, Canada Department of Agriculture, to determine the distribution of the European pine shoot moth.

Insect and disease collections made in the District are shown by hosts in Table 1; collection localities and drainage divisions are shown on Map 1. The principal problems in each Forest Insect and Disease Survey Drainage Division are shown in Table 2.

Table 1

Collections by Hosts

East Kamloops District, 1966

Coniferous hosts	Forest insects	Forest diseases	Broad-leaved hosts	Forest insects	Forest diseases
Cedar, western red	4	2	Alder, mountain	1	-
Douglas-fir	110	3	Aspen, trembling	17	1
Fir, alpine	14	1	Birch, western white	3	-
Hemlock, western	75	1	Chokecherry	2	-
Juniper species	4	-	Cottonwood, black	9	-
Larch, western	41	-	Maple, Douglas	1	-
Pine, lodgepole	25	1	Willow species	1	-
Pine, ponderosa	83	1	Miscellaneous	14	-
Pine, western white	12	10	No host	4	-
Pine species	4	-			
Spruce, Engelmann	31	-			
Totals	403	19	Totals	52	1
			GRAND TOTALS	455	20

Table 2

Currently Important Insect and Disease [1] Problems by Drainage Division, East Kamloops District, 1966

Insect and disease problems	Principal hosts [2]	Importance by drainage division [3]						
		180	181	182	183	184	185	186
BARK BEETLES								
Mountain pine beetle	lP, pP, wwP	3	3	1	1	1	1	2
Douglas-fir beetle	D	1	3	1	1	1	1	1
DEFOLIATORS								
Black-headed budworm	wH	1	0	3	0	4	1	1
Larch sawfly	wL	0	4	4	0	1	1	0
Larch bud moth	wL	0	1	4	0	0	0	0
WEATHER DAMAGE								
Frost injury	pP	1	3	0	1	0	0	0

Table 2 continued

Insect and disease problems	Principal hosts 2/	Importance by drainage division 3/						
		180	181	182	183	184	185	186
FOLIAGE DISEASES								
Needle cast of ponderosa pine	pP	4	5	1	3	3	0	0
Larch needle cast	wL	0	3	3	0	1	0	0
MISTLETOE DISEASES								
Douglas-fir dwarf mistletoe	D	4	4	1	1	1	1	1
Lodgepole pine dwarf mistletoe	lP	3	4	1	3	1	0	0

1/ Includes only weather-induced and foliage diseases subject to notable annual fluctuation.

2/ Refer to host code in Forest District introduction.

3/ High population and/or widespread outbreak in progress - 5

Scattered high populations and/or significant damage in restricted area - 4

Rising population and/or moderate numbers and/or potential problem - 3

Static or falling population and/or moderate numbers of insects and/or no problem at present - 2

Endemic population and/or no significant damage - 1

Not sampled and/or no host and/or not found - 0

FOREST INSECT CONDITIONS

Currently Important Insects

Bark Beetles

Mountain Pine Beetle, Dendroctonus ponderosae Hopk.

In 1966 an aerial survey of red-topped pine, presumably killed in 1964 and 1965, indicated an overall decline in the number of beetle-

killed trees, although increases were noted in a few areas.

The number of beetle-killed lodgepole pine increased from 350 to 900 near the junction of Joe Rich and Mission creeks. The infestation in Lambly Creek Valley decreased from 2,000 trees counted in 1965 to 700, although salvage logging accounted for part of the reduction.

More ponderosa pine died in 1966 than in 1965 in the vicinity of Salmon Lake and between Princeton and Aspen Grove. All other infestations declined.

The only notable infestation in western white pine in the District was 300 red-topped mature trees north of Agate Bay on the west side of Adams Lake. Only small pockets of this pine were killed in the vicinity of Sugar and Mabel lakes.

Aerial counts of beetle-killed pine are shown in Table 3.

Table 3

Number of Trees and Volume Killed by Mountain Pine Beetle, East Kamloops District, 1964 and 1965, as determined in 1966

Pine species	Location	No. of trees killed	Volume (cu. ft.)
Lodgepole	Terrace Creek	250	5,000
	Lambly Creek	700	14,000
	Mission Creek	900	18,000
	Keremeos	300	6,000
		2,150	43,000
Ponderosa	Salmon Lake	530	16,000
	Bald Range Creek	50	1,500
	Terrace Creek	100	3,000
	Mission Creek	100	3,000
	Princeton - Aspen Grove	320	14,500
		1,100	38,000
Western white	Adams Lake	310	12,500
	Mabel Lake	115	4,500
	Sugar Lake	225	9,000
	Trinity Valley	50	2,000
		700	28,000
Totals, all pine species			
	1966	3,950	109,000
	1965	12,150	363,000
	1964	14,180	346,000
	1963	19,810	446,500

Douglas-fir Beetle, Dendroctonus pseudotsugae Hopk.

The number of beetle-killed Douglas-fir in the District was unusually low in 1966. Three hundred red-topped trees were counted from the air in the Whiteman Creek Valley, 100 near Spanish Lake, 25 west of Monte Lake and 15 in Paxton Valley. In 1964 and 1965, respectively, 5,290 and 2,230 red-tops were counted.

Defoliators

Black-headed Budworm, Acleris variana (Fern.)

Larval populations remained high for the second consecutive year in overmature western hemlock stands in the Sicamous, Enderby and Lumby B.C.F.S. Ranger districts. However, the percentage of samples containing larvae and the number of larvae per sample decreased slightly. Although disease and parasites were present in some larval collections the cool, wet summer weather may have been partly responsible for the decline. Larval development was slow and larvae appeared sluggish and unhealthy. A comparison of hemlock collections containing black-headed budworm in 1964, 1965 and 1966 is as follows:

No. samples taken during larval period			% samples containing larvae			No. larvae per positive sample		
1964	1965	1966	1964	1965	1966	1964	1965	1966
47	48	34	51	90	85	5.9	65.1	50.5

Areas of defoliation, visible from the air, were slightly less extensive than in 1965. The largest infestation occurred in the Perry River Valley where there was light to moderate defoliation on 16,500 acres. The heaviest defoliation was at the headwaters of Crazy Creek where 3,000 acres of hemlock were moderately to heavily defoliated and 6,000 acres were lightly to moderately defoliated. In the Wap Creek, Shuswap River and Tsuius Creek valleys there were pockets of light to moderate defoliation. The heaviest defoliation occurred at elevations above 3,500 feet. Table 4 lists the location of infestations and acreages as estimated from the air in August (Map 2).

Egg sampling was done between September 20 and October 18 at 12 locations in overmature hemlock stands. At each location, the number of eggs were counted on 10-inch branch tips from five different crown levels from each of three trees. Defoliation predictions for 1967 were based on the criteria that one to seven eggs per branch tip will result in light defoliation, eight to 15 in moderate, and over 15 in heavy defoliation (Table 5).

Table 4

Western Hemlock Defoliation Caused by the Black-headed Budworm, East Kamloops District, 1966

Location	Acres of defoliation	
	light - moderate	moderate - heavy
Perry R.	16,500	0
Crazy Cr.	6,000	3,000
Wap Cr.	3,000	0
Shuswap R.	4,000	0
Tsuius Cr.	3,500	0
Holstein Cr.	1,000	0
Totals	34,000	3,000

Table 5

Black-headed Budworm Defoliation Estimates and Egg Samples, East Kamloops District, September-October 1966

Location	% defoliation (1966)	Av. no. eggs per 10-inch tip	Defoliation prediction (1967)
Crazy Cr. No. 1	40	2.6	light
Crazy Cr. No. 2	40	4.1	light
South Pass Cr.	5	5.3	light
Sim Cr. No. 1	5	14.4	moderate
Sim Cr. No. 2	10	4.3	light
Sim Cr. No. 3	15	16.3	moderate - heavy
Noisy Cr.	15	2.4	light
Kingfisher Cr.	5	3.3	light
Reiter Cr. No. 1	30	4.5	light
Reiter Cr. No. 2	15	6.7	light
Holstein Cr. No. 1	5	8.4	moderate
Holstein Cr. No. 2	15	22.9	heavy

Larch Sawfly, Pristiphora erichsonii (Htg.)

Larval populations remained at a moderate to high level in 1966 throughout the range of western larch in the Vernon and Lumby B.C.F.S. Ranger districts. Damage to mature and immature larch generally was moderate, with pockets of complete defoliation, particularly in the Coldstream

Creek Valley. Defoliation was light to moderate in the Kelowna B.C.F.S. Ranger District but very light east of Penticton, Oliver and Osoyoos. Map 3 shows the areas of larch defoliation caused by the larch sawfly and larch bud moth. Defoliation caused by the two larch insects often overlapped making a clear distinction from the air difficult but generally larch sawfly infestations occurred below 4,000 feet in elevation and those of larch bud moth above 3,500 feet.

Larch sawfly cocoons were examined in October at plots which were established in 1965 at Becker Lake and near Aberdeen Lake. Sound and empty cocoons were gathered from a square foot of duff and soil near the base of each of 10 tagged trees at each plot. A comparison for 1965 and 1966 was as follows:

Location	Sound		Dead or empty	
	1965	1966	1965	1966
Becker L.	510	502	321	783
Aberdeen L.	330	270	261	518

In November, all dead or empty cocoons were examined to determine whether sawflies had emerged or, if not, the cause of mortality. Ten sound cocoons from each tree were dissected to determine parasitism and 200 were retained for rearing.

Examination of empty cocoons indicated that predation by mammals was the biggest single factor in destroying sawfly cocoons, although the percentage of parasitism by Mesoleius tenthredinus Morley increased significantly in 1966. Another parasite associated with the larch sawfly in the Nelson Forest District, Tritneptis klugii (Ratz.), was not found in cocoons in the East Kamloops District in 1965, but in 1966, six of 1,300 empty cocoons examined were suspected of having been parasitized by Tritneptis but none was found in sound cocoons. The following shows the percentage of emergence in empty cocoons and the probable cause of mortality of the remainder.

Location	% emerged		% apparently destroyed by									
			Predation				Parasites				Miscellaneous	
			Mammal		Elaterid		Mesoleius		Tritneptis			
	'65	'66	'65	'66	'65	'66	'65	'66	'65	'66	'65	'66
Becker L.	19	29	59	57	10	3	1	9	0	1	11	1
Aberdeen L.	39	28	22	62	10	3	8	4	0	1	21	1

At Becker Lake, an average of 51 sound cocoons per square foot over-wintered in 19650-1966. This resulted in an average 65% defoliation of the 10 tagged trees in the summer of 1966. In the fall of 1966 there was an average of 50 sound cocoons. Near Aberdeen Lake where there was an average of 33 sound cocoons in October 1965, defoliation in 1966 was 50%. In the fall there were 27 sound cocoons per square foot. Parasites were not a significant control factor in 1965 but had increased substantially in 1966 as shown below:

Location	Healthy		Parasitized by			
			Mesoleius		Tritneptis	
	1965	1966	1965	1966	1965	1966
Becker L.	92	61	8	39	0	0
Aberdeen L.	92	66	7	34	0	0

The number of cocoons with living sawfly larvae is probably sufficient to result in at least moderate defoliation in 1967.

A Larch Bud Moth, Zeiraphera sp.

There were seven infestations on western larch in the Lumby B. C. F. S. Ranger District varying in size from 50 to 1,500 acres (Table 6). Late in May and early in June larvae were collected from 3,500 feet to 5,200 feet elevation but visible defoliation occurred only above 4,000 feet. By mid-June there was severe defoliation of mature larch west of Harris Creek Valley and larvae had dropped onto and lightly defoliated understory larch prior to pupation. By mid-August, however, many trees had re-foliated. Egg sampling is generally considered to be an unreliable method of predicting future defoliation by this species and was not attempted. Parasitism and disease were not significant in mass collections of larvae taken in June and, provided the weather is suitable for overwintering eggs, it is likely that further defoliation will occur in 1967. Map 3 shows the areas of larch defoliation.

Table 6

Larch Bud Moth Defoliation on Western Larch,
East Kamloops District, 1966

Location	Est. no. acres	Defoliation
Putnam Cr.	1,500	heavy
Vance Cr.	500	heavy
Harris Cr.	1,000	heavy
Creighton Cr.	1,200	light to heavy

Table 6 continued

Location	Est. no. acres	Defoliation
Echo L.	1,000	medium to heavy
Ferry Cr.	200	light
Nicklen L.	50	light
Total	5,450	

OTHER NOTEWORTHY INSECTS

Cooley Spruce Gall Aphid, Adelges cooleyi (Gill.)

The intensity of spruce gall aphid attacks on its alternate host, Douglas-fir, varied greatly throughout the District. Less than 1% of the needles on the trees in the Falkland plot were infested while a few miles distant almost all of the needles of regeneration Douglas-fir in the Cedar Hill area were attacked. Five twigs from each of five trees in each of seven plots were examined and results are shown in Table 7.

Table 7

Percentage of Douglas-fir Needles Infested by Cooley Spruce Gall Aphid, East Kamloops District, 1966

Location	No. needles examined		% infested	
				67
Celista	4,133		16.9	
Monte Cr.	2,056	1801	28.9	0.9
Falkland	1,657	2299	0.9	0.08
Lumby	2,857	2025	3.5	2.2
Kelowna	2,263	1350	22.7	3.0
Coalmont	1,692	1343	34.2	13.4
Keremeos	2,306	1605	7.4	26.

Fall Webworm, Hyphantria cunea (Drury)

Defoliation caused by the fall webworm increased significantly in 1966, especially on dry sites such as at the head of Okanagan Lake. The chief host was chokecherry and bushes were often completely denuded. On moist sites, mountain alder was frequently attacked. Only occasional webs were noted on black cottonwood and trembling aspen. The number of webs per mile at the north end of Okanagan Lake counted from a slow-moving vehicle are shown in Table 8.

Table 8

Fall Webworm Strip Counts, Okanagan Lake.
East Kamloops District

Host	No. of webs per mile								Av. no. webs per mile	
	Mi. 0 - 1		1 - 2		2 - 3		3 - 4			
	1965	1966	1965	1966	1965	1966	1965	1966	1965	1966
Aspen, trembling	0	1	0	1	0	1	0	0	0	1
Chokecherry	67	206	58	186	21	156	225	1040	93	397
Other species	0	3	0	0	0	0	0	2	0	1
Totals	67	210	58	186	21	157	225	1042	93	399

Table 9 shows the number of webs counted on the Woodsdale strip from 1964 to 1966.

Table 9

Fall Webworm Strip Counts, East Kamloops District

Host	No. of webs per mile						Av. no. webs per mile		
	Mi. 0 - 1			1 - 2					
	1964	1965	1966	1964	1965	1966	1964	1965	1966
Alder, mountain	39	28	55	3	0	2	21	14	29
Chokecherry	9	11	36	122	84	167	66	48	102
Cottonwood, black	0	1	0	2	1	11	2	1	5
Other species	7	4	8	7	11	18	6	7	13
Totals	55	44	99	134	96	198	95	70	149

A Blotch Miner, ? Leucoptera sp.

The leaves of mature black cottonwood were extensively mined (Fig. 1) at widely scattered points in the District. Infestations occurred on 5 acres at Salmon Arm, 20 acres near Enderby, 10 acres in the BX District at Vernon, 20 acres east of Kelowna and 5 acres at Penticton. Leaves of the mid and upper crowns were most heavily damaged. In mid-August larvae dropped to leaves in the lower crowns or onto saplings and spun hammock-like cocoons (Fig. 2).

Aspen Leaf Miner, Phyllocnistis populiella Cham.

The percentage of trembling aspen leaves mined varied greatly throughout the District. The heaviest infestations occurred in the northern regions, notably in the Chase, Salmon Arm and Sicamous B.C.F.S. Ranger districts. A significant increase was also observed in the Aspen Grove area.

The leaves from a 12-inch branch sample from each of 10 trees were examined at four locations to determine the percentage of leaf surfaces mined and the number of adults produced (Table 10). While parasitism decreased in all examinations, mortality from other causes increased so that combined mortality decreased only slightly in 1966 (Table 11).

Table 10

Aspen Leaf Surfaces Mined and Number of Adults Produced per 100 Leaf Surfaces, East Kamloops District, 1963-1966

Location	% leaf surfaces mined				No. of adults produced per 100 leaf surfaces			
	1963	1964	1965	1966	1963	1964	1965	1966
Carlin	63	76	26	22	24	14	13	29
Phillips Lake	77	76	34	89	30	33	14	21
McCulloch	57	59	48	4	7	14	13	1
Aspen Grove	16	45	5	27	8	9	0.4	7

Table 11

Mortality of Aspen Leaf Miners in 100-cocoon Samples, East Kamloops District, 1963-1966

Location	% mortality							
	Parasitism				Other causes			
	1963	1964	1965	1966	1963	1964	1965	1966
Carlin	21	49	26	18	12	6	3	11
Phillips Lake	20	25	37	18	3	4	3	7
McCulloch	42	36	30	4	14	3	4	28
Aspen Grove	7	3	44	22	5	8	9	18

European Pine Shoot Moth, Rhyacionia buoliana (Schiff.)

A shoot moth survey was carried out in the Okanagan Valley between May 2 and June 10 by the Plant Protection Division, Canada Department of Agriculture and the Department of Forestry and Rural Development. Over 21,700 ornamental and native pines were examined in nurseries, residential gardens and in stands of native pine. Two larvae were collected from Scots pine terminals in a Christmas tree plantation near Westbank; these trees had been imported from Ontario. One pupa was taken from Austrian pine in a Vernon nursery but was not positively identified as a European pine shoot moth. No shoot moths were found on native pines 1/.

In an experimental project at Vernon it was shown that shoot moth larvae could successfully overwinter on caged ponderosa pine 2/.

Table 12

Other Insects of Current Minor Significance

Insect	Host	Locality	Remarks
Choristoneura fumiferana (Clem.) Spruce budworm	D	Okanagan Va.	Defoliator. Populations low. 13% of collections contained an average of 1.3 larvae.
Contarinia spp. Douglas-fir needle midges	D	Throughout District	Needle miner. Scarce. Less than 2% needles mined in 7 plots.
Dendroctonus brevicomis Lec. Western pine beetle	pP	Okanagan Va., Similkameen Va.	Bark beetle. Scarce. Two trees killed at Wood Lake.
Dryocoetes confusus Swaine Western balsam bark beetle	alF	Northern portion of District	Low populations; 200 dead trees, Anstey Mtn. 100, Tsuius Cr.; 200 Whiteman Cr.; 250, Harris Cr.

1/ Ross, D. A., R. O. Wood, J. C. Hamilton and W. E. Molyneux. 1966. European pine shoot moth survey Interior British Columbia, 1966. Dep. For. and Rural Dev., For. Res. Lab., Victoria. Inform. Rept. B. C.-X-6.

2/ Ross, D. A. 1966. Overwintering of Caged Rhyacionia buoliana (Schiffermuller) at Vernon, B. C. in 1965-66. J. Ent. Soc. B.C. 63:31.

Table 12 continued

Insect	Hosts	Locality	Remarks
Ips pini (Say) and I. plastographus Lec. Engraver beetles	pP	Okanagan Va.	Bark beetle. Numerous in slash. Killed groups of 10 or more trees near Vernon and Summerland.
Lambdina fiscellaria lugubrosa (Hulst) Western hemlock looper	wH	Enderby, Lumby	Defoliator. Very scarce. 2% of collections contained an average of one larva.
Neodiprion spp. Sawflies	wH, D	Throughout District	Defoliator. Increase on wH, decrease on D.
Neophasia menapia (F. & F.) Pine butterfly	pP	Vernon, Kelowna	Defoliator. A few adults in flight near Vernon-Okanagan Centre. Defoliation negligible.
Nepytia freemani Munroe A looper on Douglas-fir	D	Throughout District	Defoliator. 20% of collections contained an average of 1.3 larvae, half that of 1965.
Nuculaspis californica (Colem.) Black pine leaf scale	pP	Keremeos	Sucking insect. Moderate in Keremeos Park.
Orgyia pseudotsugata (McD.) Douglas-fir tussock moth	D	Southern portion of Dist.	Defoliator. No larvae collected in 1966.
Phenacaspis pinifoliae (Fitch) Pine needle scale	pP	Okanagan Valley	Sucking insect. Heavy east of Kelowna, otherwise light.
Stilpnotia salicis (L.) Satin moth	bCo, tA	Hedley	Defoliator. Infestation along Similkameen River collapsed.
Tortricoidea Unidentified	Antelope bush	Okanagan Valley	Defoliator. Severe defoliation from Kaleden to Osoyoos.
Trirhabda pilosa Blake A leaf beetle	Sagebrush	Penticton	Defoliator. Severe defoliation.
Vanessa cardui (L.) Painted lady	thistle, sticky geranium	Chase, Vernon, Enderby	Defoliator. Very numerous in fields.

FOREST DISEASE CONDITIONS

Currently Important Diseases

Weather Damage

Frost Injury

The foliage of many ponderosa pine was lightly damaged near Okanagan Lake from Kelowna to Vernon and in the vicinity of Wood and Kalamalka lakes. Pines on approximately 100 acres on the north side of Mission Creek had lost about 50% of their 1965 foliage.

Foliage Diseases

Needle Cast of Ponderosa Pine, Elytroderma deformans (Weir) Darker

This needle cast was prevalent throughout the range of ponderosa pine in the District and was particularly noticeable from Kelowna to Westwold. The heaviest damage occurred on the Commonage between Vernon and Okanagan Centre. Brooming and disfiguration of branches was common and needle drop was heavy. The 1966 foliage was often only one or two inches long.

Two plots were established in 1960 to follow the progress of Elytroderma infections. In 1960 there were 75 living trees in the Carr's Landing plot and 61 in the Glenemma plot. The number of living trees and the percentage foliage infection from 1962 to 1966 was as follows:

Location	No. living trees					% foliage infected				
	'62	'63	'64	'65	'66	'62	'63	'64	'65	'66
Carr's Landing	63	63	63	62	60 1/	41	35	19	22	24
Glenemma	56	56	56	56	54 2/	30	40	28	29	24

1/ 55 trees contained one or more "brooms"

2/ 47 trees contained one or more "brooms"

Larch Needle Cast, Hypodermella laricis Tub.

Infections were general throughout western larch stands in the Lumby B.C.F.S. Ranger District but were less severe than in 1965. Infections in the remainder of the East Kamloops District were negligible.

Mistletoe Diseases

Douglas-fir Dwarf Mistletoe, Arceuthobium douglasii Engelm.

Mature Douglas-fir in the Ashnola River Valley have been infected with dwarf mistletoe for years and most trees in the valley bottom from miles 8 to 15 are severely disfigured. Mistletoe plants were so numbeous on the branches of some trees that the green foliage was hidden and the trees were brown in appearance (Figure 3).

Infected Douglas-fir were common north of Kelowna on both sides of Okanagan Lake.

Lodgepole Pine Dwarf Mistletoe, Arceuthobium americanum Nutt. ex Engelm.

Heavily infected lodgepole pines were noted at high elevations east of Okanagan Falls and Oliver and in the vicinity of Pinaus Lake.

Exotic Plantations

Following is a summary of disease conditions on the two exotic plantations which are examined annually.

XP No.	Location	Exotic species	Remarks
222	Tamarack Lake, Kelowna	Pinus sylvestris	Trees healthy.
223	Terrace Mountain	Larix decidua Larix hybrid	Trees healthy but growth is slow. Not attacked by larch sawfly as were surrounding native Larix.

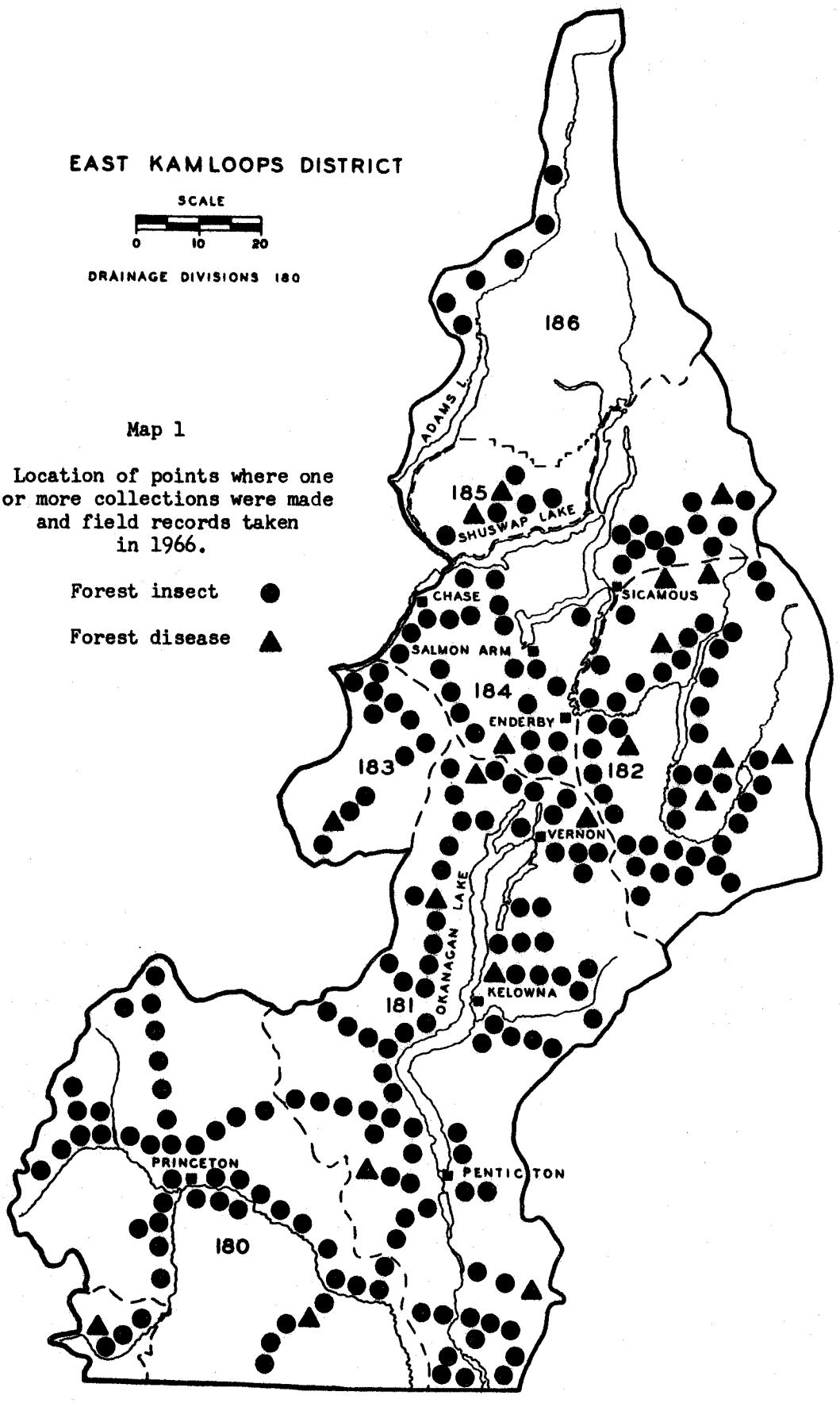
Table 13

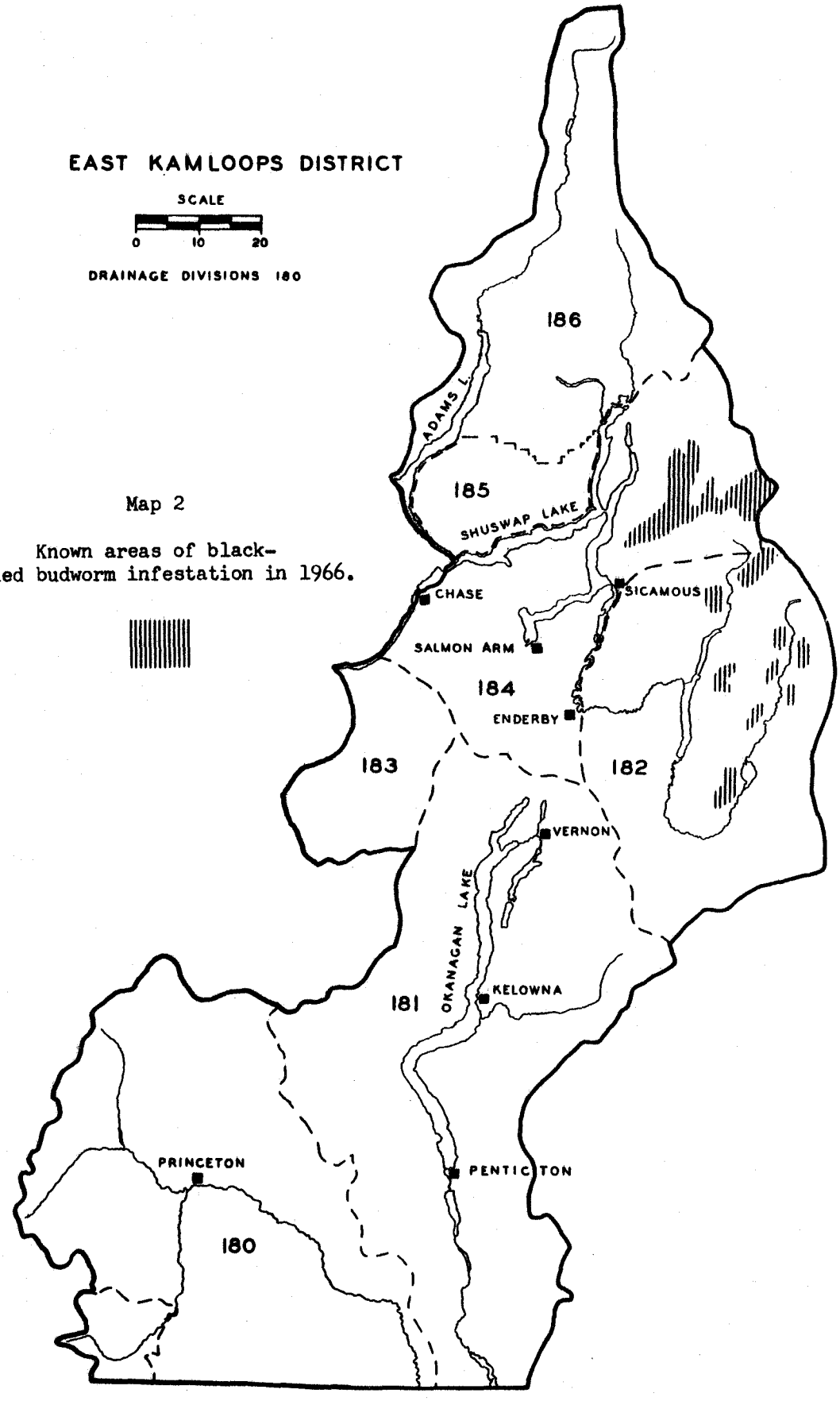
Other Diseases of Current Minor Significance

Organism and disease	Hosts	Location	Remarks
Epipolaeum tsugae (Dearn.) Shoem	wH	Taft	Sooty mold. Heavy in Crazy Creek Valley.
Melampsora medusae Thuem.	tA	Summerland	Leaf rust. Moderate damage in Deschamps Creek Valley.

Table 13 continued

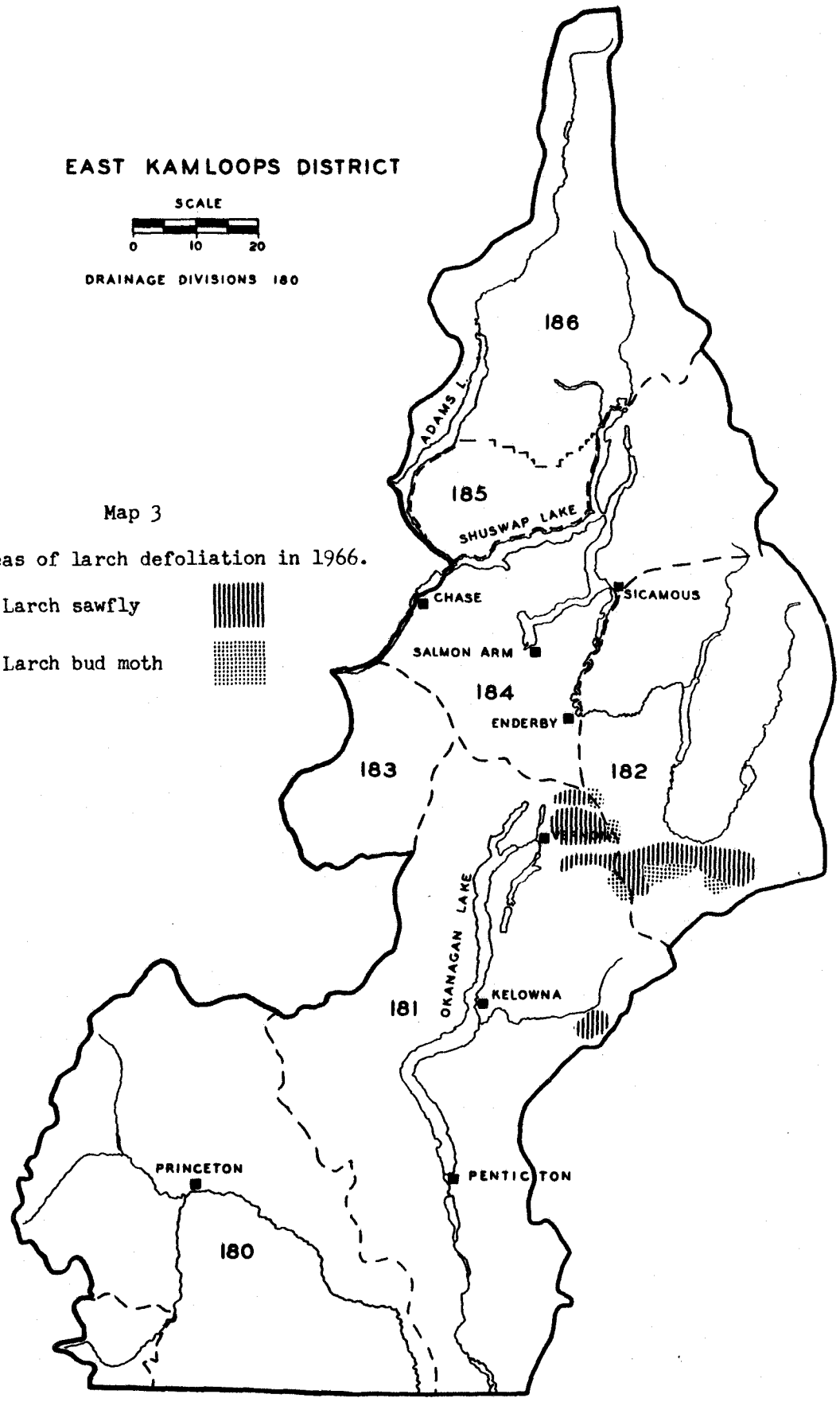
Organism and disease	Hosts	Location	Remarks
Melampsora occidentalis Jacks.	D	Falkland	Needle rust, small pockets of heavy infection.
Pole blight	wwP	Sicamous-Enderby	10 plots established to determine distribution.


EAST KAMLOOPS DISTRICT
SCALE
0 10 20
DRAINAGE DIVISIONS 180
Map 1
Location of points where one or more collections were made and field records taken in 1966.
Forest insect
Forest disease
186
185
184
183
182
181
180
ADAMS L.
SHUSWAP LAKE
CHASE
SICAMOUS
SALMON ARM
ENDERBY
VERNON
OKANAGAN LAKE
KELOWNA
PRINCETON
PENTICTON



Map 2

Known areas of black-headed budworm infestation in 1966.



Map 3

Known areas of larch defoliation in 1966.

Larch sawfly

Larch bud moth

Fig. 1. Black cottonwood leaf damaged by a blotch miner, ? Leucoptera sp.; also shows frass in the mine. Salmon Arm, East Kamloops District, September, 1966. J. K. Harvey

Fig. 2. Hammock-like cocoons constructed on cottonwood leaf by a blotch miner, ? Leucoptera sp., Salmon Arm, East Kamloops District, October, 1966.

J. K. Harvey

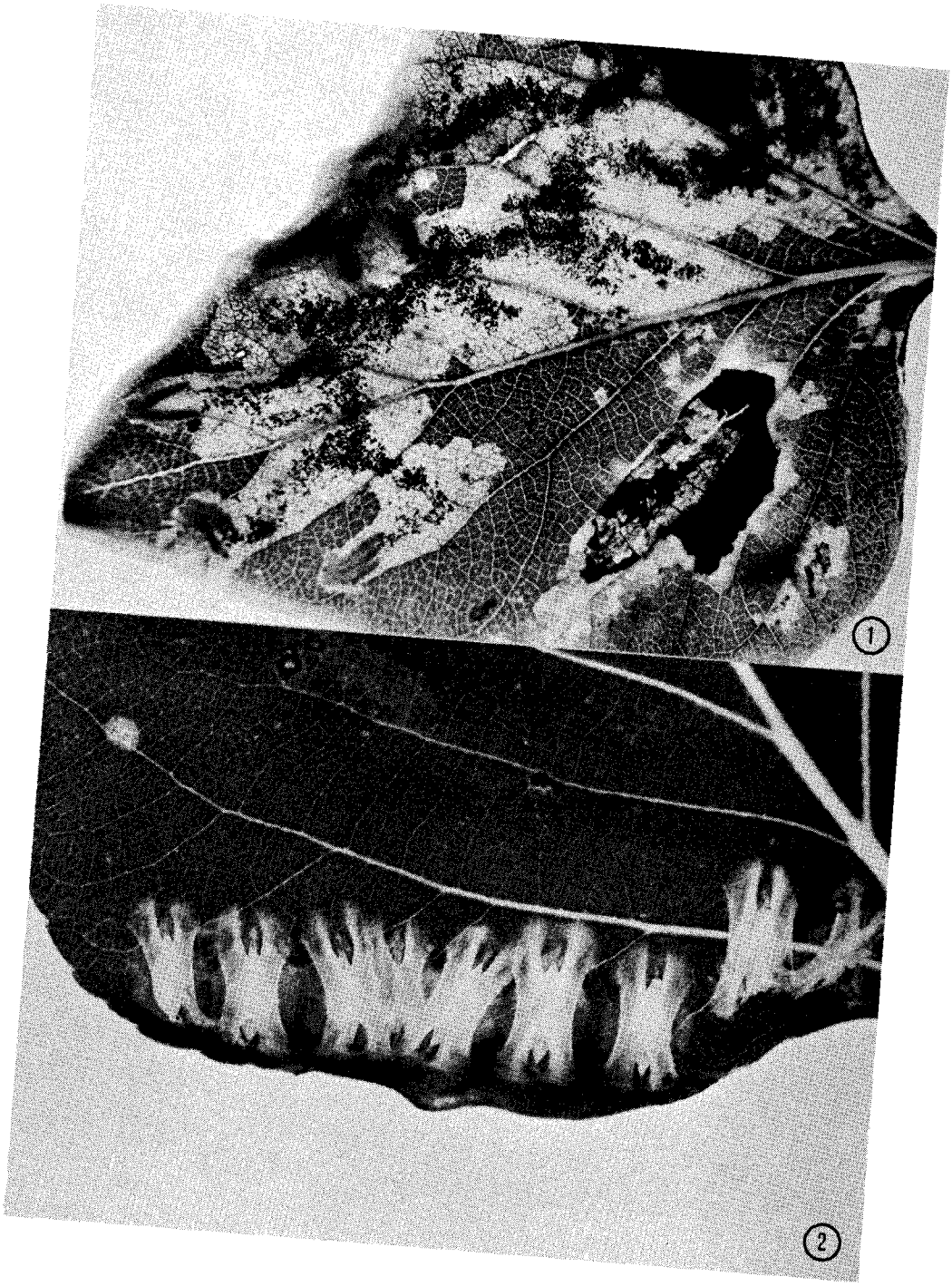

1
2

Fig. 3. Mistletoe on Douglas-fir, Arceuthobium douglasii Engelm. Female plant. Ashnola R., East Kamloops District, July, 1966. J. K. Harvey

FOREST INSECT AND DISEASE SURVEY

CENTRAL KAMLOOPS DISTRICT

1966

FOREST INSECT AND DISEASE SURVEY

CENTRAL KAMLOOPS DISTRICT

1966

R. O. Wood 1/

INTRODUCTION

Field work in the District commenced on May 16 and terminated on October 31. A special survey for European pine shoot moth was carried out in Kamloops and vicinity with negative results. Ten hours of flying time was used in aerial reconnaissance in the District in 1966.

In addition to regular field duties, the writer supervised the European pine shoot moth survey in the Interior of British Columbia and coordinated the work between the Department of Forestry and Rural Development and the Penticton Branch of the Department of Agriculture, Plant Protection Division. One week in July was spent in the West Kamloops District and assistance was given during the black-headed budworm egg survey in the East Kamloops District in October.

Table 1 lists the insect and disease collections by host; Table 2 shows the principal problems by drainage divisions. Map 1 shows the locations of collections and illustrates the drainage divisions of the District.

Table 1

Collections by Hosts

Central Kamloops District, 1966

Coniferous hosts	Forest insects	Forest diseases	Broad-leaved hosts	Forest insects	Forest diseases
Cedar, western red	19	0	Aspen, trembling	11	4
Douglas-fir	107	15	Birch, species	5	0
Fir, alpine	35	3	Cottonwood, black	5	1
Hemlock, western	38	1	Willow, species	3	1
Juniper, common	4	0	Miscellaneous	10	4
Juniper, Rocky Mtn.	14	4			
Pine, lodgepole	28	4			
Pine, ponderosa	48	5			
Pine, western white	6	0			
Spruce, Engelmann	54	5			
Totals	353	37		34	10
			GRAND TOTALS	387	47

1/ Forest Research Technician, Forest Insect and Disease Survey, Vernon.

Table 2

Currently Important Insect and Disease [1] Problems by Drainage Divisions, Central Kamloops District, 1966

Insect and disease problems	Principal hosts [2]	Importance by drainage divisions [3]						
		160	161	162	163	164	165	166
BARK BEETLES								
Mountain pine beetle	pP, wP	4	1	4	4	1	4	0
Douglas-fir beetle	D	1	0	1	1	0	0	0
Spruce beetle	eS	0	0	0	2	3	2	0
DEFOLIATORS								
Black-headed budworm	wH, eS, D, wC, alF	1	1	1	1	1	3	0
FOLIAGE DISEASES								
Pine needle cast, *Elytroderma deformans* (Weir) Darker	pP	3	0	3	3	0	0	0
A pine needle cast, *Hypodermella concolor* (Dearn.) Darker	lP	3	0	0	0	0	0	0
MISTLETOE DISEASES								
Dwarf mistletoe, *Arceuthobium americanum* Nutt. ex Engelm.	lP	3	4	0	3	0	0	0
WEATHER DAMAGE								
Climatic injury	pP	2	0	0	0	0	0	0

1/ Includes only weather-induced and foliage diseases subject to notable annual fluctuations.

2/ Refer to host code in Kamloops Forest District Introduction.

3/ High population and/or widespread outbreak in progress - 5

Scattered high populations and/or significant damage in restricted areas - 4

Rising population and/or moderate numbers of insects and/or potential problem - 3

Static or falling population and/or moderate numbers of insects and/or no problem at present - 2

Endemic population and/or no significant damage - 1

Not sampled and/or no host and/or not found - 0

FOREST INSECT CONDITIONS

Important Insects

Bark Beetles

Mountain Pine Beetle, Dendroctonus ponderosae Hopk.

Significant damage was caused to ponderosa pine in the central and southern parts of the District and to western white pine near Blue River. An estimated 6,985 red-topped ponderosa pine and 500 western white pine were noted during aerial surveys in 1966. Table 3 shows the location, species and number of mountain pine beetle-killed trees observed; Map 2 shows the distribution of these trees.

Table 3

Location and Number of Pine Trees Killed by Mountain Pine Beetle as Estimated from Aerial Surveys, Central Kamloops District, 1966

Location	Tree species	No. of trees
Chapperon Lake	pP	5,000
Clapperton Creek	pP	80
Nicola River	pP	470
Highland Valley	pP	20
Guichon Creek	pP	20
Durand Creek	pP	30
Tranquille Creek	pP	315
Paul Lake	pP	15
Pinantan Lake	pP	285
Deadman River	pP	150
North Thompson River (Kamloops to Blackpool)	pP	100
Chase	pP	500
Blue River	wP	500
Total		7,485

The infestation in ponderosa pine at Chapperon Lake continued in 1966. The area as mapped from the air covered 1,750 acres. Half-square-foot bark samples taken on May 20 yielded an average of 15 specimens per sample; 59% were large larvae, 40% small larvae and 1% were pupae. A few old adults

were found in randomly selected trees. Although logging of infested trees is now in progress it is doubtful that this will control the population. Cull logs and tops in the area were quite heavily infested with beetles and if not burned or removed will probably perpetuate the infestation.

Near Chase, the number of red-topped ponderosa pines increased from 104 in 1965 to 500 in 1966. A prism cruise was made in October to determine the volume loss. A 20-diopter prism was used to establish plots every three chains along a 57-chain strip. The following data are results of the cruise:

No. trees examined	% of trees			
	Healthy	Current attack	Red	Old grey
61	25	14	51	10

Beetle-killed pine trees in this locality averaged 31 cubic feet per tree, making a current volume loss of 15,500 cubic feet in the 500 trees killed in the area.

Two species of three-toed woodpeckers, Picoides arcticus (Swainson) and Picoides tridactylus (Linn.), were observed feeding on beetle-infested trees in this area.

Color change plots at Chapperon Lake and near Chase were examined at regular intervals from May to October. Observations indicate that in recent years trees lost up to 95% of the foliage by the end of the second year after attack, with most loss occurring during the second year. Some needles were retained up to three years.

Table 4 shows the record of color change and needle loss as determined from examinations of the plot at Chapperon Lake for the years 1963-1966.

Douglas-fir Beetle, Dendroctonus pseudotsugae Hopk.

There was a marked decrease in the number of red-topped Douglas-fir trees counted in the District in 1966. Table 5 gives the location and number of beetle-killed trees noted during aerial surveys.

Table 4

A Progressive Record of Foliage Color Change and Needle Loss of Beetle-killed Ponderosa Pine, Chapperon Lake, Central Kamloops District, 1963-1966

Date of examination	Trees attacked in 1963					Trees attacked in 1964					Trees attacked in 1965				
	No. trees in plot	Green	Fading	Red	Av. % needle loss	No. trees in plot	Green	Fading	Red	Av. % needle loss	No. trees in plot	Green	Fading	Red	Av. % needle loss
1963 Sept.	13	13	0	0	0										
1964 May		4	5	4	3										
June		0	5	8	4										
Aug.		0	4	9	8	18	18	0	0	0					
Nov.		0	0	13	28		5	12	1	0					
1965 May		0	0	13	37		0	5	13	0					
July		0	0	13	69		0	1	17	2					
Aug.		0	0	13	79		0	0	18	4					
Oct.		0	0	13	94		0	0	18	20	30	30	0	0	0
1966 May		0	0	7[1]	99		0	0	18	61		4	21	5	2
July							0	0	18[2]	69		3	19	8[2]	3
Oct.							0	0	16[2]	83		2	0	25[2]	39

1/ Remainder of trees lost 100% of needle complement
2/ Remainder of trees logged

Table 5

Douglas-fir Trees Killed by Douglas-fir Beetle from 1963 to 1965 as Determined in 1966, Central Kamloops District

Location	No. of trees	Est. volume of timber (cu. ft.)
Vavenby	10	1,000
Mamette Lake	10	900
Louis Creek	10	900
Tranquille Creek	145	14,500
Deadman River	60	5,400
Loon Lake	425	29,750
Nicola River	40	3,200
Highland Valley	100	9,000
Totals	800	64,650

Bark beetle larvae were noted in logging slash, stumps and decked logs at widely separated locations, notably along roads near Little Shuswap, Peterhope, Mamette, Knouff, Saskum and Johnson lakes, Deadman River and Jamieson Creek.

At Little Shuswap Lake, an estimated five acres of logging slash on the Indian Reserve was infested with a light beetle population in 1966. On June 24 there was an average of 26 larvae in half-square-foot bark samples from cull logs and an average of eight larvae in samples from stumps.

Color change plots were examined at intervals to assess the needle loss on trees attacked in 1963 and 1964. At Tranquille Creek, one plot of 1963-attacked trees had dropped 100% of the needle complement by June, 1966. Estimations of needle drop were continued on 1964-attacked trees at Loon Lake, Highland Valley and Tranquille Creek. About 65% of the needles were dropped by the end of the first year after attack although some trees lost 100%. By the end of the second year, about 95% of the needle complement was lost. Table 6 gives a progressive record of color change studies in the District on beetle-attacked Douglas-fir trees.

Table 6

A Progressive Record of Color Change and Foliage Loss of Beetle-killed Douglas-fir, Central Kamloops District

Date of examination	No. trees in plot	Foliage condition				
		Green	Fading	Red	100% needle loss	Av. % needle loss
				Trees attacked in 1963		
1965: June	28	0	0	9	19	93
1966: June		0	0	0	28	100
				Trees attacked in 1964		
1965: May	75	16	57	2	0	2
June		10	11	54	0	22
August		1	1	73	0	54
October		0	0	67	8	66
1966: May		0	0	54	17 1/	93
August		0	0	51	19 1/	94
October		0	0	36	31 1/	97

1/ Remainder of trees cut

Spruce Beetle, Dendroctonus obesus (Mann.)

Engelmann spruce in the North Thompson River drainage were lightly to moderately attacked in 1966. Occasional trees and decked logs containing beetle larvae were found along the North Thompson River road west of Gosnell, along the Canoe River road and north-west of Kamloops in the Jamieson Creek area. At Moira Lake the infestation continued; moderate populations of adults and larvae were found in stumps and windfalls on May 11.

A trap tree program was initiated by Clearwater Timber Co. near Moira Lake early in June. Thirty-seven trees 12 to 14 inches dbh were felled in groups of from three to five along 1.5 miles of road. Table 7 shows the number and stage of spruce beetles in square-foot bark samples taken from randomly selected trap trees on June 30.

Table 7

Number of Galleries and Stage of Spruce Beetle Present in Square-foot Bark Samples, Moira Lake, Central Kamloops District, 1966.

Tree no.	Log section	No. galleries per sq. ft.	No. adults present	Other stages present
1	butt	7	7	0
	mid	14	18	0
	upper	6	10	egg
2	butt	0	0	0
	mid	0	0	0
	upper	7	10	egg
3	butt	1	1	0
	mid	8	17	egg
	upper	6	12	egg
Av. per sq. ft.		5	8.3	

The upper surfaces of all trap trees were heavily infested with Ips spp. Bark samples were taken from the sides and underside of the logs. The average of eight adults per square foot is not considered to be a true indication of the immediate hazard. It is believed that the majority of the beetles in this locality have a two year life cycle; the heaviest attack would therefore occur in 1967. Additional sampling of the trap trees was prevented by their removal to the sawmill in July.

Logging operations are expected to have the infested area clear-cut by 1967.

Defoliators

Black-headed Budworm, Acleris variana (Fern.)

Populations of this budworm were light on Engelmann spruce, alpine fir and Douglas-fir in 1966. The largest numbers of larvae were collected from western hemlock in the Blue River area but were lower than in 1965. In 1965, collections in this area were 82% positive with an average of 50 larvae per collection; in 1966 only 71% of the collections were positive with an average of 19.1 larvae.

Defoliation estimates and egg counts were done early in October. Defoliation was not visible from the air. Estimates from ground observations varied from 5 - 10% of the current year's growth and about 2% of the total foliage. Egg counts were made on five 10-inch branches cut from various crown levels of each of three trees at each plot. At the laboratory a caustic solution and filter was used to remove the eggs from the foliage samples. A comparison of egg counts made in 1965 with those of 1966 is as follows:

Location	Variation in no. eggs per branch		Av. no. eggs per branch	
	1965	1966	1965	1966
Mud Lake	1 - 12	0 - 23	4.4	10.3
Blue River	1 - 23	1 - 15	8.1	6.5

It is expected that populations of the black-headed budworm will be moderate near Blue River in 1967.

Other Noteworthy Insects

Spruce Budworm, Choristoneura fumiferana (Clem.)

Two-year-cycle budworm larvae were collected only in the Jamieson Creek area with a maximum of 10 larvae per collection. Estimated defoliation of overstory Engelmann spruce and alpine fir at the Jamieson Creek plot was from 5 to 10%; on 100 understory trees it ranged from 0 to 2%. Only four egg masses were found on 20 square feet of foliage examined. No evidence of the insect was found near Grizzly or McGillivray lakes where plots have been sampled annually since 1960.

Fall Webworm, Hyphantria cunea (Drury)

Road side counts of webs were made along both sides of the road for

three miles west of Savona and for seven miles along the Nicola River east of Spences Bridge. The average number of webs per mile near Savona increased from 15 in 1965 to 94 in 1966; near Spences Bridge there was a slight reduction (Table 8).

Table 8

Roadside Web Counts of Fall Webworm near Savona and along Nicola River, Central Kamloops District, 1966

Host	No. webs per mile							Av. per mile
	Mile 0-1	1-2	2-3	3-4	4-5	5-6	6-7	
Savona								
Chokecherry	134	2	3	-	-	-	-	46
Black cottonwood	39	27	38	-	-	-	-	34
Miscellaneous	15	21	5	-	-	-	-	13
Totals: 1966	188	50	46	-	-	-	-	94
1965	22	14	10	-	-	-	-	15
Nicola River								
Chokecherry	23	4	8	0	6	0	0	5
Black cottonwood	20	1	2	0	0	0	1	3
Miscellaneous	3	0	2	2	4	0	0	1
Totals: 1966	46	5	12	2	10	0	1	11
1965	11	4	11	24	22	3	9	12

Aspen Leaf Miner, Phyllocnistis populiella Cham.

Infestations of aspen leaf miner in the Central Kamloops District were generally light in 1966. A comparison of plot records taken since 1964 showed a fluctuating population. A decrease in parasitism coincided with an increase in the number of adult leaf miners produced at two plots (Table 9). Data on parasitism at four plots are shown in Table 10. An insufficient number of cocoons at Deadman River prevented cocoon sampling in 1966.

Table 9

Aspen Leaf Surfaces Mined and Number of Adults Produced per 100 Surfaces, Central Kamloops District, 1966

Location	% leaf surfaces with mines			No. adults produced per 100 surfaces		
	1964	1965	1966	1964	1965	1966
Paul Lake	47	26	28	1	0.7	8.2
Cache Creek	18	29	5	6	1.7	1.3
Campbell Range	41	28	21	19	2.1	9.9
Coldwater River	29	44	3	1	4.0	1.1
Deadman River	29	36	6	6	2.4	-

Table 10

Mortality of Aspen Leaf Miners in 100-cocoon Samples, Central Kamloops District, 1964-1966

Location	% mortality					
	Parasitism			Other causes		
	1964	1965	1966	1964	1965	1966
Paul Lake	42	46	27	18	14	1
Cache Creek	36	55	27	10	5	2
Campbell Range	23	69	22	8	14	0
Coldwater River	48	42	46	16	20	5
Deadman River	30	60	-	5	12	-

Douglas-fir Needle Midges, Contarinia spp.

A maximum of 2.8% of needles on Douglas-fir were infested with needle midges at sample plots in the District in 1966. Samples consisted of five current year's terminals from each of five trees at each plot. Table 11 gives a comparison between results of 1965 and 1966 needle counts at four plots.

Table 11

Number of Needles Examined and Percentage of Needles Infested by Douglas-fir Needle Midges, Central Kamloops District, 1965 and 1966

Location	No. needles examined		% needles infested	
	1965	1966	1965	1966
Monte Creek	2,580	1,947	0.3	0.5
Cherry Creek	2,431	1,724	0.1	0.7
Heffley Creek	2,142	2,766	9.2	1.1
Barriere	2,695	2,811	0.7	2.8

Engelmann Spruce Weevil, Pissodes engelmanni Hopk.

Three plots containing 100 trees each were examined in the Clearwater area to determine the intensity of attack by this weevil. Current attack on reproduction Engelmann spruce was as high as 25% as shown below:

Location	% trees		
	Current attack	Old attack	Uninfested
Reflector Lake	15	13	72
Grizzly Lake	2	6	92
Candle Creek	25	9	66

Table 12

Other Insects of Current Minor Significance

Insect	Host	Locality	Remarks
Barbara colfaxiana Kft. Douglas-fir cone moth	D	Heffley Cr., Glimpse Lake Rd.	Feeds on seeds in cones; 26-58% of cones infested in 50-cone samples.
Dendroctonus valens Lec. Red turpentine beetle	pP	Nicola River, Lac le Jeune Rd.	A bark beetle; small numbers of adults found in cull logs.
Dioryctria auranticella Dyar A pine coneworm	pP	Mamette Lake, Nicola, Savona, Little Shuswap Lake.	From 60 to 100% of cones infested in 20-cone samples.

Other Insects of Current Minor Significance - continued

Insect	Host	Locality	Remarks
Dryocoetes confusus Swaine Western balsam bark beetle	alF	Moira Lake	About 500 trees killed.
Lambdina fiscellaria lugubrosa (Hulst) Western hemlock looper	wH	North Thompson River area	Thirty-three per cent of collections contained an average of 1.1 larvae.
Laspeyresia prob. miscitata Heinr. A pine seed moth	pP	Nicola, Savona, Little Shuswap Lake	From 52 to 64% of cones infested in 50-cone samples.
Laspeyresia youngana (Kearf.) Spruce seed moth	eS	Clearwater area	From 7 to 15% of cones infested in 100-cone samples.
Monochamus sp. Round-headed borer	eS, alF	Clearwater	Infested log decks in mill yard.
Neodiprion sp. A sawfly	D	Widespread	A defoliator; 25% of collections were positive with an average of 1.9 larvae.
Neophasia menapia Feld. Pine butterfly	in flight	Kamloops	A defoliator; occasional adults observed.
Nepytia freemani Munroe A Douglas-fir looper	D	General	A defoliator; 11% of collections contained an average of 1.7 larvae.
Nothorhina aspera Lec. A round-headed borer	eS	Clearwater	One adult emerged from infested log sample.
Orgyia pseudotsugata (McD) Douglas-fir tussock moth	D	Cache Creek, Heffley Creek	A defoliator; only two larvae collected in 1966.
Pissodes piperi Hopk. A weevil in alpine fir	alF	Clearwater	Infested log decks in mill yard.
Serropalpus sp. A wood borer	alF	Clearwater	Adults and larvae found in logs in mill yard.
Sternochetus lapathi (L.) Poplar-and-willow borer	W	Nicola River, Wells Gray Park Road	Larvae bore into stems; light population.

Other Insects of Current Minor Significance - continued

Insect	Host	Locality	Remarks
Stilpnotia salicis (L.) Satin moth	bCo, tA	Douglas Lake, Wells Gray Park Road	Estimated 150 acres of tA defoliated near Wells Gray Park; 10 larvae collected from bCo near Douglas Lake.
Urocerus sp. A wood wasp	alF	Clearwater	One adult reared from infested log sample.
Xyela sp. A sawfly	pP	Widespread	Larvae infest staminate flowers; up to 47% of flowers infested.

FOREST DISEASE CONDITIONS

Currently Important Diseases

Foliage Diseases

Needle Cast of Ponderosa Pine, Elytroderma deformans (Weir) Darker

Scattered areas of ponderosa pines in the District were infected with this needle cast in 1966, the most significant of which was on Promontory Mountain. Other localities with moderate to heavy infection were: Tranquille Creek, along the North Thompson River from Kamloops to Jamieson Creek, west of Kamloops to Savona and at Nicola Lake.

The two permanent plots established in the District to record the effect of the disease on ponderosa pine were examined early in August. Since 1959, 30% of a 71-tree plot along the Lac le Jeune Road have died; this does not include a small number of trees weakened by the disease and killed by mountain pine beetle. In a 30-tree plot on Promontory Mountain, 7% of the trees have died. Mortality was restricted to suppressed and intermediate crown class trees.

Data from observations at these plots for the years 1964 to 1966 are recorded in Table 13.

Table 13

Needle Cast Damage on Ponderosa Pine at Two Sample Plots, Central Kamloops District, 1964-1966

Est. % foliage infected	No. of trees and infection class					
	Lower Nicola			Lac le Jeune		
	1964	1965	1966 1/	1964	1965	1966
0	1	0	0	0	4	1
10	4	8	5	18	22	18
20	5	3	4	10	4	9
30	4	0	4	6	6	2
40	1	0	3	0	2	5
50	3	6	1	4	3	3
60	1	0	1	1	1	2
70	0	4	3	1	4	0
80	1	0	1	3	0	4
90	9	8	2	10	6	0
100	0	0	2	1	0	0
Dead	1	1	2	17	19	27 2/

1/ Two trees not found in 1966

2/ Includes five trees killed by mountain pine beetle

A Needle Cast, Hypodermella concolor (Dearn.) Darker

Lodgepole pine trees at the junction of the Mamette Lake - Highland Valley roads were infected by H. concolor in 1966. On August 10, 410 needles on three branch samples were examined; 17% were discolored. Approximately half the needle bundles had both needles infected while on others only one was damaged. Some needle drop had occurred by August 10.

Branch samples with damage by this organism were also taken near the junction of the Face Lake - Mamette Lake roads.

Mistletoe Diseases

Dwarf Mistletoe, Arceuthobium americanum Nutt. ex Engelm.

Lodgepole pine in many areas of the District have been lightly to heavily infected by A. americanum. At Mile 25, Highland Valley Road, 50 trees were examined and all were severely infected. Lodgepole pines with lesser degrees of infection were noted along Scottie, Clapperton and Tranquille creeks.

Weather Damage

Climatic Injury

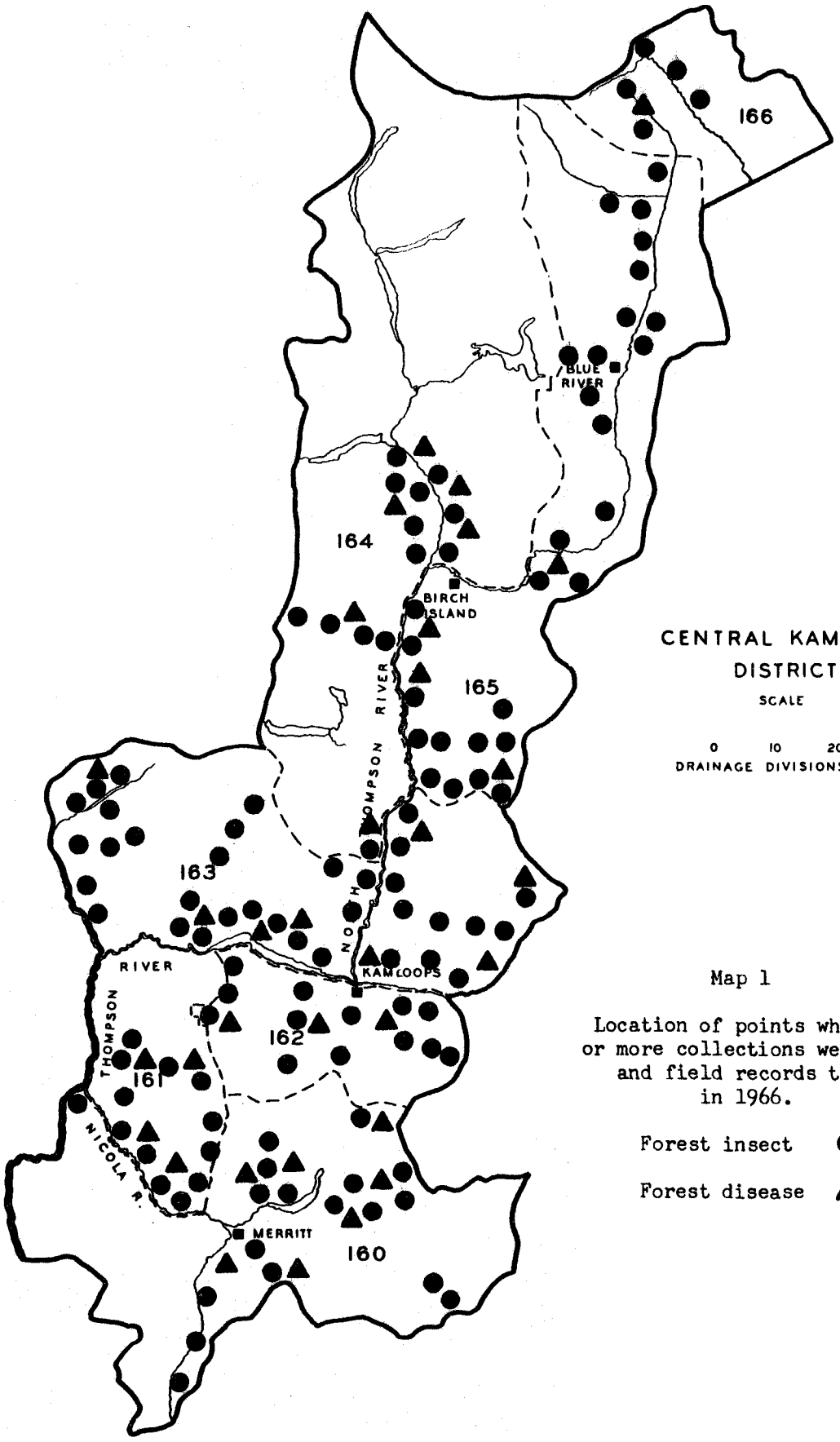
On May 16, ponderosa pine trees with discolored foliage were observed

about 800 feet above the Mamette Lake Road. These trees were in a strip estimated to be 100 yards wide by three miles long. A similar condition was noted on May 31 in an area 500 feet above the north shore of Nicola Lake. Subsequent examinations showed that the amount of discoloration varied on the needles; some were affected only on the tip while others were red for the outer two-thirds of their length. Some needles on mature trees were completely red. Damage was present on ponderosa pines of all sizes but Douglas-fir trees in the stand were not affected.

Table 14

Other Diseases of Current Minor Significance

Organism and disease	Host	Locality	Remarks
Chrysomyxa arctostaphyli Diet. A needle rust	eS	Louis Creek	Light infection noted.
Chrysomyxa weirii Jacks. A needle rust	eS	Bridge Lake Road	Only light infection.
Gymnosporangium nidus-avis Thaxt. Bird's nest rust	roJ	Nicola	Causes witches' brooms and swelling of stems.
Melampsora medusae Thuem. A foliage rust	tA	Campbell Range	Western larch and Douglas-fir alternate hosts; heavy infection in localized areas.
Phacidium abietis (Dearn.) Reid & Cain A snow blight	D	Tranquille Creek	A needle blight infecting needles buried by snow.
Phaeocryptopus gaeumannii (Rohde) Petr. A needle cast	D	Adams Lake	Damaging to young plantations.
Pucciniastrum epilobii Otth Balsam needle rust	alF	McGillivray Lake	Heavy infection in localized areas.
Rhabdocline pseudotsugae Syd. Douglas-fir needle cast	D	Mamette Lake	Light infection on small trees.



CENTRAL KAMLOOPS DISTRICT

SCALE

0 10 20

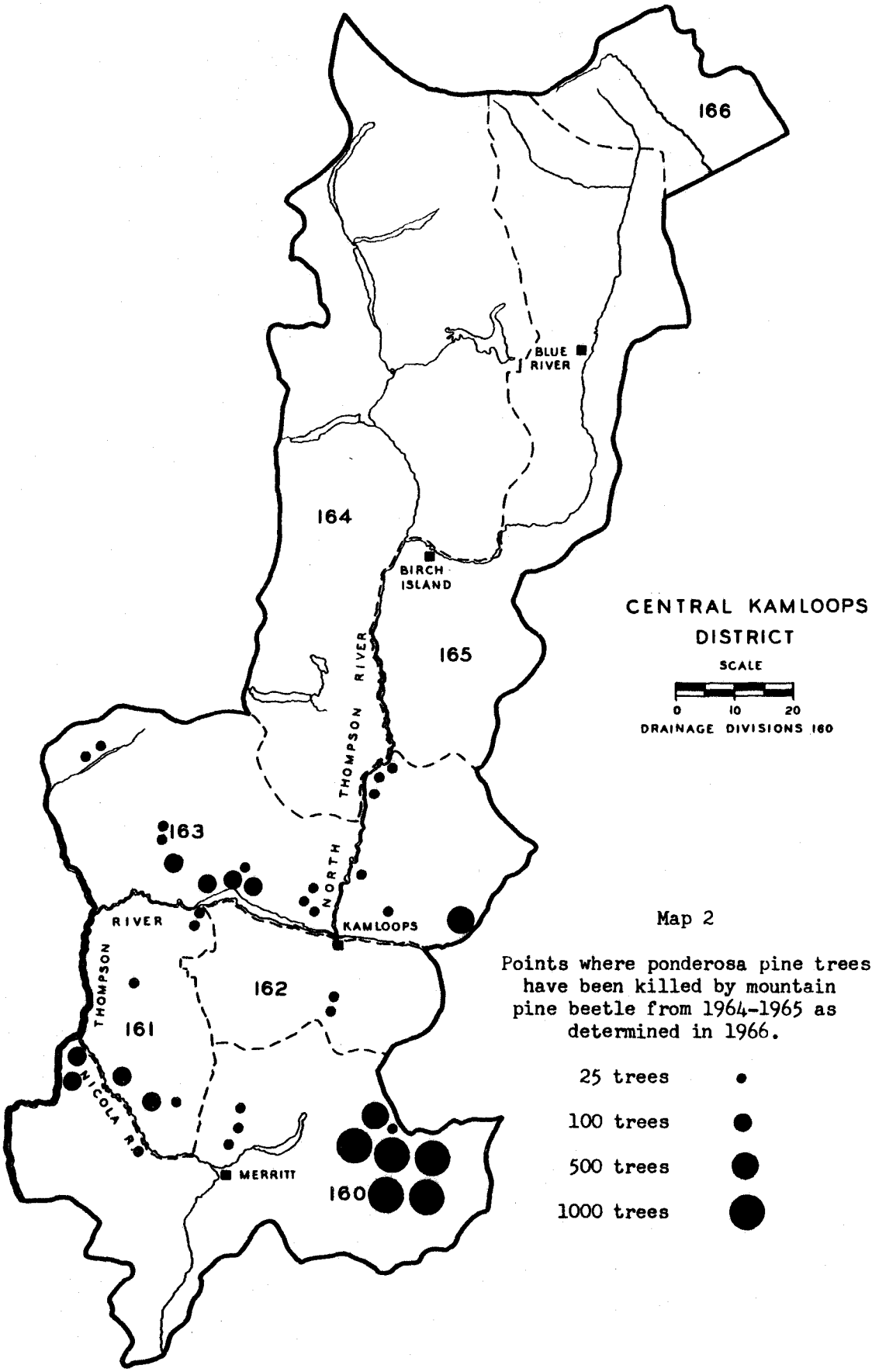
DRAINAGE DIVISIONS 160

Map 1

Location of points where one or more collections were made and field records taken in 1966.

Forest insect ●

Forest disease ▲



Map 2

Points where ponderosa pine trees have been killed by mountain pine beetle from 1964-1965 as determined in 1966.

25 trees •

100 trees ●

500 trees ●

1000 trees ●

FOREST INSECT AND DISEASE SURVEY

WEST KAMLOOPS DISTRICT

1966

FOREST INSECT AND DISEASE SURVEY

WEST KAMLOOPS DISTRICT

1966

N. J. Geistlinger [1]

INTRODUCTION

Regular field work in the District commenced on May 16 and terminated September 28. Cruise strips were run in mountain pine beetle infestations in October and November.

Personnel of the Forest Research Laboratory, Victoria, conducted a special survey in July to determine the effects of a spring frost on Douglas-fir trees in the Williams Lake area. An aircraft for a survey of frost damaged areas late in May was provided by the British Columbia Forest Service.

Assistance was given in the spruce beetle survey in Prince George Forest District from September 6 to 15, and in a wood-borer control project near Vernon. Douglas-fir needle midge sampling was supervised in the East Nelson District during the summer.

Approximately 10 hours flying time were used to determine the status of bark beetle infestations in the District.

Table 1 lists insect and disease collections by host. Map 1 shows locations where one or more collections were made or field records taken in 1966 and illustrates the drainage divisions of the District.

Principal problems in each Forest Insect and Disease Survey Drainage Division are shown in Table 2.

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[1] Forest Research Technician, Forest Insect and Disease Survey Ranger, Vernon.

Table 1

Collections by Hosts

West Kamloops District, 1966

Coniferous hosts	Forest insects	Forest diseases	Broad-leaved hosts	Forest insects	Forest diseases
Cedar, western red	2	1	Alder species	1	-
Douglas-fir	135	8	Aspen, trembling	22	3
Fir, alpine	5	1	Birch species	9	-
Hemlock, western	1	-	Cherry, bitter	2	-
Juniper, common	5	-	Cottonwood, black	2	1
Juniper, Rocky Mtn.	24	-	Maple, Douglas	2	1
Pine, lodgepole	71	3	Willow species	1	-
Pine, ponderosa	28	-	Miscellaneous	2	2
Spruce, Engelmann	58	3			
Totals	329	16	Totals	41	7
			GRAND TOTALS	370	23

Table 2

Currently Important Insect and Disease [1] Problems by Drainage Divisions, West Kamloops District, 1966

Insect and disease problems	Principal hosts [2]	Importance by drainage divisions [3]						
		140	141	142	143	144	145	146
BARK BEETLES								
Douglas-fir beetle	D	1	1	1	2	2	1	1
Mountain pine beetle	lP, pP	4	1	1	1	5	1	5
WEATHER DAMAGE								
Frost damage of Douglas-fir	D	0	0	0	5	5	0	0
Climatic injury of lodgepole pine	lP	0	0	0	0	4	0	0
FOLIAGE DISEASES								
Pine needle cast	pP	0	0	0	0	4	0	0

1/ Includes only weather-induced and foliage diseases subject to notable annual fluctuation.

2/ Refer to host code in Kamloops Forest District Introduction

3/ High population and/or widespread outbreak in progress - 5

Scattered high populations and/or significant damage in restricted areas - 4

Rising population and/or moderate numbers of insects and/or potential problem - 3

Static or falling population and/or moderate numbers of insects and/or no problem at present - 2

Endemic population and/or no significant damage - 1

Not sampled and/or no host and/or not found - 0

FOREST INSECT CONDITIONS

Currently Important Insects

Bark Beetles

Douglas-fir Beetle, Dendroctonus pseudotsugae Hopk.

Mortality of Douglas-fir trees attributable to attack by this beetle declined sharply in 1966 in all areas of infestation. Annual losses have decreased since 1963 (Table 3). Largest numbers of red-tops were east of the Fraser River from Clinton to Dog Creek and west in the Chilcotin River Valley (Map 2).

Brood mortality studies were not conducted in the spring of 1966 as no 1965 beetle-attacked Douglas-fir trees could be located.

Annual examination of the stand depletion strips in the Lac la Hache and Williams Lake areas was discontinued in 1966 primarily because several of the strips have been logged or are within the boundaries of pending timber sales.

The drastic reduction in the number of red-tops observed in 1966 was due to a very light beetle attack in 1965, which may have resulted from high brood mortality in the winter of 1964-65.

Table 3

Number and Volume of Douglas-fir Trees Killed by Douglas-fir Beetles in Two-year Periods as Determined in 1962 to 1966 Inclusive, West Kamloops District

Period	Year of survey	No. of trees killed	Est. total volume (cu. ft.)
1960 - 1961	1962	19,132	1,445,400
1961 - 1962	1963	37,016	2,878,900
1962 - 1963	1964	29,590	2,227,900
1963 - 1964	1965	26,301	1,959,800
1964 - 1965	1966	5,280	393,400

Foliage colour change

Plots established prior to 1966 to record colour change and needle loss of beetle-infested trees were examined three times during the summer. Needle loss at 5 plots examined in the fall was over 90% (Table 4).

Table 4

Needle Loss of Beetle-killed Douglas-fir Trees Calculated in Autumn, West Kamloops District

Year of attack	Locality	No. of trees	% needle loss		
			1964	1965	1966
1963	Lac la Hache	8	35	86	97
	134 Mile House	20	59	84	99
1964	134 Mile House	15	0	36	92
	Chimney Creek	18	0	47	92
	Clinton	12	0	58	98
	Fly Creek	9	0	92	99

Mountain Pine Beetle, Dendroctonus ponderosae Hopk.

Aerial surveys in 1966 revealed a substantial increase in the numbers of ponderosa and lodgepole pine trees killed by this beetle (Table 5)) Map 3 shows numbers and general locations of red-tops.

Largest infestations in ponderosa pine stands were at Lower Hat

Creek and near Clinton. Smaller groups of red-tops were located in Venables Valley and near Gunn Lake. The basis for volume figures was measurement of beetle-killed ponderosa pine trees at Lower Hat Creek and near Clinton.

Largest infestations in lodgepole pine were located on Bull Mountain, near Tyee and Cuisson lakes northeast of Williams Lake and near Gunn Lake in the Bridge River area. The basis for volume figures was measurement of attacked trees at Bull Mountain and near Cuisson Lake.

Table 5

Number and Volume of Ponderosa and Lodgepole Pine Killed by Mountain Pine Beetle in Two-year Periods, as Determined from Aerial Surveys in 1962 to 1966 Inclusive, West Kamloops District

Period	No. of trees killed	Est. total volume (cu. ft.)
Ponderosa pine		
1960 - 1961	172	7,260
1961 - 1962	412	20,420
1962 - 1963	2,115	88,450
1963 - 1964	3,075	123,980
1964 - 1965	4,810	197,210
Lodgepole pine		
1960 - 1961	62	1,356
1961 - 1962	476	11,219
1962 - 1963	15,525	373,917
1963 - 1964	10,047	250,035
1964 - 1965	14,540	319,880

Foliage colour change

Plots established near Clinton and Venables Valley to record ponderosa pine colour change and foliage loss were examined three times in 1966. Three years after infestation the trees had lost sufficient foliage to exclude them from counts made during aerial surveys in July. Foliage on most 1965-attacked trees near Clinton had begun to change colour by mid-April, 1966 (Table 6).

Lodgepole pine foliage colour change plots on Bull Mountain and in Fountain Valley were examined in 1966 to determine the rate of needle drop (Table 7).

Table 6

A Progressive Record of Foliage Colour Change and Needle Loss of Beetle-killed Ponderosa Pine, Clinton, West Kamloops District

Date of examination	Trees attacked in 1963				Trees attacked in 1964				Trees attacked in 1965			
	Green	Fading	Red	Av. % needle loss	Green	Fading	Red	Av. % needle loss	Green	Fading	Red	Av. % needle loss
October, 1963	2	8	0	0								
May, 1964	1	6	3	2								
June, 1964	1	1	8	6								
August, 1964	0	2	8	12								
October, 1964	0	0	10	18								
May, 1965	0	0	10	31	35	0	0	0				
June, 1965	0	0	10	43	0	26	9	0				
August, 1965	0	0	10	57	0	0	35	5				
October, 1965	0	0	10	61	0	0	35	10				
May, 1966	0	0	10	87	0	0	35	56	0	30	0	5
July, 1966	0	0	9*	90	0	0	35	66	0	0	30	7
October, 1966	0	0	4*	95	0	0	35	78	0	0	30	38

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

Table 7

Foliage Loss of Beetle-killed Lodgepole Pine Calculated in Autumn, 1963 to 1966, West Kamloops District

Year of attack	Locality	No. of trees	% needle loss			
			1963	1964	1965	1966
1962	Fountain Valley	7	31	84	97	100
1963	Fountain Valley	15	0	17	43	95
1964	Fountain Valley	15	-	-	7	85
1964	Bull Mountain	13	-	-	12	90
1965	Bull Mountain	15	-	-	-	26

A cruise of an eight-acre strip in the Lower Hat Creek infestation in ponderosa pine on November 7, showed that 44% of the trees were healthy, 11% had been attacked in 1966 and 45% had been killed prior to 1966. This infestation expanded from an estimated 700 red-tops in 1965 to 3,100 in 1966. The estimated total volume of timber killed in this area, excluding 1966-attacked trees, is 127,000 cubic feet.

Sixteen acres of the Bull Mountain infestation were cruised in October to determine the percentage of trees killed by beetles. Of the 410 trees examined, 35% were healthy, 1% had been attacked in 1966 and 64% had been killed in 1965 or earlier. The number of currently attacked trees was substantially lower than in 1965; 1% compared with 19% in 1965.

Other Noteworthy Insects

Black-headed Budworm, Acleris variana (Fern.)

The population of this budworm remained at a low level in 1966. The average number of larvae per positive sample was 1.3 for Douglas-fir and 1.7 for Engelmann spruce.

Aphids on Conifers, Adelges sp. and Pineus sp.

Moderate to heavy populations of these aphids were observed on the foliage of understory Engelmann spruce and Douglas-fir trees in the Horsefly, Williams Lake and 100 Mile House (North) Ranger districts.

Douglas-fir Cone Moth, Barbara colfaxiana Kft., and a Cone Pyralid, Dioryctria abietivorella (Grote).

The Douglas-fir cone crop was heavy in the southern portion of the District in 1966. Ten cones were picked randomly from each of five Douglas-fir trees at four locations to determine percentage infestation by these cone borers (Table 8).

Table 8

Percentage of Douglas-fir Cones Infested by the Douglas-fir Cone Moth and a Cone Pyralid, West Kamloops District, 1966

Locality	% cones infested		Uninfested
	Barbara colfaxiana	Dioryctria abietivorella	
Lower Hat Creek	20	18	62
Fountain Valley	72	0	28
Spences Bridge	34	0	66
Venables Valley	76	8	16
Averages	52	7	41

A Midge in Engelmann Spruce Cones, Cecidomyiidae

Engelmann spruce cones in the Horsefly Ranger District were heavily infested with larvae of a midge in 1966. Ninety-six per cent of 200 cones examined were infested at Mile 9.5, Horsefly River Forest Development Road.

The British Columbia Forest Service reported that cones harvested for seed near Elbow Lake were 100% infested, rendering them unfit for seed purposes.

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

Spruce budworm larvae were not numerous in random beating samples of conifers in 1966. No larvae were taken in Douglas-fir samples at six permanent plots in the Lillooet district. No evidence of larval feeding or egg masses were found during examination of trees in these plots late in August. A maximum of seven larvae per collection was taken in a Douglas-fir sample along Cayoosh Creek, south of Lillooet.

The occurrence of spruce budworm larvae in Douglas-fir beating samples taken between June 1 and July 15, 1964 - 1966 was as follows:

No. of samples taken during larval period			% samples containing larvae			Av. no. of larvae per positive sample		
1964	1965	1966	1964	1965	1966	1964	1965	1966
78	51	78	8	6	17	1.1	1.0	1.5

Spruce Beetle, Dendroctonus obesus (Mann.)

No discoloured spruce trees were observed during aerial surveys of the Quesnel Lake and Horsefly areas but some felled right-of-way trees near Morehead Lake were lightly infested. No beetles were found in decked logs north of Horsefly.

Western Balsam Bark Beetle, Dryocoetes confusus Sw.

A total of 250 red-foliaged alpine fir trees was observed south of Moffat Lake during aerial surveys. Small groups of red-tops were also noted in other areas of the Horsefly and 100 Mile House Ranger districts.

Fall Webworm, Hyphantria cunea (Drury)

Only one tent was observed on the roadside strip along the Fraser River near Lillooet and none on the strip along the Texas Creek road. The heaviest infestation was noted on chokecherry, bitter cherry and wild rose bushes near Seton Lake where a total of 63 tents was counted. Thirty-two tents were counted on chokecherry along the old Cariboo Highway north of Williams Lake.

A Pine Seed Moth, Laspeyresia prob. miscitata Heinr.

Fifty ponderosa pine cones were examined at each of five localities in the District. Percentage infestation ranged from 20% at Clinton to 76% at Lytton (Table 9).

Table 9

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

Locality	% cones infested			
	1963	1964	1965	1966
Venables Valley	66	48	58	44
Lytton	60	80	84	76
Lillooet	24	88	92	68
Lower Hat Creek	24	24	12	30
Clinton	0	26	30	20
Averages	34	53	55	48

Aspen Leaf Miner, Phyllocnistis populiella Cham.

Population levels of the aspen leaf miner remained low throughout the District in 1966. A new sample plot was established at Soda Creek

because several trees had been removed from the previously sampled plot. Table 10 shows the degree of infestation at the four plots.

Table 10

Percentage of Aspen Leaf Surfaces Mined and Average Number of Adult Aspen Leaf Miners Produced per 100 Leaf Surfaces, West Kamloops District

Locality	% leaf surfaces mined				No. adults produced per 100 leaf surfaces			
	1963	1964	1965	1966	1963	1964	1965	1966
Oregon Jack Creek	0	21	26	9	0	1	1	0.6
Clinton	6	8	2	3	2	3	1	0.6
Williams Lake	10	2	2	0	0	0	2	0
Soda Creek	-	-	-	1	-	-	-	*

* insufficient cocoons

There were insufficient cocoons at the Williams Lake and Soda Creek plots to determine percentage mortality and emergence. Results of examinations of 100 cocoons from the other two plots are as follows:

Locality	% mortality in cocoon stage							
	Parasitism				Other causes			
	1963	1964	1965	1966	1963	1964	1965	1966
Oregon Jack Creek	-	50	44	40	-	14	21	24
Clinton	23	29	*	22	4	9	*	16

* insufficient cocoons

Lodgepole Terminal Weevil, Pissodes terminalis Hopping

Damage to reproduction lodgepole pine trees was observed along the Big Bar road near Meadow Lake, along Bridge Lake road and near Tatla Lake. Most severe attack was noted near Tatla Lake where approximately 25% of the leaders of reproduction pines had been infested in the past. Nineteen adults were removed from pupal cells in pines along the Big Bar Road and sent to Dr. S. G. Smith, Sault Ste. Marie Laboratory. At most other points, only occasional trees were infested.

Pine Needle-sheath Miner, Zelleria haimbachi Busck

Populations of this needle miner were light throughout the Dis-

trict in 1966. Twenty-five tips on each of four ponderosa pine trees at five localities in the southern portion of the District were examined to determine the percentage infested (Table 11).

Table 11

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

Locality	% tips infested				
	1962	1963	1964	1965	1966
Lillooet	2	28	16	6	12
Lytton	0	8	9	3	2
Spences Bridge	-	1	0	0	26
Venables Valley	0	2	0	0	1
Lower Hat Creek	0	2	0	0	10
Averages	0.5	7.8	5.0	1.8	10.2

Table 12

Other Insects of Current Minor Significance

Insect	Host	Locality	Remarks
Contarinia spp. Douglas-fir needle midges	D	Widespread	Needle miner. Light populations. No damage.
Hylobius spp. Pine root weevils	lP	Vicinity of 150 Mile House	Feed in pitch mass on root collars. Has caused light mortality in reproduction stands.
Lambdina fiscellaria lugubrosa (Hlst.) Western hemlock looper	D	Widespread	Defoliator. Low population level. No damage noted.
Neophasia menapia Feld. Pine butterfly	in flight	Mission Mtn.	Defoliator. Twenty-four adults counted. No damage.
Nepytia freemani Munroe A looper on Douglas-fir	D	Southern portion of District	Defoliator. Very light population. No damage.

Table 12 continued

Insect	Host	Locality	Remarks
Orgyia pseudotsugata (McD.) Douglas-fir tussock moth	D	Carquile, Venables Valley	Defoliator. Low population level. Nine larvae collected.
Pissodes engelmanni Hopk. Engelmann spruce weevil	eS	North-eastern portion of District	Terminal weevil. Light infestation of reproduction.
Schizura concinna (J. E. Smith) Red-humped caterpillar	Apple Chokecherry	Lillooet Pavilion	Defoliator. Light defoliation of occasional roadside trees and bushes.
Sternochetus lapathi (L.) Poplar-and-willow borer	W	Oregon Jack Cr. Botanie Cr.	Bores in stems. Light infestations.
Xyela sp. A sawfly in staminate flowers	pP	Southern portion of District	Infests staminate flowers. Up to 30% of flowers infested.

FOREST DISEASE CONDITIONS

Currently Important Diseases

Weather Damage

Late Frost Damage to Douglas-fir

Extreme temperature fluctuations in the Williams Lake area during the first half of April caused widespread frost damage to conifers, especially Douglas-fir. Temperatures at Williams Lake reached a high of 75°F. on April 5 and dropped to a low of 0°F. on April 11. These temperatures prevailed, with minor variations, throughout the area where damage occurred.

All Douglas-fir stands in the Williams Lake area showing any degree of frost injury were mapped in four damage categories during an aerial survey on May 26 (Map 4). The total area of damage was 303,520 acres of which 41,960 acres were light, 122,400 light to moderate, 85,720

moderate, and 53,440 severe.

Affected areas extended from Mile 140, Cariboo Highway to Macalister. Damage in most areas was heaviest on hillsides, except on the plateau south of Williams Lake where severe browning of foliage extended as far south as Chimney Lake.

Ground examinations of trees in injured stands were made during the week of May 23. Needle drop in a 40-tree plot near Williams Lake ranged from 0 to 95% with an average loss of 37%. By mid-July, average foliage loss had reached 63%. Many trees had a high percentage of their buds killed.

Although the recovery rate of injured trees was very high, there remains a possibility that many trees may be susceptible to attack by the Douglas-fir beetle.

Plots and strips established in July to assess the impact of this late frost will be re-examined in 1967.

Winter Drying of Lodgepole Pine

Drying winds in the winter of 1965-66 damaged lodgepole pine stands west of Clinton. Approximately 1,500 acres of reddened trees near Big Bar Lake and 1,000 acres near Jesmond Creek were mapped during aerial surveys.

Foliage Diseases

Needle Cast on Ponderosa Pine, Elytroderma deformans (Weir) Darker

The permanent plots at Clinton and Lower Hat Creek established in 1960 to record progress of disease on ponderosa pine, were examined on August 22, 1966. Table 13 shows results of a four year study of these plots.

Table 13

Needle Cast Damage on Ponderosa Pine at Two Sample Plots, West Kamloops District

Est. % of foliage infected	No. of trees							
	Lower Hat Creek				Clinton			
	1963	1964	1965	1966	1963	1964	1965*	1966
0	1	14	11	7	6	6	3	4
10	11	2	3	5	3	4	3	7
20	3	1	3	4	3	5	5	4
30	4	0	2	4	3	2	4	2
40	2	3	1	3	4	1	2	2
50	3	4	3	2	1	3	1	4
60	1	1	1	0	3	0	4	0
70	0	0	0	0	4	0	4	0
80	2	1	1	2	6	8	2	3
90	2	2	2	0	3	6	5	6
100	0	0	1	1	2	3	3	3
No. of dead trees	1	2	2	2	0	4	4	5

* one tree logged in 1965

Exotic Plantations

The exotic plantation along the Knife Creek road was examined in mid-April and again late in September with no evidence of insect or disease damage found during either examination.

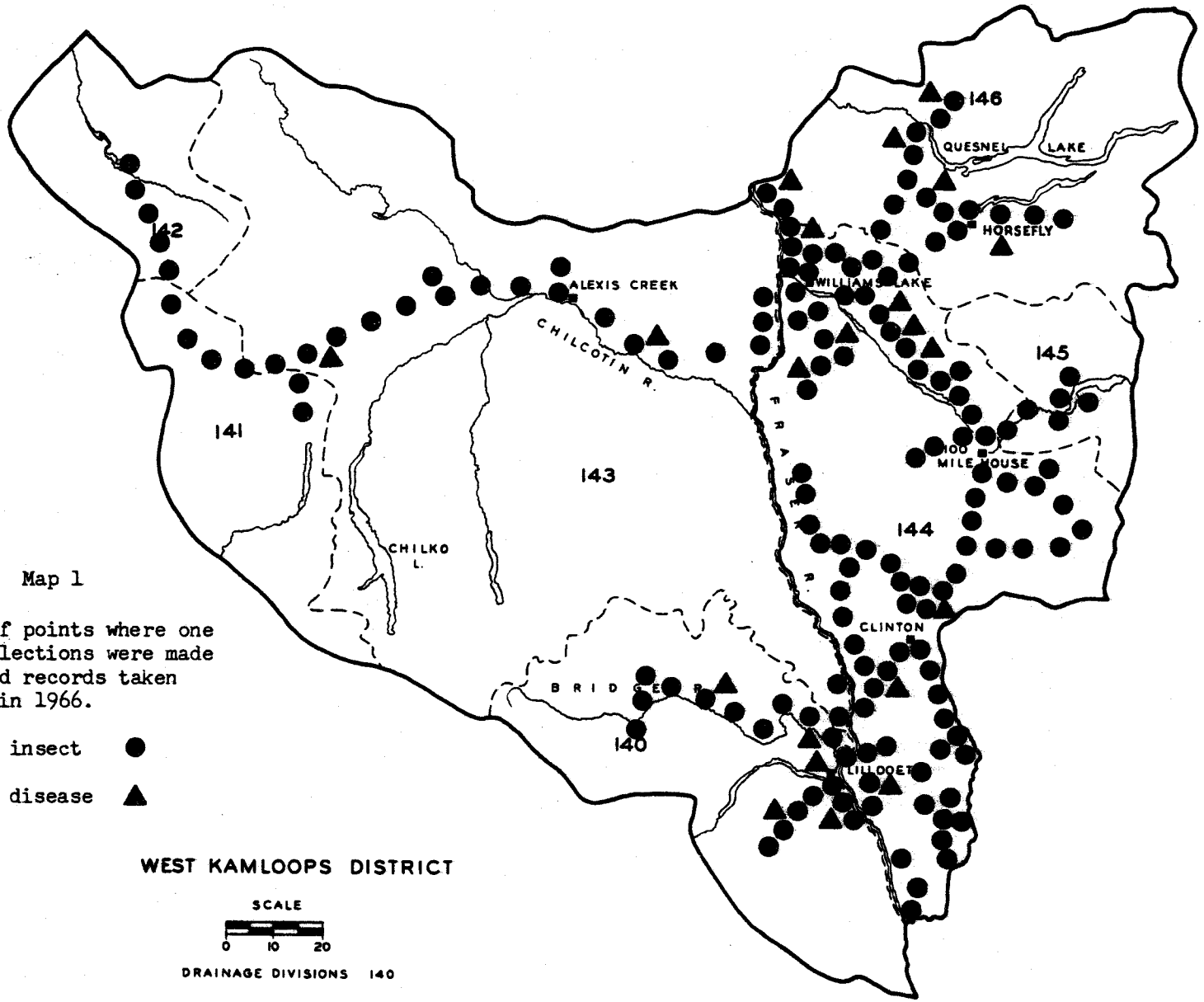
Table 14

Other Diseases of Current Minor Significance

Organism and disease	Hosts	Locality	Remarks
Camarosporium sp. Bud necrosis	D	Bull Mountain	Light to moderate infection of understory.
Chrysomyxa pirolata Wint. Spruce cone rust	eS	Horsefly River Fly	Light infection.
Didymascella thujina (Durand) Maire Cedar leaf blight	wC	Cariboo River	Light infections; common.

Table 14 continued

Organism and disease	Hosts	Locality	Remarks
Hypodermella concolor (Dearn.) Darker Needle cast	lP	Chimney Lake	Common in this area.
Melampsora medusae Thuem. Leaf rust	tA	Clinton	Heavy infections in this area.



Map 1

Location of points where one or more collections were made and field records taken in 1966.

Forest insect ●

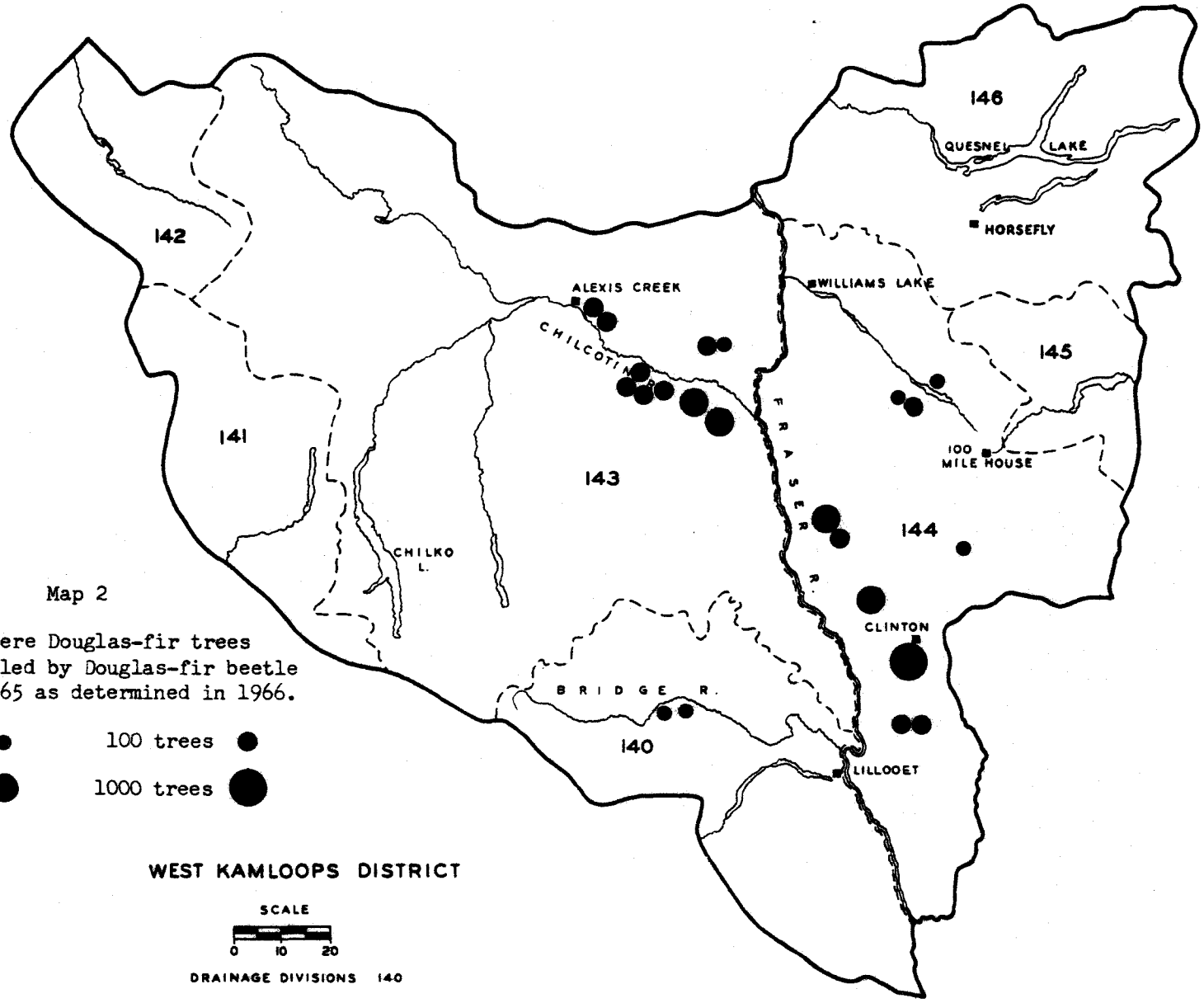
Forest disease ▲

WEST KAMLOOPS DISTRICT

SCALE

0 10 20

DRAINAGE DIVISIONS 140



Map 2

Points where Douglas-fir trees have been killed by Douglas-fir beetle from 1964-1965 as determined in 1966.

50 trees ● 100 trees ●

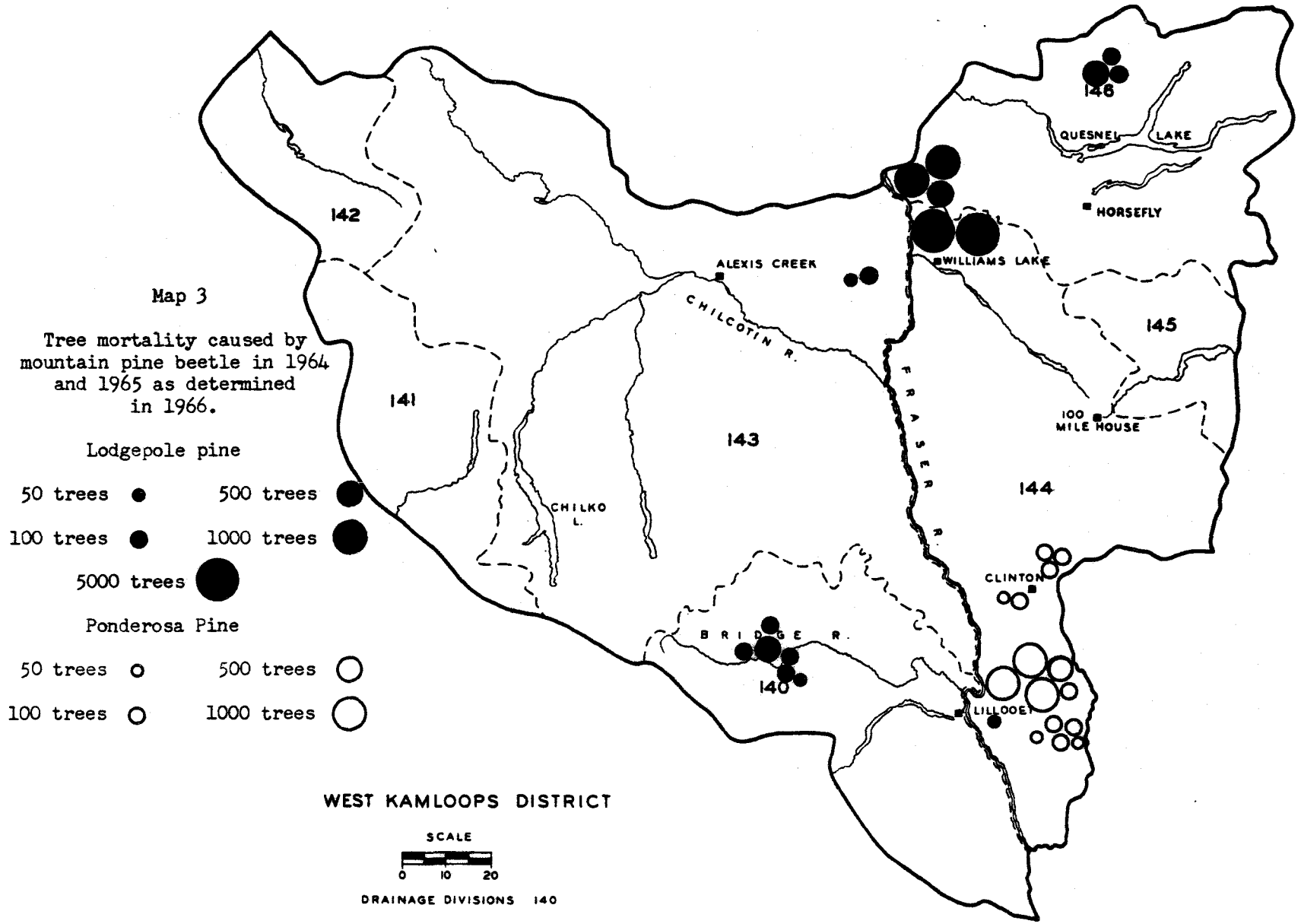
500 trees ● 1000 trees ●

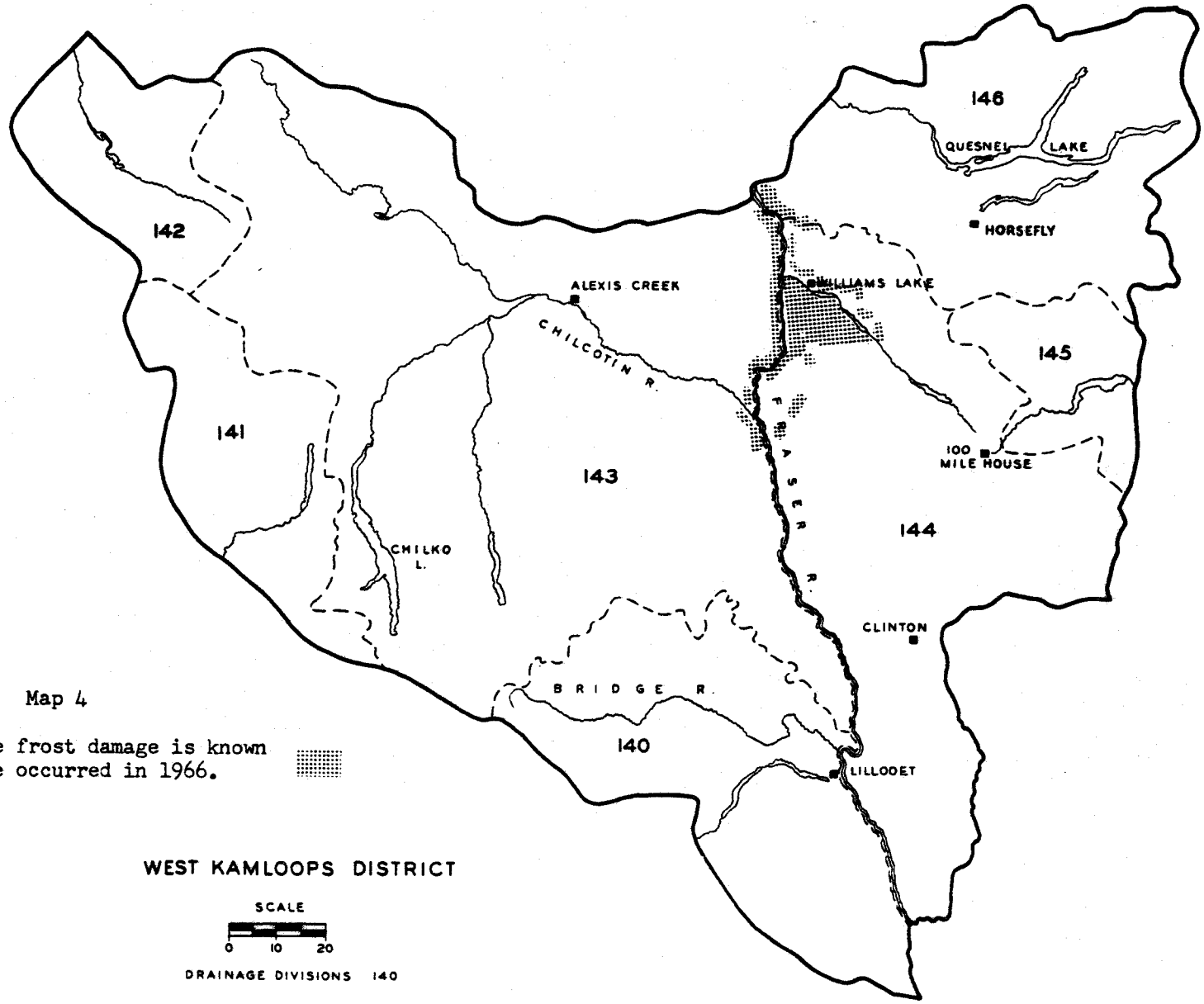
WEST KAMLOOPS DISTRICT

SCALE

0 10 20

DRAINAGE DIVISIONS 140


Map 3
Tree mortality caused by mountain pine beetle in 1964 and 1965 as determined in 1966.
Lodgepole pine
50 trees
100 trees
500 trees
1000 trees
5000 trees
Ponderosa Pine
50 trees
100 trees
500 trees
1000 trees
142
141
143
140
144
145
146
ALEXIS CREEK
CHILCOTIN R.
CHILKO L.
WILLIAMS LAKE
QUESNEL LAKE
HORSEFLY
100 MILE HOUSE
FRASER R.
CLINTON
BRIDGE R.
LILLOOET
WEST KAMLOOPS DISTRICT
SCALE
0 10 20
DRAINAGE DIVISIONS 140



Map 4

Areas where frost damage is known to have occurred in 1966.

WEST KAMLOOPS DISTRICT

SCALE

0 10 20

DRAINAGE DIVISIONS 140

FOREST INSECT AND DISEASE SURVEY

BRITISH COLUMBIA

1966

NELSON FOREST DISTRICT

FOREST INSECT AND DISEASE SURVEY

BRITISH COLUMBIA

1966

NELSON FOREST DISTRICT

R. J. Andrews [1/]

Through rotation and replacement of ranger personnel, in 1966 N. Bauman was assigned to East Nelson district, E. V. Morris remained in Central Nelson and the writer was assigned to West Nelson as senior ranger for the Nelson Forest District.

Below normal temperatures and above normal precipitation during June, retarded insect development; climatic conditions for the remainder of the field season, however, were normal.

Counts of mountain pine beetle-attacked pines were considerably lower in 1966 than in 1965.

Larch sawfly populations were found over most of the range of western larch in the District in 1966. An estimated 363,000 acres of moderate to heavy defoliation were mapped from an aircraft. No tree mortality has yet been attributed to this insect.

Black-headed budworm infestations increased in intensity and extent in 1966. The larger areas of damage were confined to the north central portion of the District but several infestations were recorded near Nelson. Egg surveys in the fall indicated a continuing moderate to high population in 1967.

The larch casebearer was collected on the British Columbia side of the International Boundary for the first time in 1966. Its distribution, however, was comparatively limited. The status of this insect is reported jointly for the Nelson Forest District at the end of this introduction.

Larch bud moth infestations decreased in intensity within the Nelson Forest District. Noticeable defoliation was limited to one large and several small infestations in the West Nelson District.

Douglas-fir needle midge damage to Christmas-tree stock was lighter in 1966 than in 1965 except near Coffee Creek and between New Denver and Thrums where damage to pole-sized trees remained heavy.

1/ Forest Research Technician, Forest Insect and Disease Survey, Senior Ranger, Vernon.

The following is a list of standard abbreviations for tree species mentioned in this report:

HOST TREE ABBREVIATIONS

Abbreviation	Common name	Abbreviation	Common name
D	Douglas-fir	Al	alder
alF	alpine fir	tA	trembling aspen
gF	grand fir	wB	white birch
wH	western hemlock	bCo	Black cottonwood
wL	western larch	W	willow
lP	lodgepole pine		
pP	ponderosa pine		
wwP	western white pine		
eS	Engelmann spruce		

Larch Casebearer, Coleophora laricella (Hbn.)

R. J. Andrews, E. V. Morris, N. Bauman

INTRODUCTION. The larch casebearer, introduced from Europe, initially attacked tamarack, Larix laricina (Du Roi) K. Koch, in eastern United States. It then spread to Central Minnesota and recently (in 1965) to southeastern Manitoba. In 1957, an infestation covering 170 square miles was discovered in western larch, Larix occidentalis Nutt., in Idaho. By 1963 it had dispersed over 7,500 square miles in the Idaho Panhandle, northern Washington and northwestern Montana. 1/

The insect was first collected in British Columbia on western larch near Rossland in 1966. To determine the limits of distribution along the International Boundary and in southern British Columbia, western larch stands in the valleys of the Kettle, Pend d'Oreille, Salmo, Kootenay, Yahk and Moyie rivers were examined. The largest populations were in the Creston area and in the Salmo and Moyie river valleys. Small numbers were also collected along Kootenay Lake to Riondel, on the Kootenay River at Thrums, at Laurier near Grand Forks, and at Moyie Lake (Map 1).

METHODS. No standard method of sampling for larch casebearer has been developed. Three methods were used in British Columbia to compare re-

1/ Denton, R. E. 1965. Larch casebearer in western larch forests. U.S. D. A. Forest Pest Leaflet 96.

sults and establish a sampling pattern. The number of casebearers per sample unit is the basis for classifying populations.

A preliminary sample of five randomly chosen 12-inch branches from the lower crown from each of five trees was selected in early June near Creston and Salmo. Later in June, a sequential sampling method used in New Brunswick was tried at five localities. In this method, 100 fascicles on a shoot constitute one sample unit, although if a shoot does not contain this number the entire opposite or next lower shoot is also examined even though the total may exceed 100 fascicles. Counts are continued until predetermined levels, which indicate intensity of infestation, are reached. In October a survey to determine the population density of the succeeding generation was carried out using as a sample unit ten 16-inch branches taken from the lower crown from each of five trees at five localities.

Eleven collections containing 130 larvae and pupae were submitted to the Insectary in June for rearing to determine the occurrence and abundance of parasites.

RESULTS. On the five 12-inch branch samples at Creston and Salmo there was an average of 4.0 and 1.4 casebearer larvae per branch, respectively. Based on sequential sampling, infestations at all but one plot were classed as light (Table 1).

Table 1

Sequential Sampling for Larch Casebearer on Western Larch at Five Localities, Nelson Forest District, June 1966

Location	No. of trees	No. of fascicles	No. of cases	Av. no. per 100 fascicles	Inf. class 1/	Stand defoliation
West Creston	3	308	23	7.6	L	light
Porthill	4	500	61	12.1	M	"
N. Creston	4	400	34	8.5	L	"
Salmo	5	623	22	3.5	L	"
Yahk	10	1,000	14	1.4	L	"

1/ L = light, M = moderate

The ten 16-inch branches from five trees at five locations averaged from 14.4 to 52.2 casebearers per branch (Table 2).

Table 2

Branch Sampling for Larch Casebearers on Western Larch at Five Localities, Nelson Forest District, October 1966

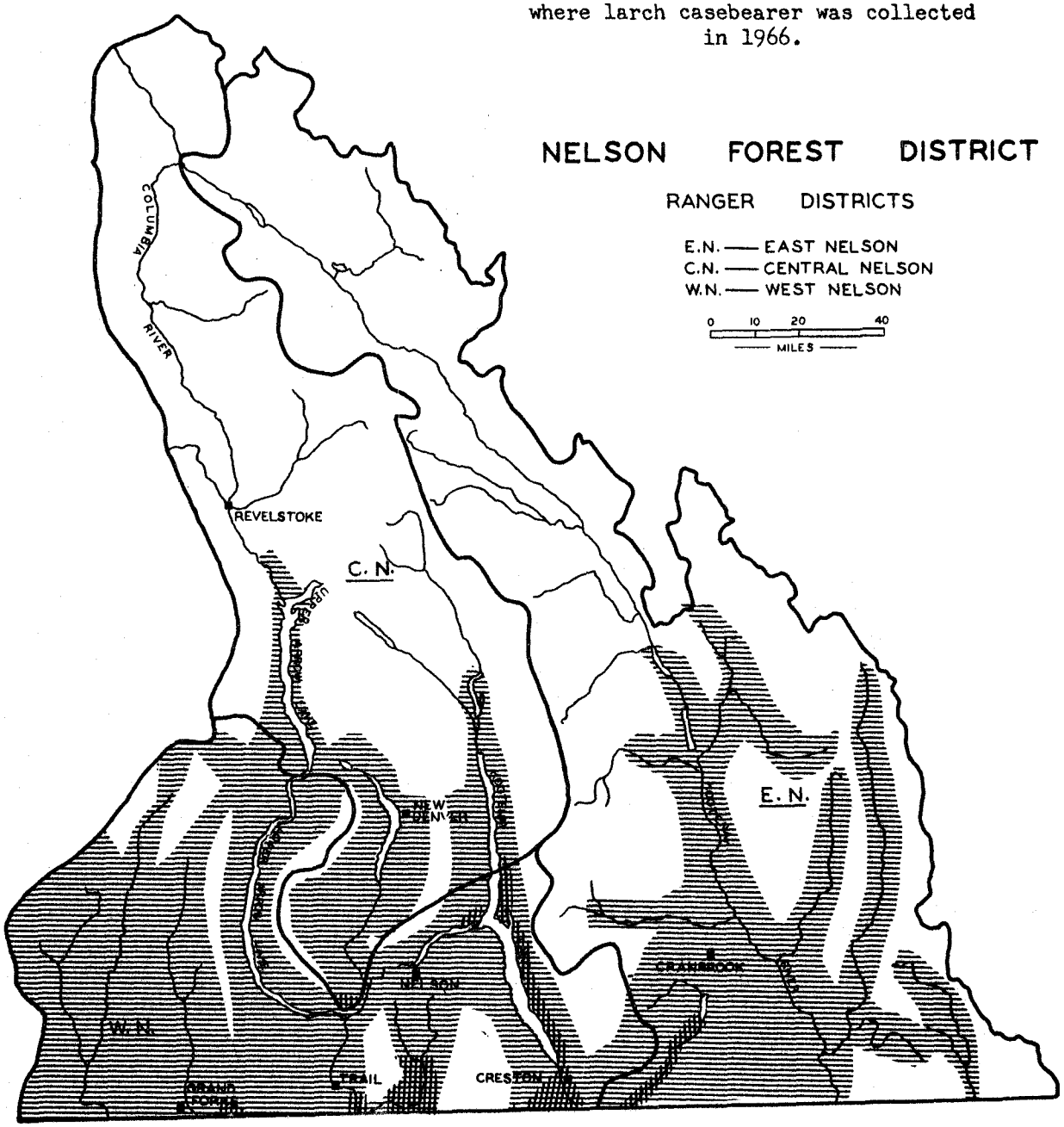
Locality	Av. no. of casebearers per 16-inch branch
W. Creston	52.8
Porthill	51.9
N. Creston	55.2
Salmo	16.7
Yahk	14.4

Parasitism was light; only a small number of Spilochalcis albifrons (Walsh) adults were produced from the casebearer larvae and pupae reared at the laboratory.

DISCUSSION. Damage to western larch foliage was not obvious during the first three instars because the larvae remained mostly in the needle. It was during the last three instars, after overwintering, that feeding damage became apparent. Noticeable defoliation was negligible in June; during the fall survey a substantial increase in defoliation had occurred. While no tree mortality has been attributed to this insect, a brown or scorched appearance is an indication of a moderate to heavy population. Moderate to severe browning of foliage near Creston and an increase of damage in all other sample areas may be expected in 1967.

Map 1

Distribution of western larch and locations where larch casebearer was collected in 1966.



FOREST INSECT AND DISEASE SURVEY

WEST NELSON DISTRICT

1966

FOREST INSECT CONDITIONS

WEST NELSON DISTRICT

1966

R. J. Andrews

INTRODUCTION

Field work began on June 1 and continued to October 21. Special surveys carried out in the District were: larch casebearer, June 6-10 and October 17-21; larch sawfly survey, September 6-16; black-headed budworm, September 19-23; aerial survey for the Nelson Forest District, August 1-4. In addition, one week was spent in East Nelson District introducing N. Bauman to survey sampling methods and procedures, and one week was spent on spruce beetle surveys.

Generally, defoliators increased in 1966; 87% of the beating collections contained larvae, compared with 68% in 1965.

Totals of 281 insect and 33 forest disease collections were taken in the District. Tabel 1 shows the collections by host. Collection points and drainage divisions are shown on Map 1. The principal problems in each Forest Insect and Disease Drainage Division are shown in Table 2.

Table 1

Collections by Hosts

West Nelson District, 1966

Coniferous hosts	Forest insects	Forest diseases	Broad-leaved hosts	Forest insects	Forest diseases
Cedar, western red	6	-	Alder species	2	1
Douglas-fir	73	2	Birch, western white	1	-
Fir, alpine	14	4	Aspen, trembling	1	-
Fir, grand	9	2	Cottonwood, black	-	1
Hemlock, western	67	2	Willow species	5	1
Juniper, Rocky Mtn.	1	-	Miscellaneous	1	-
Larch, western	68	3			
Pine, lodgepole	10	2			
Pine, ponderosa	4	1			
Pine, western white	3	17			
Spruce, Engelmann	16	2			
Totals	271	30	Totals	10	3
			GRAND TOTALS	281	33

Table 2

Currently Important Insect and Disease [1/] Problems by Drainage Divisions, West Nelson District, 1966

Insect and disease problems	Principal hosts [2/]	Importance by drainage divisions [3/]			
		200	201	202	203
DEFOLIATORS					
Larch casebearer	wL	0	0	3	3
Larch sawfly	wL	5	5	5	5
Black-headed budworm	wH	4	1	4	4
Larch bud moth	wL	2	1	2	2
FOLIAGE DISEASES					
Larch needle cast, Hypodermella laricis Tub.	wL	4	4	4	4

1/ Includes only weather-induced and/or foliage diseases subject to annual fluctuations.

2/ Refer to host code in Forest District introduction

3/ High population and/or widespread outbreak in progress - 5

Scattered high populations and/or significant damage in restricted areas - 4

Rising population and/or moderate numbers of insects and/or potential problem - 3

Static or falling population and/or moderate numbers of insects and/or no problem at present - 2.

Endemic population and/or no significant damage - 1

Not sampled and/or no host and/or not found - 0

FOREST INSECT CONDITIONS

Currently Important Insects

Defoliators

Larch Sawfly, Pristiphora erichsonii (Htg.)

Damage to western larch caused by the larch sawfly was heavy over

an estimated 400 square miles in the West Nelson District in 1966 (Map 2). Defoliation became noticeable during the first week of July and progressed to higher elevations until the end of August. Elevations at which damage was observed ranged from 1,800 to 5,500 feet. Severe defoliation occurred in stands containing a small percentage of larch as well as pure stands.

Cocoon populations were measured by counting the number of cocoons in one square foot sample of duff and soil taken from beneath each of 10 marked trees at each of seven localities in 1966. The numbers of sound (unopened) and dead or empty cocoons were recorded for each locality (Table 3).

Table 3

Numbers of Larch Sawfly Cocoons in 10-square-foot Duff Samples at Each of Seven Localities, West Nelson District

Locality	Number of cocoons			
	Sound		Dead or empty	
	1965	1966	1965	1966
Whatshan	903	154	353	469
Fauquier	486	554	73	584
Nelson	346	113	198	339
Salmo	312	510	360	575
Paulson	531	179	73	483
Beaverdell	179	262	21	214
Gray Creek	-	473	-	534

Empty cocoons and cocoons with dead larvae were examined to determine the percentage of successful emergence and the number which had been destroyed by predation or parasitism (Table 4).

Table 4

Cumulative % Emergence and Cocoon Mortality,
West Nelson District

Locality	% emerged		% apparently destroyed by: Predation: Mammal		Predation: Elaterid		Parasites: Mesoleius		Parasites: Tritneptis		Miscellaneous	
	'65	'66	'65	'66	'65	'66	'65	'66	'65	'66	'65	'66
Whatshan	24	27	62	65	7	4	2	1	5	1	0	2
Fauquier	38	53	18	11	22	8	4	6	18	22	0	0
Nelson	18	53	53	34	15	6	7	3	5	2	2	2
Salmo	20	31	66	37	7	3	2	7	4	19	1	3
Paulson	43	26	30	60	27	6	0	6	0	1	0	1
Beaverdell	68	68	16	18	11	3	0	9	5	2	0	0
Gray Cr.	-	42	-	44	-	5	0	5	-	4	-	0

To determine parasitism by Tritneptis klugii (Ratz.) and Mesoleius tenthredinus Morley, 100 overwintering larvae in cocoons from each of the seven plots were dissected and the results compared with those from a similar study conducted in 1965 (Table 5).

Table 5

Classification of Larvae from 100 Sound Cocoons at each of
Seven Sawfly Study Plots, West Nelson District.

Locality	Healthy		Parasitized by: Tritneptis		Mesoleius	
	1965	1966	1965	1966	1965	1966
Whatshan	94	49	0	2	6	49
Fauquier	80	44	9	33	11	23
Nelson	100	93	0	0	0	7
Salmo	77	19	9	70	14	11
Paulson	97	60	2	16	1	24
Beaverdell	94	58	0	13	6	29
Gray Creek	-	91	-	1	-	8

The Nelson and Gray Creek plots had a relatively small population of parasites; in the other five plots there was a substantial increase in parasitized overwintering larvae. Moderate defoliation may be expected in 1967.

A plot was established near Salmo to trap larvae for information on possible larval diapause. The traps consisted of a funnel with a two-

square-foot opening suspended over a metal 6 x 6 x 5 inch box with a copper screen bottom and incurved upper edges, sunk to a depth of 3 to 4 inches. Duff and soil was placed in the box and it was covered with 1/3-inch mesh hardware cloth to exclude shrews and mice.

Five of the 10 traps set under 10 trees were removed in September and the remaining five will be removed in August, 1967. The cocoons were removed from the metal boxes, counted and segregated into two groups, sound and dead or empty.

Ten overwintering larvae from sound cocoons were dissected from each of 10 soil samples and from each of five traps to obtain information on parasitism by Tritneptis klugii (Ratz.) and Mesoleius tenthredinus Morley. Results were as follows:

Soil samples			Trap samples		
Healthy	Mesoleius	Tritneptis	Healthy	Mesoleius	Tritneptis
19	11	70	22	18	60

Further comparisons will be made of emergence from artificially reared cocoons collected from the traps in September, and from cocoons that were left in the traps in the field. Objectives of this program are to determine presence or absence of diapause, to compare percentage of diapause in incubator material with that in the field and to compare parasite data from traps with those in soil samples.

Black-headed Budworm, Acleris variana (Fern.)

Light to heavy defoliation by the black-headed budworm occurred in widely separated stands of over-mature western hemlock in the west Nelson District in 1966. Heavy defoliation was recorded at Crawford Creek, Whatshan Lake area and Smallwood Creek, moderate defoliation at Gray and Give-out creeks, and light defoliation along Mackie Mountain. The infestations were confined mainly to higher elevations (3,000-4,500 feet) but occasionally ranged from 2,800 to 4,800 feet.

Most western hemlock collections contained black-headed budworm in 1966. A summary of black-headed budworm collections from western hemlock for the past three years follows:

Number of samples taken during larval period			% samples containing larvae			Average number of larvae per positive sample		
1964	1965	1966	1964	1965	1966	1964	1965	1966
38	17	39	2	41	95	1	13	54

A 100-tree plot was established at Crawford Creek to record occurrence of top kill or tree mortality resulting from heavy defoliation. The trees were numbered and defoliation was estimated by crown level (Table 6).

Table 6

Average Current Defoliation of Western Hemlock by Crown Levels and Diameter Classes, Crawford Creek, 1966

Tree diameters (ins.)	No. of trees	% defoliation			Stripped tops	
		Upper	Mid	Lower	No. of trees	Av. length (ft.)
2- 6	51	66	54	40	3	3
7-12	19	86	84	63	12	11
13-18	20	92	86	67	10	14
19-24	6	87	82	57	1	10
25+	4	75	86	63	0	-

No top kill or tree mortality was observed in 1966.

Sampling of western hemlock for black-headed budworm egg populations was completed in October. The method used was to fell three dominant trees at each plot and take five 10-inch branches from five crown levels of each tree. The guide for predicting the next year's defoliation based on the average number of eggs per 10-inch branch is as follows: light, one to seven eggs; moderate, 8 to 15, and heavy, 16 or more eggs.1/

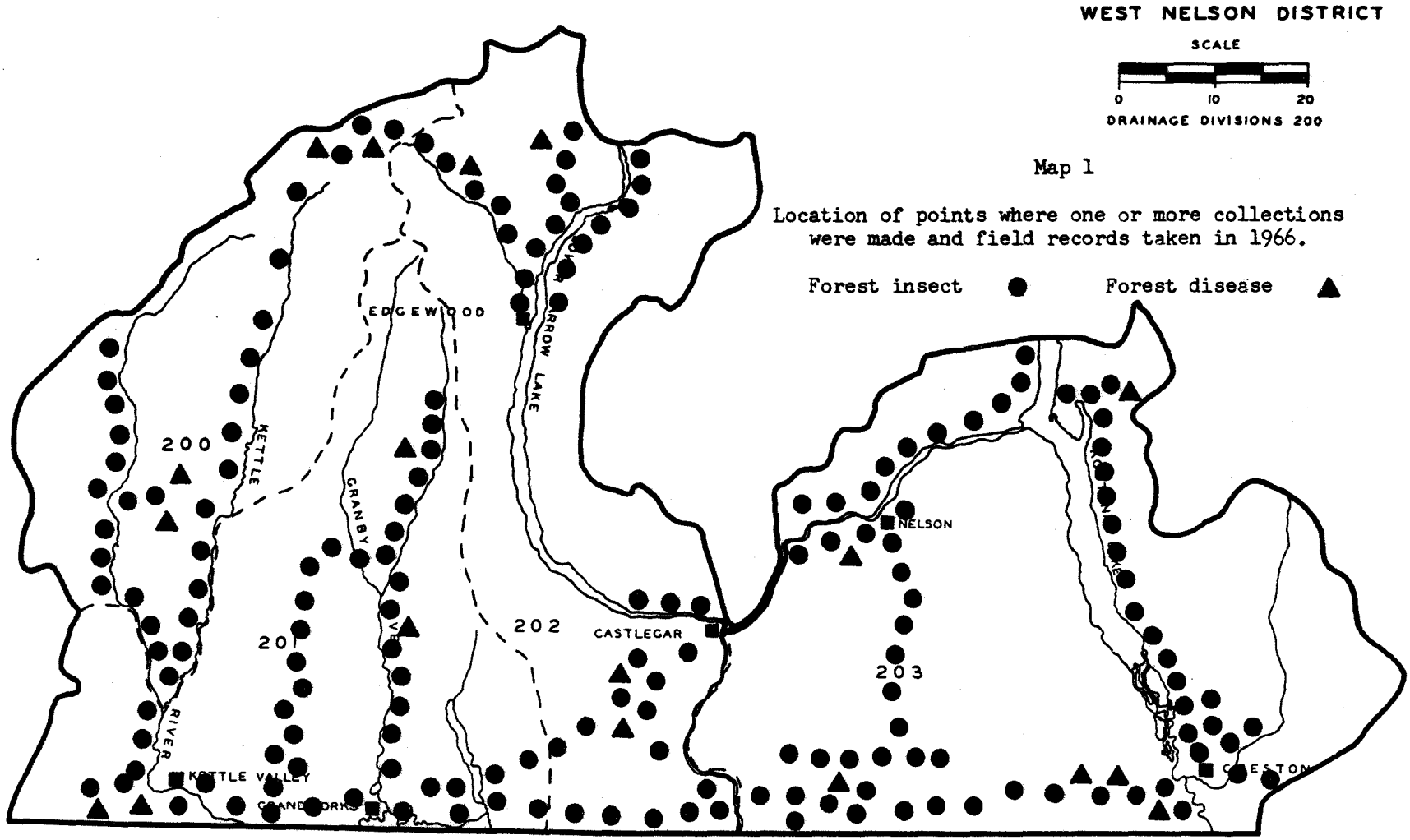
Table 7

Results of Black-headed Budworm Defoliation and Egg Surveys, West Nelson District, October 1966

Locality	% defoliation		Av. no. of eggs per branch sample	Predicted 1967 defoliation
	Current	Total		
Crawford Cr.	74	30	23.6	Heavy
Gray Cr.	61	10	22.0	Heavy
Giveout Cr.	68	10	20.6	Heavy
Smallwood Cr.	83	24	12.6	Moderate
Mackie Mtn.	22	5	5.5	Light
Stevens Cr.	35	8	16.2	Heavy
Caribou Pass	68	30	24.1	Heavy

Unless unforeseen mortality occurs in the egg or early larval stages, light defoliation may be expected along Mackie Mountain, moderate

1/ Silver G.T. 1959. A method for sampling eggs of the black-headed budworm. Jour. For. Vol. 57, No. 3.


WEST NELSON DISTRICT
SCALE
0
10
20
DRAINAGE DIVISIONS 200
Map 1
Location of points where one or more collections were made and field records taken in 1966.
Forest insect
Forest disease
EDGEWOOD
ARROW LAKE
200
KETTLE
GRANBY
201
202
CASTLEGAR
NELSON
203
RIVER
KETTLE VALLEY
GRAND FORKS

defoliation near Smallwood Creek and heavy defoliation near Crawford, Gray, Giveout and Stevens creeks and Cariboo Pass.

A Larch Bud Moth, Zeiraphera sp.

Defoliation of western larch by the larch bud moth was confined to mature and overmature trees at high elevations, although larvae were commonly collected at 2,500 feet. Damage decreased from 242 square miles in 1965 to 32 square miles in 1966 (Map 3). Outbreaks generally occurred in new locations, but moderate defoliation recurred west of Christina Lake and south of Nelson. The largest area of severe browning of larch foliage was near Rossland at the headwaters of Big and Little Sheep and Murphy creeks.

Branch samples of larch were collected at Murphy Creek in September for trial extraction of bud moth eggs in a sodium hydroxide solution and to determine the egg population (Table 8). The branches were cut into workable lengths (18 to 31 inches) and soaked in a solution of 1.25% sodium hydroxide. This loosened the lichens and even the bark scales so that they could be dislodged by agitating with water during the rinsing procedure. Eggs were recovered by screening the material simultaneously through a coarse hand seive and 20, 30 and 50 mesh Endicott screens, the latter size retaining the eggs.

Samples were processed in two categories: branches from which lichens and bark had been stripped and eggs extracted separately and whole branch samples cut into sections and extracted intact. Table 8 shows the results of this extraction method.

Table 8

Results of Extraction Trials for Recovery of Zeiraphera sp. Eggs from Western Larch, September, 1966

Sample no.	Branch max. diam. (in.)	Branch length (in.)	Number of eggs			Av. no. eggs per in.
			whole branch	lichens only	bark only	
1	3/4	19	-	22	19	2.1
2	3/4	24	-	10	7	0.7
3	1/2	18	33	-	-	1.8
4	1/2	26	49	-	-	1.8
5	1/2	31	40	-	-	1.3
6	3/4	21	0	-	-	0.0
7	1	24	-	5	5	0.4
8	3/8	19	-	0	0	0.0
9	3/8	22	-	5	2	0.3
10	3/4	23	-	0	0	0.0
11	3/4	33	-	39	5	1.3
12	3/4	29	-	13	0	0.4
13	5/8	36	-	43	10	1.4
14	3/4	22	-	29	15	2.0
15	3/4	20	-	8	10	0.9
16	5/8	25	-	43	8	2.0

The conclusions drawn by S. Condrashoff, who developed the extraction process, were that results were superior to manual counting because counts were made faster and were more consistently accurate, regardless of examiner.

Although the number of eggs found indicated a possible recurrence of bud moth damage near Rossland in 1967 (Table 8), it has been determined in western Europe that because of overwintering mortality, autumn egg counts are not necessarily an accurate guide to the following year's population. However, if overwintering conditions are favourable, scattered light to moderate defoliation is expected in 1967.

Other Noteworthy Insects

Douglas-fir Needle Midge, Contarinia spp.

There was a low population of needle miners in current year's needles of Douglas-fir in most areas sampled (Table 9). The exception was near Coffee Creek where 42% of the needles were infested.

Table 9

Number of Needles Examined and the Percentage Infested by Contarinia spp. at Seven Localities, West Nelson District, 1966

Locality	No. of needles examined	Percentage of needles infested
Beaverdell	1,502	4.0
Westbridge	1,944	2.0
Grand Forks	1,896	0.7
Syringa Creek	2,544	11.2
Kokanee Creek	1,311	11.3
Coffee Creek	1,399	42.6
Gray Creek	1,951	1.9

Mountain Pine Beetle, Dendroctonus ponderosae Hopk.

Counts of red-topped lodgepole pines increased slightly near the main Kettle River infestation. About 200 trees were counted in 1966 compared with 100 in 1965.

Near Beaverdell, 100 red-topped mountain pine beetle-attacked ponderosa pines were recorded in 1966.

Fall Webworm, Hyphantria cunea Drury

The heaviest concentrations of fall webworm tents were observed near Genelle and Wynndel. The numbers of tents on both sides of the road were counted from a slow moving vehicle for two miles south of Genelle and three miles west of Wynndel (Table 10).

Table 10

Roadside Web Counts of Fall Webworm near Genelle and Wynndel, West Nelson District, 1966

Locality	Hosts	Mile 0-1	1-2	2-3	Av. per mile
Genelle	Chokecherry	-	10	-	5
	Cottonwood	4	44	-	24
	Elm	5	23	-	14
Wynndel	Cottonwood	25	5	-	9
	Saskatoon	2	11	9	7
	Apple	2	-	-	11

Aspen Leaf Miner, Phyllocnistis populiella Cham.

Increased mortality in cocoons reduced the number of adults produced per 100 leaf surfaces in 1966 (Tables 11 and 12).

Table 11

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

Locality	Percentage of leaf surfaces with mines			No. of adults produced per 100 leaf surfaces		
	1964	1965	1966	1964	1965	1966
Greenwood	19	17	17	6	3	1.4
Grand Forks	21	54	3	2	21	0.5
Phoenix	73	51	6	19	15	1.5
Crawford Cr.	31	13	62	18	3	1.4

Table 12

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

Locality	Percentage mortality					
	Parasitism			Other causes		
	1964	1965	1966	1964	1965	1966
Greenwood	30	27	30	1	1	15
Grand Forks	38	29	35	0	7	18
Phoenix	21	19	15	0	4	5
Crawford Cr.	23	12	18	0	4	10

Table 13

Other Insects of Current Minor Significance

Insect	Hosts	Locality	Remarks
Altica spp. Leaf beetles	bCo, Al	Whatshan Lake Crawford Bay Needles	Skeletonizer. Heavy skeletonizing of foliage.
Choristoneura fumiferana (Clem.) Spruce budworm	D	Widespread	Defoliator. Of 45 collections during larval period, 25% averaged 2 larvae.
Corythuca sp. Lace bug	W	Paulson	Sucking insect. Estimated 300 acres defoliated.
Dendroctonus pseudotsugae Hopk. Douglas-fir beetle	D	Kettle Valley	Only occasional single red-topped trees observed.
Dimorphopteryx pinguis (Nort.) A sawfly	wB	Crawford Bay	Defoliator. 0.5 acre moderate defoliation.
Galerucella sp. Leaf beetle	W	Whatshan Lake Crawford Bay to Lockhart	Skeletonizer. Heavy browning of willow foliage.
Melanolophia imitata Wlk. Green-striped forest looper	wH, D	Widespread	Defoliator. 38% of collections contained average of 1.8 larvae. 29% of D collections averaged 1.8 larvae.

Table 13 continued

Insects	Hosts	Locality	Remarks
Neophasia menapia Feld. Pine butterfly	wwP	Whatshan Lake Needles	Defoliator. Up to 6 adults commonly seen at tree top level.
Nepytia freemani Munroe A looper on Douglas-fir	D	Widespread	Defoliator. 10% of collections contained an average of 1.8 larvae.
Pleroneura borealis Felt. The alpine fir twig sawfly	alF	Goat Mtn.	Tip borer. 25% of tips infested near Goat Mtn. Lookout.
Sternochetus lapathi (L.) Poplar-and-willow borer	W	Burrell Creek	75% of willow clumps infested near upper five miles of Burrell Creek.

FOREST DISEASE CONDITIONS

Currently Important Diseases

White Pine Blister Rust, Cronartium ribicola J. C. Fisch. ex Rab.

Damage to mature white pines caused by blister rust was common throughout most of the host range. There was particularly high infection from the valley bottom of Summit Creek to the height of land along the Creston Skyline Highway.

Larch Needle Cast, Hypodermella laricis Tub.

Discoloration of western larch caused by larch needle cast was patchy but widespread in the Beaverdell, Kettle Valley and Grand Forks ranger districts.

Other Noteworthy Diseases

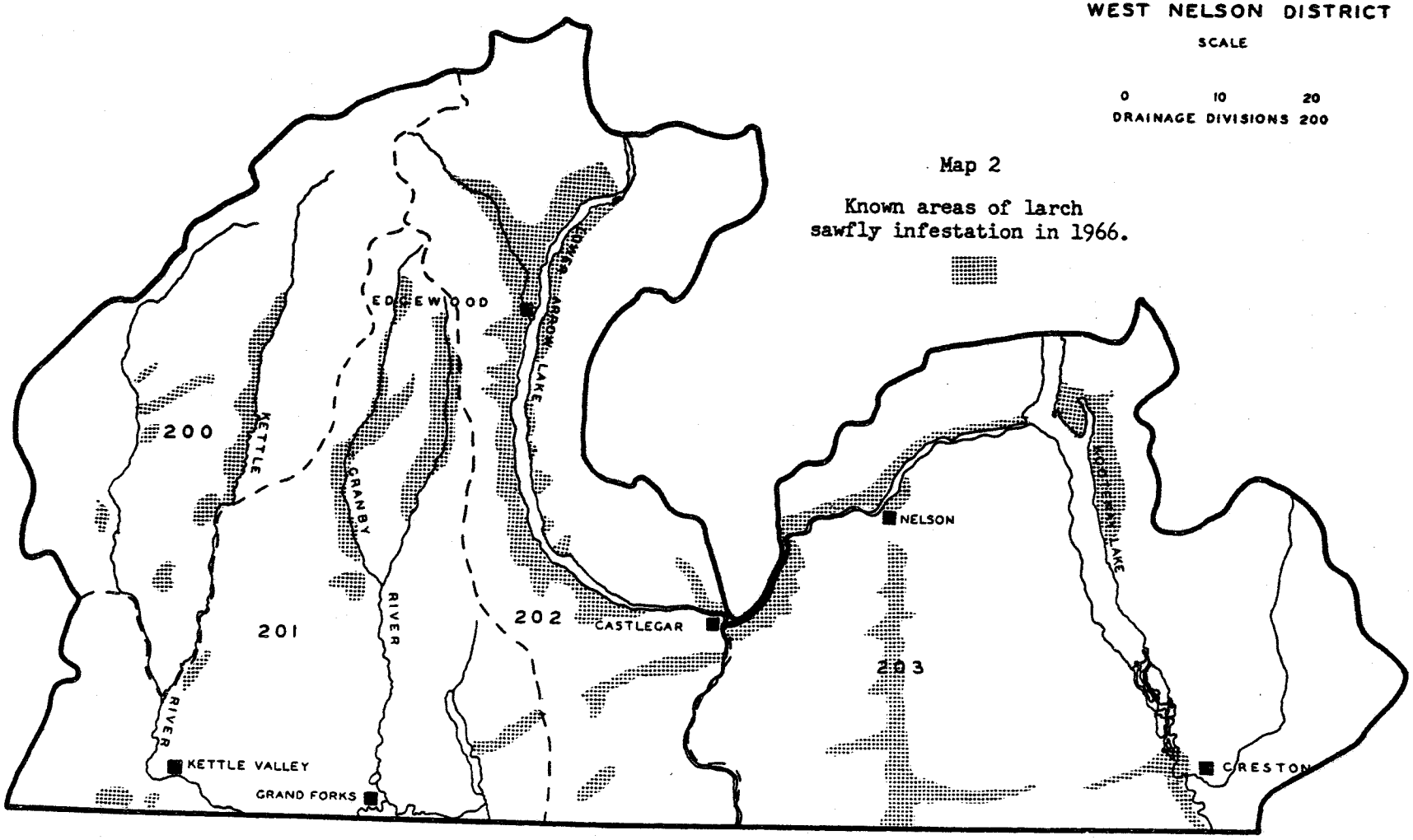
Table 14

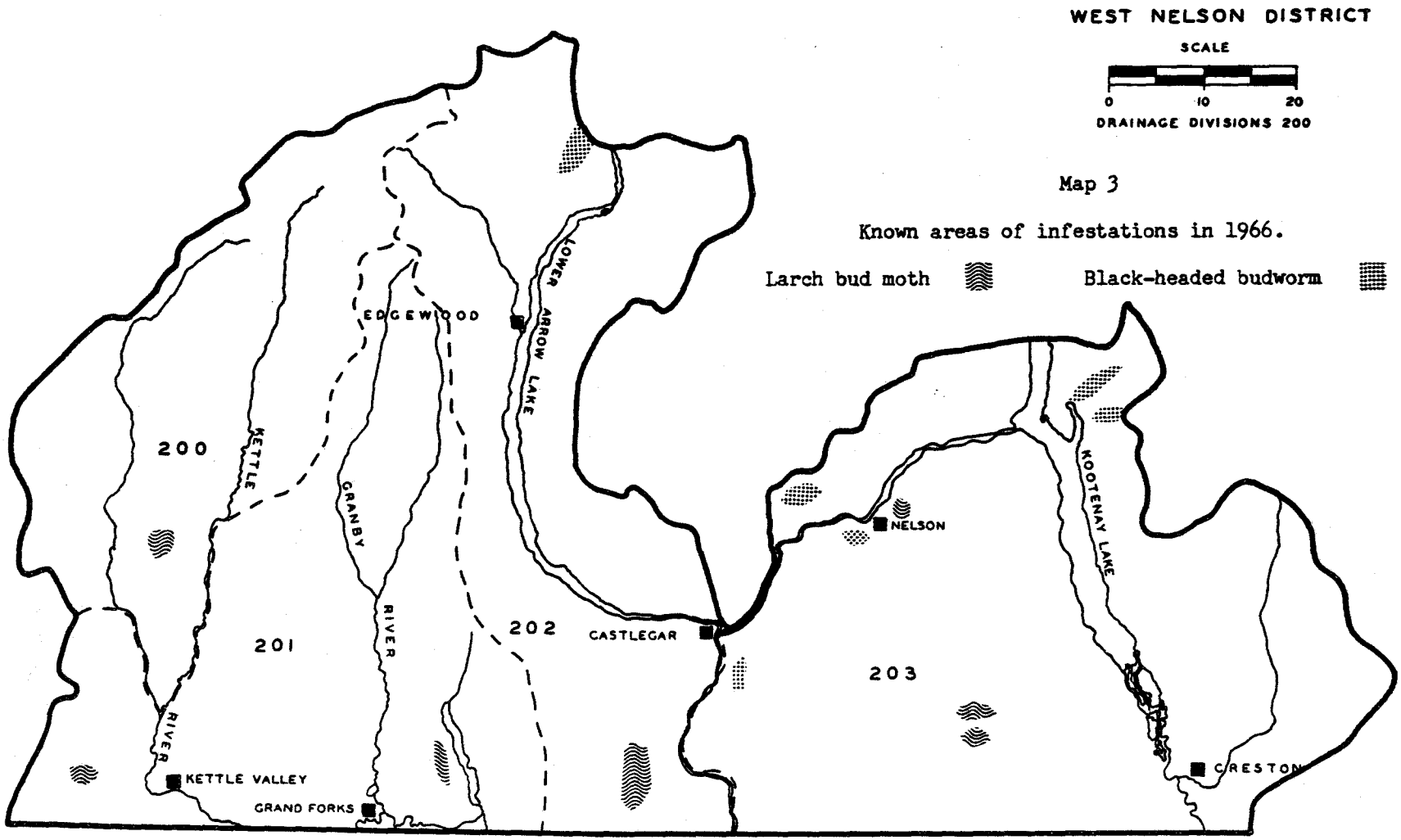
Other Diseases of Current Minor Significance

Organism and disease	Hosts	Locality	Remarks
Chrysomyxa pirolata Wint. Spruce needle rust	eS	McIntyre Creek	Common

Table 14 continued

Organism and disease	Hosts	Locality	Remarks
Delphinella balsameae (Waterm.) E. Muell. Balsam tip blight	alF	Blazed Creek	Common, patchy.
Elytroderma deformans (Weir) Darker Needle cast	lP	Wauchope Creek	Light to medium infection.
Melampsora epitea Thuem. Foliage rust	wL, W	Inonoaklin Creek	Heavy yellowing of foliage.
Pucciniastrum vaccinii (Wint.) Joerst. Hemlock needle rust	wH	Sullivan Creek	Medium to heavy infection.
Uredinopsis (?) pteridis Diet. & Holw. Grand fir needle rust	gF	W. Creston	Medium to heavy infection.


WEST NELSON DISTRICT
SCALE
0 10 20
DRAINAGE DIVISIONS 200
Map 2
Known areas of larch sawfly infestation in 1966.
EDGEWOOD
LOWER ARROW LAKE
KETTLE
GRANBY
RIVER
200
201
202
203
CASTLEGAR
NELSON
KOOTENAY LAKE
KETTLE VALLEY
GRAND FORKS
CRESTON


WEST NELSON DISTRICT
SCALE
0
10
20
DRAINAGE DIVISIONS 200
Map 3
Known areas of infestations in 1966.
Larch bud moth
Black-headed budworm
200
201
202
203
KETTLE
RIVER
GRANBY
RIVER
EDGEWOOD
LOWER
ARROW LAKE
KOOTENAY LAKE
NELSON
CASTLEGAR
CRESTON
KETTLE VALLEY
GRAND FORKS

FOREST INSECT AND DISEASE SURVEY

CENTRAL NELSON DISTRICT

1966

FOREST INSECT AND DISEASE SURVEY

CENTRAL NELSON DISTRICT

1966

E. V. Morris [1/]

INTRODUCTION

Field work in the District commenced in April and continued to the end of October. Two special surveys were done in the latter part of the field season. One week was spent on cocoon sampling for larch sawfly population studies and three weeks were spent on black-headed budworm egg surveys. An additional two weeks were used earlier in the season on aerial reconnaissance and larch casebearer surveys in the Nelson Forest District.

Insect and Disease collections made in the District are shown by hosts in Table 1. Collection points and drainage divisions are shown on Map 1. The principal problems in each Forest Insect and Disease Survey Drainage Division are shown in Table 2.

There was a small increase in the numbers of larval defoliators found in field collections in 1966; 89% of beating collections contained larvae compared with 80% in 1965.

Two defoliators that were epidemic in 1965 remained at high population levels in 1966. Black-headed budworm infestations on western hemlock increased and caused light to moderate defoliation of approximately 400 square miles of mature and overmature hemlock forests. Larch sawfly outbreaks increased in the southern part of the District notably along the Slocan Valley, and caused moderate to heavy defoliation of western larch. Larch bud moth infestations that were widespread in high elevation larch stands in 1965 subsided in 1966.

There was a further decline in the number of mountain-pine-beetle-attacked white pine trees counted during aerial surveys.

White pine blister rust remained the most widespread disease problem and was found over much of the range of white pine.

1/ Forest Research Technician, Forest Insect and Disease Survey, Vernon.

Table 1

Collections by Hosts

Central Nelson District, 1966

Coniferous hosts	Forest insects	Forest diseases	Broad-leaved hosts	Forest insects	Forest diseases
Cedar, western red	34	1	Alder species	1	1
Douglas-fir	70	3	Aspen, trembling	5	3
Fir, alpine	9	6	Birch, western white	1	2
Fir, grand	5	-	Cottonwood, black	1	1
Hemlock, western	150	7	Maple, Douglas	-	1
Larch, western	32	2	Willow species	1	3
Pine, lodgepole	20	2	Miscellaneous	2	8
Pine, ponderosa	2	-			
Pine, western white	22	9			
Spruce, Engelmann	24	1			
Totals	368	31	Totals	11	19
			GRAND TOTALS	379	50

Table 2

Currently Important Insect and Disease [1] Problems by Drainage Divisions, Central Nelson District

Insect and disease problems	Principal hosts [2]	Importance by drainage divisions [3]					
		220	221	222	223	224	225
DEFOLIATORS							
Black-headed budworm	wH	1	1	4	5	5	5
Larch sawfly	wL	5	4	1	1	0	0
Larch casebearer	wL	1	1	1	1	0	0
Larch bud moth	wL	1	1	1	1	0	0
BARK BEETLES							
Mountain pine beetle	wwp	1	1	2	2	1	1

1/ Includes only weather-induced and foliage diseases subject to notable annual fluctuation.

2/ Refer to host code in Nelson Forest District introduction.

3/ High populations and/or widespread outbreak in progress - 5
Scattered high populations and/or significant damage in restricted areas - 4
Rising population and/or moderate numbers of insects and/or potential problem - 3

Static or falling population and/or moderate numbers of insects and/or no potential problem at present - 2

Endemic population and/or no significant damage - 1
Not sampled and/or no host and/or not found - 0

FOREST INSECT CONDITIONS

Currently Important Insects

Defoliators

Black-headed Budworm, Acleris variana (Fern.)

Black-headed budworm larval populations remained high throughout many of the mature and overmature western hemlock forests in the northern portion of the District, with significant increases in the Trout Lake and Lardeau River watersheds. Several small infestations were found in the south. The occurrence and number of budworm taken in three-tree beating samples from western hemlock during the larval period (July 7 to August 12) for 1964 to 1966 is shown in the following summary:

No. of samples during larval period			% samples containing larvae			Av. no. of larvae per positive samples		
1964	1965	1966	1964	1965	1966	1964	1965	1966
56	48	63	36	68	92	3.8	42.2	48.9

Defoliation was heaviest in mature and overmature hemlock stands and light defoliation occurred in a few pole-sized hemlock stands at lower elevations. Discoloured hemlock foliage was mapped on approximately 400 square miles during aerial surveys (Map 3). The main areas where defoliation was evident from aerial and ground surveys were Upper Arrow Lake from Saddle Mountain to Arrowhead, Nakusp to Beaton, Columbia River from Arrowhead to Mica Creek, along Rogers Pass Highway in Glacier National Park, Jordan River Valley, Trout Lake, and Lardeau River from Gerrard to Meadow

Creek. Small infestations were found in the south at Keen and Woodbury creeks in the Kootenay Lake area, and at Carpenter and Koch creeks in the Slocan watershed. Highest larval populations were found from 2,500 to 4,500 feet elevation.

Western hemlock was the only tree species that showed noticeable defoliation, generally on the current foliage; some feeding on old foliage occurred at Trout Lake, Low Pass and Wilson Lake in the Upper Arrow Lake and at Keen Creek in the Kootenay Lake watershed. Most feeding occurred in the upper crown and could cause some top kill at these localities if heavy defoliation occurs in 1967. Low numbers of budworm larvae were commonly found on Douglas-fir, Engelmann spruce, alpine fir, and western red cedar.

Mass collections of budworm larvae and pupae were made for parasitism and virus studies at four locations in the Upper Arrow Lake and at Keen Creek in the Kootenay Lake area. Parasitism of larvae and of pupae was relatively high in 1966 (Table 3).

Table 3

Black-headed Budworm Parasitism in Laboratory Reared Material, Central Nelson District, 1966

Locality	Number reared		% parasitism	
	Larvae	Pupae	Larvae	Pupae
Cusson Creek	144	50	59	26
Wilson Lake	45	40	26	29
Kuskanax Creek	166	-	57	-
Saddle Mountain	27	-	44	-
Keen Creek	137	120	34	62

Parasitism was higher in 1966 than in 1965 in both the larval and pupal stages. There was high mortality from unknown causes in all mass collections of budworm larvae and pupae. Several mass collections of larvae were sent to the Victoria Laboratory for disease studies but no pathogens were found. Some larvae in the field were in poor condition, possibly due to cool damp weather during June which may have retarded their development and prevented feeding.

Moth flights were observed and egg laying had commenced at several localities on September 6 and 7 with exceptionally high numbers of moths noted in the Trout Lake and Lardeau River areas. A survey was conducted in September and October to determine the severity of 1966 defoliation, the overwintering egg population and the population trend for 1967. The 23 plots established in the District in 1965 were sampled in 1966, using the same sampling method as in 1965. Ten trees were selected at random and an estimate was made of the percentage defoliation of the current year's growth and of total

foliage. Egg counts were made on five 10-inch branch samples selected at random from each of three overstory trees.

Information gathered from previous black-headed budworm outbreaks on the Coast of British Columbia and egg sampling in the Central Nelson District in 1965 indicated that from one to seven eggs per 10-inch branch sample may be expected to produce a larval population which will cause light defoliation the following year 8 to 15 medium, and 16 or more eggs per sample, heavy defoliation. Unless unforeseen mortality occurs in the egg or early larval stage, black-headed budworms will cause light to moderate defoliation along Upper Arrow Lake and along the Columbia River Valley from Revelstoke to Mica Creek in 1967, moderate defoliation along the Rogers Pass Highway in Glacier National Park and heavy defoliation in the Trout Lake and Beaton areas (Table 4).

Table 4

Results of Black-headed Budworm Defoliation and Egg Surveys
Central Nelson District, October 1966

Locality	% defoliation		Av. no. of eggs per branch sample		Predicted 1967 defoliation
	Current	Total	1965	1966	
Upper Arrow Lake					
Vipond Road	25	5	0.7	4.4	light
Mi. 10 Kuskanax Cr.	60	20	11.9	8.4	medium
Mi. 5 Wilson L.	55	15	7.0	3.7	light
Mi. 2 Wilson L.	55	15	26.6	2.7	light
Low Pass	40	15	8.7	4.2	light
North Low Pass	75	35	6.0	17.3	heavy
Mi. 6 Halfway R.	35	5	11.4	5.2	light
Mi. 4 Halfway R.	20	5	12.6	4.8	light
Galena Bay	10	5	4.2	12.0	medium
Victor Road	25	5	1.9	10.6	medium
Revelstoke - Big Bend					
Jordan River	60	25	6.4	16.5	heavy
Kirkup Creek	60	20	9.0	6.2	light
Sale Creek	50	15	8.3	15.8	medium
Lapoint Road	15	5	-	11.7	medium
Keystone Road	35	10	6.0	3.9	light
Goldstream Road	35	10	8.0	5.7	light
(Br. 4) Goldstream Rd.	5	25	3.6	6.6	light
Rogers Pass	15	5	1.8	8.2	medium
Cougar Creek	45	15	7.4	11.4	medium

Table 4 continued

Locality	% defoliation		Av. no. of eggs per branch sample		Predicted 1967 defoliation
	Current	Total	1965	1966	
Beaton-Trout Lake					
Beaton Junction	60	20	9.8	59.2	heavy
Trout Lake	40	10	-	27.8	heavy
Kootenay Lake					
Mi. 6 Keen Cr.	40	10	7.7	6.4	light
Mi. 4 Keen Cr.	25	5	10.5	2.0	light

A 100-tree mortality plot was established at Beaton in an overmature western hemlock stand to study the effects of black-headed budworm defoliation. The average current defoliation was 70% and the average total defoliation was 29%. The heaviest defoliation was in the upper third of the crowns; some of the trees had lost up to 90% of their foliage. Some top kill could occur at this plot if there is heavy budworm feeding in 1967.

Larch Sawfly, Pristiphora erichsonii (Htg.)

Western larch stands throughout the Slocan Valley were again defoliated by larch sawfly in 1966. Smaller infestations were found at several localities in the north along the Upper Arrow and Kootenay lakes. Sawfly adults were first noted in flight on May 19 and eggs were found on June 1. Defoliation became obvious in early July. The following summary shows the increase in numbers of larch sawfly larvae in three-tree-beating collections from western larch during the larval period (June 1 to August 15) from 1964 to 1966:

Number of samples taken during larval period			% samples containing larvae			Av. no. of larvae per sample		
1964	1965	1966	1964	1965	1966	1964	1965	1966
13	25	21	10	48	47	1	41.8	63.5

Aerial surveys in August showed approximately 100 square miles of moderate to heavy defoliation throughout many of the larch stands at the following localities: Slocan River Valley from Thrums to five miles north of Slocan City, Thrums to Castlegar along the Kootenay River, Little Slocan River from Passmore to Slocan City, Koch and Winlaw creeks. Several small infestations were found at Kaslo, along the Kaslo River, at West Demars and at Mosquito and Fosthall creeks in the Upper Arrow Lake area.(Map 4). Defoliation ranged up to 90%. At the four cocoon sample plots, there was 40% defoliation at West Demars, 64% at Passmore, 83% at Perry Siding and 91% at

Kaslo. A 100-tree plot was established at Perry Siding to determine the effect of defoliation. The average defoliation was 76% on trees ranging from 4 to 20 inches dbh but no tree mortality had resulted.

Larch sawfly cocoon sampling for predicting the 1967 population level was done in September in plots at four localities; Kaslo, West Demars, Perry Siding and Passmore. Ten dominant and co-dominant trees were selected at each plot and a square-foot duff sample was removed from beneath each of the trees. Cocoons from the duff samples were classified as sound and dead or empty (Table 5).

Table 5

Number of Larch Sawfly Cocoons in Ten Square-foot Duff Samples at Each of Four Localities, Central Nelson District, 1965 - 1966

Locality	No. of cocoons			
	Sound		Dead or empty	
	1965	1966	1965	1966
West Demars	261	202	125	416
Perry Siding	604	521	313	913
Passmore	515	597	312	535
Kaslo	-	616	-	260

The empty cocoons and cocoons with dead larvae were examined and classified as emerged, probably destroyed by mammals or Elateridae, parasitized by Mesoleius tenthredinus Morley or Tritneptis klugii (Ratz.) (Table 6).

Table 6

Cumulative % Emergence and Cocoon Mortality Central Nelson District, 1966

Locality	% emerged	% cocoons apparently destroyed by			
		Predation		Parasites	
		Mammal	Elateridae	Mesoleius	Tritneptis
West Demars	29	29	6	33	2
Perry Siding	46	24	16	3	5
Passmore	56	28	7	3	4
Kaslo	49	27	6	2	9

One hundred sound cocoons from each plot were opened and the larvae dissected to determine percentage parasitism (Table 7).

Table 7

Classification of Larvae from 100 Sound Cocoons, at Four Plots, Central Nelson District

Locality	Healthy		% cocoons parasitized by:			
			Tritneptis		Mesoleius	
	1965	1966	1965	1966	1965	1966
West Demars	64	40	0	2	36	58
Perry Siding	100	69	0	27	0	4
Passmore	93	72	4	27	2	1
Kaslo	-	44	-	55	-	1

There was an increase in Tritneptis and Mesoleius at all plots except at Passmore where there was a small decrease in Mesoleius. The highest percentage parasitism by Tritneptis was at Kaslo, where defoliation was first noticeable in 1966. It is expected that larch sawfly larval populations will again be at a high level in 1967.

Ten traps were set up at Perry Siding plot to collect larvae for information on larval diapause. The traps consisted of funnels with two-square-foot openings placed under representative larch trees in the stand; under each funnel a metal box 6 x 6 x 5 inches with a copper screen bottom and incurved upper edge was buried to ground level and filled with duff.

The box was covered with 1/3-inch mesh hardware cloth to exclude mice and shrews. Five of the traps were removed in the fall and the cocoons classified as sound and dead or empty. There was an average of 56 sound and 7 dead or empty cocoons per trap. The sound cocoons will be reared to determine the prevalence of diapause, to compare diapause in incubated cocoons with those in the field, and to compare parasitism of cocoons in traps with that from standard soil samples. The five traps left in the field will be examined after adult emergence in the summer of 1967.

Larch Bud moth, Zeiraphera sp.

Discoloration of western larch foliage caused by bud moth feeding was not observed during aerial and ground surveys in 1966. In larch stands at Springer Creek that had heavy bud moth larval populations in 1965 only 12% of 100 needle fascicles examined had been fed on in early June; no noticeable defoliation or discolored foliage was observed at this locality later in the season. Small numbers of bud moth larvae were commonly found on larch at lower elevations.

Larch Casebearer, Coleophera laricella Hbn.

Reported in Nelson Forest District introduction.

Bark Beetles

Mountain Pine Beetle, Dendroctonus ponderosae Hopk.

A sharp decline in the number of red-top western white pine counted from aerial and ground surveys was recorded again in 1966. Significant decreases occurred near the Upper Arrow Lake from West Demars to Arrowhead and in the Mosquito Creek drainage. A total of 1,000 red-top white pines were counted in the District during 1966, representing decreases of 3,800 trees from the 1965 figure and 14,000 from the 1964 estimates. Table 8 gives the number of red-topped white pine killed in 1965 as determined in 1966 by aerial and ground surveys. An average of 42 cubic feet per tree was used to calculate the volume of timber killed at each locality. This figure was based on measurements of beetle-killed trees taken at several localities.

Table 8

Number of White Pine Trees and Volume Killed by Mountain Pine Beetle in Central Nelson District, 1965, as Determined by Aerial and Ground Surveys, 1966

Locality	No. of trees killed	Volume (cu. ft.)
West Shore Upper Arrow Lake (West Demars to Arrowhead)	290	12,180
Mosquito Creek Drainage (Arrow Park to Mosquito Lake)	75	3,150
Fosthall Creek	145	6,090
Arrowhead to Boat Encampment (Columbia River)	140	5,880
Trout Lake	100	4,200
Wilson Creek (Slocan Lake)	100	4,200
Lardeau River	110	4,620
Duncan River	30	1,260
Totals	990	41,580

The five colour change plots established in 1965 to make observations on foliage color change and needle loss on 1964 beetle-killed white pine trees were examined in June, 1966 (Table 9).

Table 9

Color Change and Needle Loss of 1964 Beetle-attacked Western White Pines, Central Nelson District

Location and date examined	No. of trees red	% needle loss
Mosquito Creek		
September 1965	20	60
June 1966	0	100
Low Pass		
September 1965	15	50
June 1966	0	100
Galena Bay		
September 1965	12	52
June 1966	0	100
Trout Lake		
September 1965	5	60
June 1966	0	100
Wilson Creek		
September 1965	12	60
June 1966	0	100

Colour change plots have shown over the past three years that aerial surveys in the latter part of July and early August detect as red tops only the previous year's beetle-killed trees. Trees dead more than one year had lost all their foliage.

Five new color change plots were established in 1966 on 1965 beetle-killed white pine trees and the color change and needle loss recorded each month from June to September (Table 10).

Table 10

Foliage Colour Change of Western White Pines
Killed in 1965, Central Nelson District, 1966

Locality	No. of trees			% needle loss
	Green	Fading	Red	
Mosquito Creek				
June	2	18	0	10
July	0	0	20	35
August	0	0	20	50
September	0	0	20	50
Low Pass				
June	0	5	2	12
July	0	0	7	41
August	0	0	7	64
September	0	0	7	68
Wilson Creek				
June	2	11	0	10
July	0	0	13	28
August	0	0	13	67
September	0	0	13	78
Poplar Creek				
June	0	0	10	40
July	0	0	10	63
August	0	0	10	74
September	0	0	10	79
Slewiskin Creek				
June	2	3	7	20
July	0	4	8	26
August	0	0	12	53
September	0	0	12	62

Aerial surveys along the Canoe River north of Boat Encampment showed 210 lodgepole pine red tops; these were the only beetle-killed lodgepole pine found in the District in 1966.

Other Noteworthy Insects

Spruce Budworm, Choristoneura fumiferana (Clem.)

Larval collections of spruce budworm were again at a low level in 1966 from the two preferred hosts, Douglas-fir and western hemlock. The highest numbers of larvae per collection were 10 at Jordan River from hemlock and four from Douglas-fir at Riondel. The following summary gives a comparison of spruce budworm collections taken between June 1 and July 31 from western hemlock and Douglas-fir in Central Nelson District, 1964 to 1966:

Host	No. of samples taken during larval period			% samples containing larvae			Av. no. of larvae per positive sample		
	1964	1965	1966	1964	1965	1966	1964	1965	1966
Douglas-fir	44	55	50	14	18	16	1.7	1.6	1.6
Western hemlock	71	56	80	6	17	11	1.2	1.5	2.2

Douglas-fir Needle Midges, Contarinia spp.

Needle midge damage continued in the Slocan Valley; populations increased at Thrums and Lemon Creek and decreased at Gwillum Creek, Vallican, and Little Slocan River. The needles of five terminal twigs from five trees at each of these localities were examined to determine the percentage of current needles mined (Table 11).

Table 11

Results of Examination of Douglas-fir Needles for Midge Damage at Five Plots, Central Nelson District

Locality	% current year's needles infested	
	1965	1966
Thrums	37	58
Lemon Creek	30	38
Gwillum Creek	44	10
Vallican	68	40
Little Slocan River	43	40

Douglas-fir Beetle, Dendroctonus pseudotsugae Hopk.

Douglas-fir beetle populations remained at a low level in the

District during 1966. Thirty-five scattered red-topped Douglas-fir were counted in the Trout Lake area. Power line right-of-way Douglas-fir and western larch slash in the Meadow Creek area was heavily infested, but no standing trees were attacked.

Western Balsam Bark Beetle, Dryocoetes confusus Sw.

A further decline in beetle-killed alpine fir was noted during aerial surveys. Small groups of red-topped trees were observed at the following localities: Pingston, Cusson, and upper Fosthall creeks in the Upper Arrow Lake watershed; Enterprise Creek in the Slocan area; and along Keen Creek in the Kootenay Lake watershed.

A Willow Leaf Beetle, Galerucella sp.

Willow stands throughout much of the Upper Arrow Lake and Summit Lake areas were heavily infested with leaf beetles. By August 10, up to 100% of the leaves were skeletonized at Saddle Mountain in the Mosquito Creek drainage and along the hillsides in the Summit Lake area southeast of Nakusp.

Western Hemlock Looper, Lambdina fiscellaria lugubrosa (Hulst)

Hemlock looper larval populations remained at a low level in 1966. A maximum of 10 larvae was collected in a sample from western red cedar at Armstrong Lake. Table 12 summarizes collections of hemlock looper from 1964 to 1966 from four coniferous hosts, during the larval period May 29 to August 15.

Table 12

Summary of Western Hemlock Looper Collections
Central Nelson District

Host	No. samples taken during larval period			% samples containing larvae			Av. no. larvae per positive sample		
	1964	1965	1966	1964	1965	1966	1964	1965	1966
Western hemlock	88	82	85	36	32	19	2.3	2.0	1.5
Engelmann spruce	26	19	22	12	31	9	2.3	1.6	1.0
Western red cedar	61	31	23	38	10	26	5.3	4.3	3.0
Douglas-fir	60	62	57	5	2	5	2.3	1.0	1.9

A Hemlock Sawfly, Neodiprion sp.

Hemlock sawfly populations increased in many of the mature and over-mature hemlock forests in the District. Larvae were present in 48% of hemlock collections, with an average of 22.2 per sample. The highest number of larvae per collection was 225 at Wilson Creek; at Downie Creek

on the Big Bend Highway 120 larvae were collected in one sample.

A Looper, Nepytia freemani Munroe

Populations of Nepytia larvae on western hemlock and Douglas-fir remained at a low level. Thirty-six per cent of collections from Douglas-fir contained larvae, with an average of 1.2 larvae per positive sample; 11% of the hemlock collections were positive, with an average of 1.6 larvae.

Aspen Leaf Miner, Phyllocnistis populiella Cham.

Aspen leaf miner infestations on trembling aspen decreased in 1966 (Table 13). There was an increase in parasitism at all plots and a large number of pupae had died from unknown causes (Table 14).

Table 13

Comparison of Aspen Leaf Surfaces Mined and Number of Adults Produced per 100 Leaf Surfaces at Five Plots, Central Nelson District, 1964 to 1966

Locality	Percentage of leaf surfaces with mines			No. of adults produced per 100 leaf surfaces		
	1964	1965	1966	1964	1965	1966
Revelstoke	76	72	53	43	43	17
McKay Creek	41	64	38	14	52	10
Summit Lake	1/	69	38	1/	49	8
New Denver	67	67	49	44	42	16
Winlaw	55	69	50	15	22	6

Table 14

Mortality of Aspen Leaf Miner in 100-cocoon Samples at Five Locations, Central Nelson District, 1964 to 1966

Locality	% mortality					
	Parasitism			Other causes		
	1964	1965	1966	1964	1965	1966
Revelstoke	33	20	18	7	13	30
McKay Creek	33	12	22	10	20	12
Summit Lake	1/	8	16	1/	17	12
New Denver	21	13	12	4	11	40
Winlaw	36	24	15	11	15	30

not sampled; heavy tent caterpillar defoliation

Table 15

Other Insects of Current Minor Significance

Insect	Host	Locality	Remarks
Adelges cooleyi (Gill.) Cooley spruce gall aphid	D	Widespread in south	Sucking insect causing noticeable discoloration of foliage.
Corythucha sp. Lace Bugs	W	Widespread in 1965	Sucking insect, no damage noted in 1966.
Lyonetia saliciella Busck A leaf blotch miner	wB, W, Al	Trout Lake, Kootenay Lake	Leaf miner, greatly reduced population from 1965.
Monochamus spp. Sawyer beetles	wwP	Mosquito Cr.	Woodborers infesting beetle killed white pine at several localities.
Neophasia menapia Feld. Pine butterfly	D, wwP	Galena Bay Road	Defoliator, adults noted in flight in pole-sized Douglas-fir-white pine stands.
Sternochetus lapathi (L.) Poplar-and-willow borer	W, bCo	Summit L., Enterprise Cr.	Borer, willow clumps heavily infested; cottonwood saplings also infested.

FOREST DISEASE CONDITIONS

Currently Important Diseases

White Pine Blister Rust, Cronartium ribicola J. C. Fisch. ex Rab.

White pine blister rust was the most widespread disease encountered in the District. It was found throughout much of the range of the western white pine, with heavy infections occurring at the following localities: along the main valley from New Denver to Kaslo, along Meadow Creek, and along the west shore of the Upper Arrow Lake from Arrow Park to Arrowhead. Lighter infections were found in the Trout Lake and Lardeau River valleys. A large number of beetle-killed white pines had top kill caused by blister rust.

Porcupine Damage

There was a definite increase in damage caused by porcupines from that noted in 1965. Aerial surveys revealed numerous pockets of high elevation lodgepole pine, alpine fir and, to a lesser degree, white pine damaged or killed by porcupines Erethizon dorsatum nigrescans Allen. In most areas only the tops and branches were killed but at several localities near Slocan Lake, lodgepole pine and alpine fir had been completely stripped of bark.

Exotic Plantations

Exotic plantations in the District were examined in October (Table 16).

Table 16

Summary of Disease Conditions on Exotic Plantations, 1966

XP number	Location	Exotic species	Remarks
167	Marble Head	Mixed hardwoods	Trees doing well that have not been damaged by climatic injury. This plot has been neglected and needs thinning.
216	Mosquito Cr.	Picea sitchensis (Bong.) Carr.	Trees doing well, some spruce gall aphid damage; 4 to 6 inches new growth on trees growing in open.
217	Low Pass Camp	Picea sitchensis (Bong.) Carr.	Inaccessible in 1966; not examined.
218	Plante Cr.	Picea sitchensis (Bong.) Carr.	Heavy underbrush at this plot; trees doing well in open; 6 to 7 inches new growth.

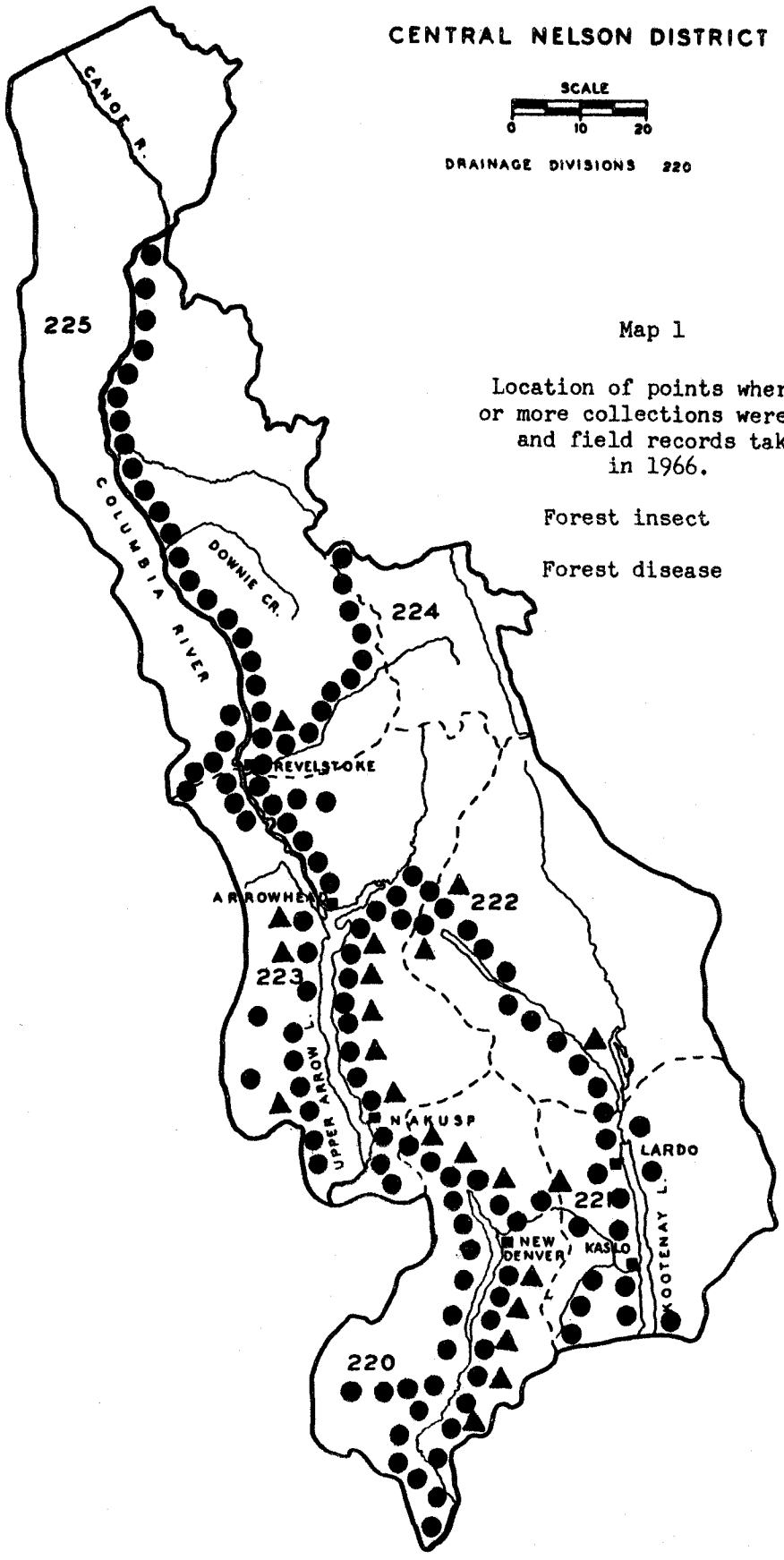
Table 17

Other Diseases of Current Minor Significance

Organism and disease	Hosts	Locality	Remarks
Arceuthobium campylopodum Engelm. f. laricis (Piper) Gill Dwarf mistletoe	wL	Wilson Cr. Howser Ridge	Common on overmature larch.

Table 17 continued

Organism and disease	Hosts	Locality	Remarks
Armillaria mellea (Fr.) Krummer Shoestring root rot	D, wwP	Widespread	Douglas-fir and white pine seedlings and saplings infected at numerous localities.
Bacterium pseudotsugae Hans. and R. E. Smith Bacterial gall	D	Vallican New Denver	Heavy infection on understory.
Caliciopis pseudotsugae Fitzp. Stem canker	D	Roseberry	Light infection on understory trees.
Cryptosporium sp. Dieback disease	tA	Summit Lake	New host record
Delphinella balsameae (Waterm.) E. Mueller Foliage disease	alF	Kane, Keen and Enterprise creeks	Common on understory trees.
Hypodermella laricis Tub. Larch needle cast	wL	Kaslo, Lardeau, Howser Ridge	Light infections on sapling and pole-sized trees.
Melampsora medusae Thuem. Needle rust	wH	Kane and Enterprise creeks	Light infection.
Melampsora medusae Thuem. Needle rust	D	Along Arrowhead-Revelstoke Highway, Slocan Valley	Heavy infections on understory stands.
Pucciniastrum epilobii Otth	alF	Carpenter Cr. Seaton Cr. Kane Cr.	Common on understory trees.
Pole-blight	wwP	Upper Arrow Lake	Symptoms of pole-blight found at Pingston Creek and Shelter Bay in the Upper Arrow Lake area.

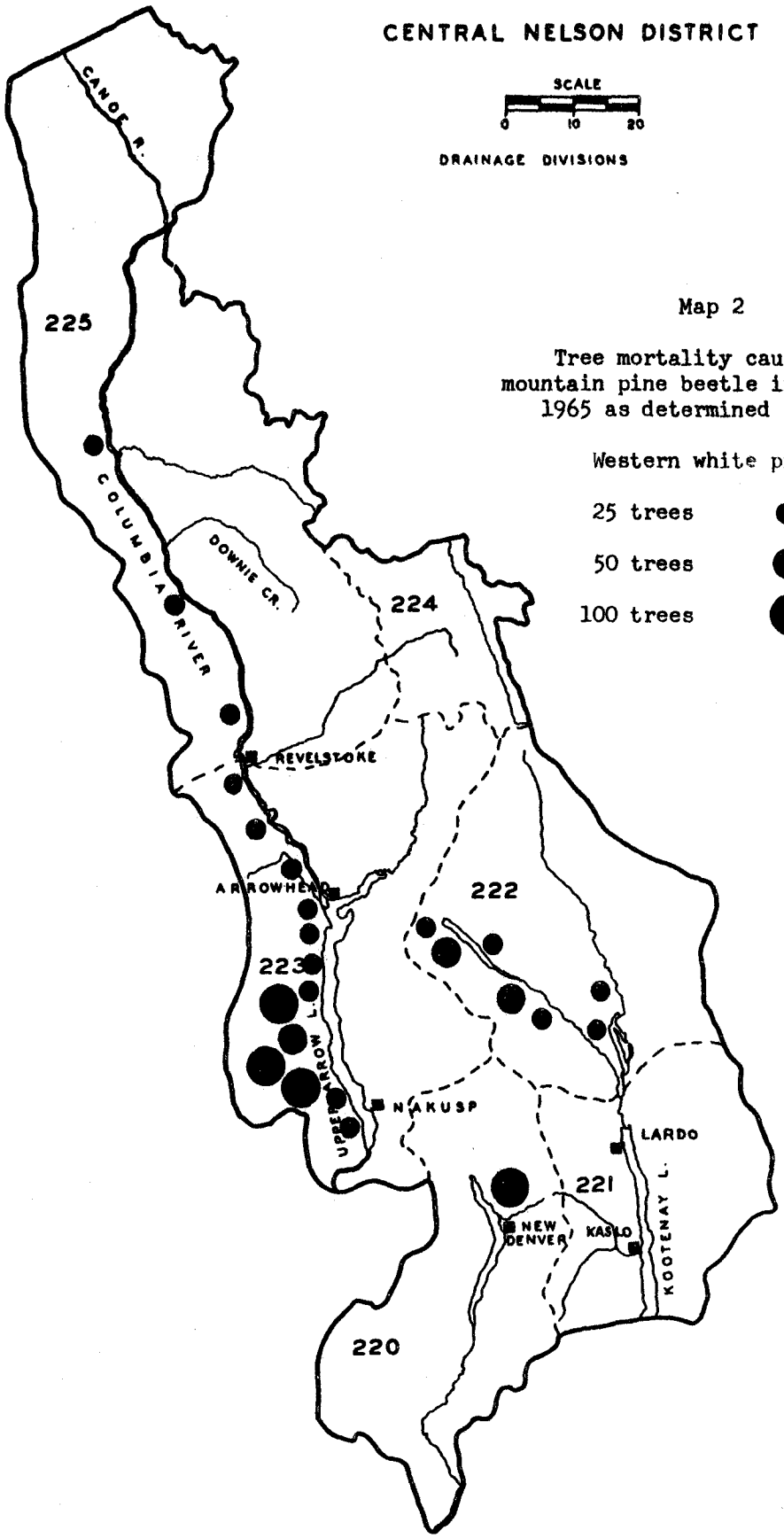


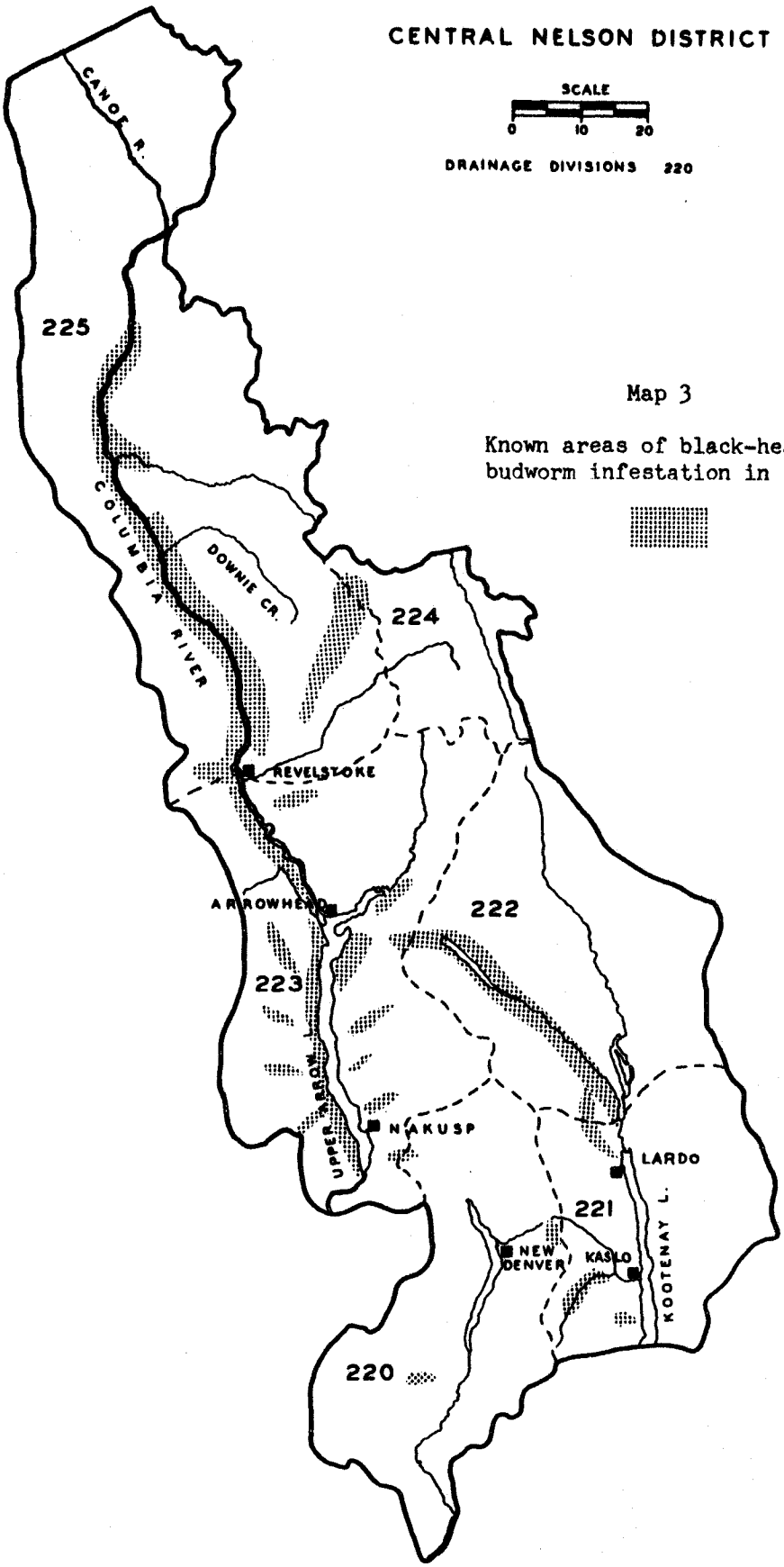
Map 1

Location of points where one or more collections were made and field records taken in 1966.

Forest insect ●

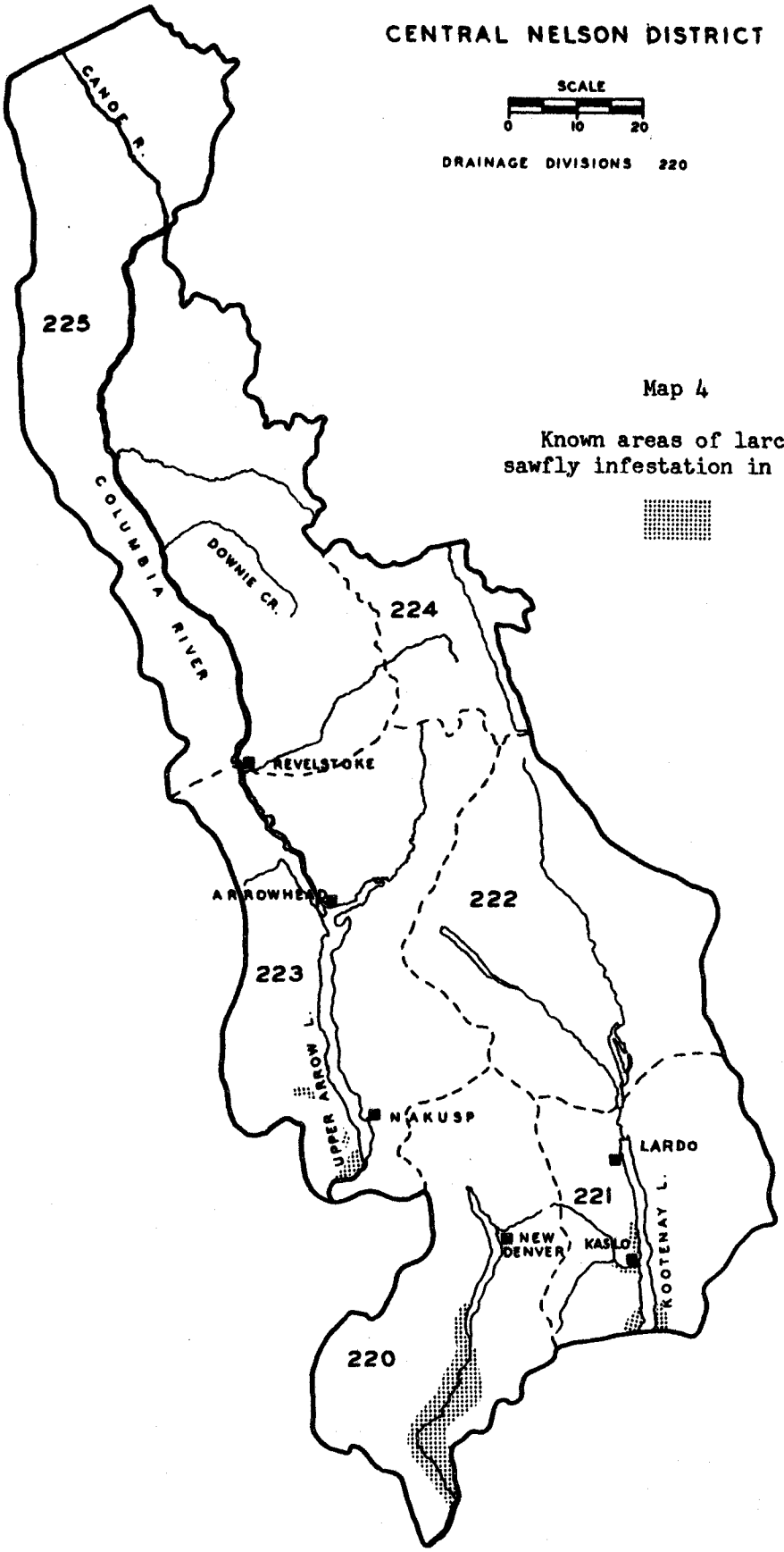
Forest disease ▲


CENTRAL NELSON DISTRICT
SCALE
0
10
20
DRAINAGE DIVISIONS
Map 2
Tree mortality caused by mountain pine beetle in 1964 and 1965 as determined in 1966.
Western white pine
25 trees
50 trees
100 trees
CANOE R.
225
COLUMBIA RIVER
DOWNIE CR.
224
REVELSTOKE
ARROWHEAD
222
223
UPPER ARROW L.
NAKUSP
LARDO
221
NEW DENVER
KASLO
KOOTENAY L.
220



Map 3

Known areas of black-headed budworm infestation in 1966.



Map 4

Known areas of larch sawfly infestation in 1966.

FOREST INSECT AND DISEASE SURVEY

EAST NELSON DISTRICT

1966

FOREST INSECT AND DISEASE SURVEY

EAST NELSON DISTRICT

1966

N. B. Bauman [1/]

INTRODUCTION

The 1966 field season in the East Nelson District began on June 13 and ended on October 19. During this period five weeks were spent on special surveys. Late in June and again in October a survey was undertaken to determine the spread of the larch casebearer. During the last week of July the occurrence of spruce beetles in the 1964 wind-felled spruce in the Elk and Flathead watersheds was checked. An aerial survey was conducted during the first week of August. In the second week of September duff sampling for larch sawfly cocoons was completed. Three weeks were spent in the West Nelson District assisting with surveys for the larch casebearer, larch sawfly, and black-headed budworm.

Totals of 304 forest insect and 25 forest disease collections were taken in the District. Table 1 lists the collections by hosts, and Map 1 shows the locations where one or more collections were made in 1966. The principal problems in each Forest Insect and Disease Survey Drainage Division are shown on Map 1.

Table 1

Collections by Hosts

East Nelson District, 1966

Coniferous hosts	Forest insects	Forest diseases	Broad-leaved hosts	Forest insects	Forest diseases
Cedar, western red	5	0	Aspen, trembling	0	1
Douglas-fir	96	3	Willow species	1	0
Fir, alpine	26	3	Miscellaneous	3	3
Hemlock, western	9	0			
Juniper, Rocky Mtn.	10	1			
Larch, alpine	1	0			
Larch, western	43	3			
Pine, lodgepole	45	9			
Pine, ponderosa	17	0			
Spruce, Engelmann	48	2			
Totals	300	21	Totals	4	4
			GRAND TOTALS	304	25

1/ Forest Research Technician, Forest Insect and Disease Survey, Vernon, B.C.

In general, the numbers of larval defoliators in field collections were slightly lower this year with only 60% of all beating collections containing larvae.

Table 2

Currently Important Insect and Disease 1/ Problems by Drainage Division, East Nelson District, 1966

Insect and disease problems	Principal hosts 2/	Importance by drainage divisions 3/				
		240	241	242	243	244
BARK BEETLES						
Mountain pine beetle	lP	4	1	0	4	4
Spruce beetle	eS	0	2	1	0	0
Douglas-fir beetle	D	0	0	0	2	0
DEFOLIATORS						
Larch sawfly	wL	5	5	5	2	0
Larch casebearer	wL	3	0	0	0	0
NEEDLE MINERS						
Douglas-fir needle midge	D	1	0	0	1	0
FOLIAGE DISEASES						
Larch needle cast	wL	4	3	0	0	0
Pine needle cast	lP	0	0	0	2	0
Douglas-fir needle rust	D	0	0	0	1	0
Spruce needle rust	eS	0	0	0	0	3

1/ Includes only weather-induced and foliage diseases subject to notable annual fluctuation.

2/ See Nelson Forest District introduction for list of host tree abbreviations.

3/ High population and/or widespread outbreak in progress - 5
Scattered high populations and/or significant damage in restricted areas - 4
Rising population and/or moderate numbers of insects and/or potential problem - 3

Static or falling population and/or moderate numbers of insects and/or no potential problem at present - 2

Endemic population and/or no significant damage - 1
Not sampled, no host, or not found - 0

FOREST INSECT CONDITIONS

Currently Important Insects

Bark Beetles

Mountain Pine Beetle, Dendroctonus ponderosae Hopk.

Although the mountain pine beetle was still a serious problem in lodgepole pine stands in the East Nelson District, the numbers of red-topped trees decreased considerably from the 1965 level (Table 3). The only increase occurred at Redgrave where the number of red-topped trees increased from 2,000 to 3,000 in the past year. Map 2 shows the locations and numbers of trees killed as determined by the 1966 aerial survey.

Table 3

Estimated Number of Lodgepole and Western White Pine Killed by Mountain Pine Beetle as Determined by Aerial Surveys, East Nelson District

Location	Host	Number of red-tops		
		1964	1965	1966
Bush River	lP, wwP	2100	1700	250
Redgrave	lP	1250	2000	3000
Waitabit Creek	lP	2250	2000	-
Parson	lP	25	10	-
Horsethief Creek	lP	125	165	-
Dutch Creek	lP	375	155	-
Findlay Creek	lP	225	120	-
Elk Creek	lP	800	1200	265
Coyote Creek	lP	900	3500	2000
Kootenay River-White River	lP	300	1120	350
Forster Creek	lP	225	150	-
Steamboat Mtn.	lP	50	25	-
Kinbasket Lake	wwP	-	25	10
Palliser River	lP	-	250	-
Cross River	lP	-	200	-
Blackwater Lake	wwP	-	15	-
Harvey Pass	lP	-	-	25
Totals		8,625	13,010	5,900

Spruce Beetle, Dendroctonus obesus (Mann.)

The spruce beetle population remained low during 1966. The 1964 Engelmann spruce blowdown in the Fernie B. C. F. S. Ranger District was examined for spruce beetle but little or nothing was found (Table 4). There is little possibility of the old blowdown being reinfested as the bark is too desiccated.

A small population was present in Harvey Pass and at 29 Mile Creek in some 1966 blowdown and logging slash. A small infestation was reported in Tegart Pass (8 miles east of Windermere) by a B. C. Forest Service cruising party.

Table 4

Average Number of Partial and Complete Galleries and Spruce Beetle Progeny per Square Foot of Bark Surface in Fernie Ranger District, 1966

Location	Material	Number of sq. ft. examined	Average number per sq. ft.				
			Galleries		Progeny		
			Partial	Complete	Larvae	Pupae	Adults
Harmer Cr.	chunks	12	0.0	0.1	0.0	0.0	2.2
29 Mile Cr.	logs	12	2.7	3.1	0.0	0.0	0.0
Harvey Pass	chunks	3	1.6	2.6	0.0	0.0	0.0
Sage Cr.	stumps	10	0.2	0.0	0.0	0.0	0.3
Roche Cr. (Sage Cr.)	logs	18	0.2	0.4	0.2	0.9	1.3

Douglas-fir Beetle, Dendroctonus pseudotsugae Hopk.

There was a significant decrease in the number of red-topped Douglas-fir trees observed during the 1966 aerial survey. Table 5 shows a comparison between locations and number of red-tops for the last three years.

Table 5

Estimated Number of Douglas-fir Trees Killed by Douglas-fir Beetle Observed During Aerial Surveys, East Nelson District

Location	Number of red-tops		
	1964	1965	1966
Windermere Lake	75	30	0
Kootenay River	150	115	55
Whiteswan Lake-White River	400	765	425
Gold Creek-Caven Creek	-	770	-
Elko-Roosville	75	40	-
Wigwam River	250	-	-
Toby Creek	-	-	15
Totals	950	1,720	495

Defoliators

Larch Sawfly, Pristiphora erichsonii (Htg.)

During 1966 the larch sawfly reached epidemic proportions throughout most of the range of western larch in the East Nelson District. Approximately 33,000 acres of western larch were defoliated (Map 3). The largest single infestation was in the Bull River drainage system where more than 10,000 acres were defoliated. Defoliation in all infested areas was severe except for the Gold Creek Valley and parts of the Bull River drainage system.

Three permanent plots were established for cocoon sampling and defoliation estimating in the District in 1966. Cocoon populations were measured by counting the number of cocoons in one square foot duff samples taken from beneath each of 10 trees at each of 4 locations.

The average number of sound cocoons per square foot ranged from 21 to 60 while the average number of dead or empty cocoons ranged from 2 to 65 (Table 6).

Table 6

Estimated Percentage Defoliation of 10 Trees and Average Number of Cocoons per Square Foot Duff Sample, East Nelson District, 1966

Location	Estimated % defoliation	Average no. cocoons per sq. ft.	
		Sound	Dead or empty
Bull River	75	21	7
Hosmer	65	60	65
Jim Creek	85	31	2
Sunrise Creek	70	25	47

The dead and empty cocoons were examined to determine the percentage successful emergence and mortality caused by various agencies (Table 7).

Table 7

Cumulative % Emergence and Cocoon Mortality of Larch Sawfly Cocoons from 10 Square Foot Duff Samples, East Nelson District, 1966

Location	% emerged	% apparently destroyed by			
		Predators		Parasites	
		Mammal	Elaterid	Mesoleius	Tritneptis
Bull River	41	50	3	1.5	1.5
Hosmer	32	66	1	0.1	1.2
Jim Creek	19	56	12	0.0	13.0
Sunrise Creek	42	56	1	0.0	1.2

To determine the percentage of healthy and parasitized larvae in the sound cocoons, 100 cocoons from each plot were opened. Parasitism ranged from 0 to 11% by Tritneptis klugii (Ratz.) and from 9% to 42% by Mesoleius tenthredinus Morl. (Table 8). The latter is probably helping to reduce the sawfly populations but not appreciably at present.

Table 8

Classification of Larvae from 100 Sound Cocoons at Four Larch Sawfly Plots in the East Nelson District, 1966

Location	Healthy	Parasitized	
		Tritneptis	Mesoleius
Bull River	87	0	13
Hosmer	56	2	42
Jim Creek	91	0	9
Sunrise Creek	66	11	23

The high overwintering population of sound cocoons with the generally low incidence of parasitism indicates high sawfly populations and possible expansion of damage to western larch stands in the East Nelson District in 1967.

Larch Casebearer, Coleophora laricella Hbn.

See the larch casebearer report following the introduction for the Nelson Forest District.

Needle Miners

Douglas-fir Needle Midge, Contarinia spp.

There was a general decrease in the percentage of Douglas-fir needles infested by Contarinia spp. in 1966. The high degree of infestation encountered near Edgewater in 1965 dropped to less than one per cent in 1966 (Table 9).

Five randomly picked branch tips from five marked trees in each of four permanent sample plots were examined to determine the intensity of the infestation. Percentage of needles infested ranged from 2.4 at Canal Flats in the south to 0.1 at Brisco 60 miles further north.

Table 9

Percentage of Douglas-fir Needles Infested by Contarinia
East Nelson District, 1966

Location	% infested			
	Range		Average	
	1965	1966	1965	1966
Canal Flats	0.3 - 1.9	0.7 - 5.4	0.7	2.4
Invermere	0.0 - 4.9	0.0 - 1.3	1.6	0.7
Edgewater	11.1 - 36.6	0.0 - 0.7	21.8	0.4
Brisco	0.0 - 2.3	0.0 - 0.3	0.8	0.1

A small scale experiment was carried out on 10 pairs of trees in a Christmas tree cutting area near Edgewater. One tree from each pair was treated with Cygon 4E (Dimethoate) and the other tree of each pair was left untreated. The chemical was applied to the stems on May 4, 1966 with a brush in a band 6 inches wide approximately 8 inches from the ground. The percentage of infested needles was over eight times greater on the untreated trees than on the treated trees; however, due to the light infestation the trial was not conclusive and further tests are required.

Treatment	Percentage infestation	
	Range	Average
Dimethoate	0.0 - 0.5	0.1
Control	0.0 - 3.2	1.1

Other Noteworthy Insects

Black-headed Budworm, Acleris variana (Fern.)

The population of black-headed budworm remained low in 1966. Only 25 larvae were taken in 11 positive collections from alpine fir, Engelmann spruce, Douglas-fir, and western hemlock during the field season from Moyie Lake in the south to Boat Encampment on the Big Bend Highway in the north. A maximum of five larvae was taken in a collection from Engelmann spruce at Boat Encampment.

An Aphid on Douglas-fir, Adelges sp.

There was light to severe damage to Douglas-fir Christmas tree stock in the East Nelson District; some trees suffered excessive needle discoloration and distortion. Collections were made at the four Con-

tarinia sample plots at Canal Flats, Invermere, Edgewater and Brisco where 14% to 31% of the needles were infested with Adelges sp. (Table 10).

Table 10

Percentage of 1966 Douglas-fir Needles Infested by Adelges sp., East Nelson District

Location	% needles infested
Canal Flats	31
Invermere	16
Edgewater	20
Brisco	14

Western Balsam Bark Beetle, Dryocoetes confusus Sw.

A significant decrease in the number of alpine fir trees killed in the East Nelson District occurred in 1966. The largest infestations occurred at Beavermouth and Sundown Creek (Table 11).

Table 11

Locations and Estimated Numbers of Alpine Fir Trees Killed by Western Balsam Bark Beetle in East Nelson District, 1966

Location	Estimated no. red-topped trees
Beavermouth	210
Sundown Creek	200
Whiteswan Lake	110
Surprise Rapids	20
Total	540

Aspen Leaf Miner, Phyllocnistis populiella Cham.

Aspen leaf miner populations were generally lower in 1966. The only plot that showed an increase over the past year was at Moyie Lake. The plot at St. Mary's Lake was destroyed during right-of-way clearing and a new plot was established nearby. Between 31% and 70% of the leaf surfaces were mined while between 6 and 26 adults were produced per 100 leaf

surfaces in 1966 (Table 12).

Parasitism ranged from 12% to 36% in cocoon samples taken during 1966 (Table 13).

Table 12

Percentage of Aspen Leaf Surfaces Mined and Average Number of Adult Aspen Leaf Miners Produced per 100 Leaf Surfaces at Five Locations, East Nelson District

Location	% leaf surfaces mined			Av. no. of adults produced per 100 leaf surfaces		
	1964	1965	1966	1964	1965	1966
St. Mary's Lake	82	89	70	55	56	26
Nicholson	20	48	31	20	15	13
Findlay Creek	45	38	38	13	11	6
Moyie Lake	57	36	52	43	24	25
Dutch Creek	-	78	62	-	11	6

Table 13

Aspen Leaf Miner Mortality in 100-cocoon Samples at Five Locations, East Nelson District

Location	Percentage mortality					
	Parasitism			Other causes		
	1964	1965	1966	1964	1965	1966
St. Mary's Lake	9	13	26	9	13	11
Nicholson	23	38	16	2	13	16
Findlay Creek	23	17	22	11	9	13
Moyie Lake	7	11	12	11	8	8
Dutch Creek	-	34	36	-	18	14

A Larch Bud Moth, Zeiraphera sp.

There was light damage to western larch in the Sunrise Creek drainage system where nine larvae and two pupae were taken in a collection from pole-size trees. No other Zeiraphera larvae were collected in the East Nelson District in 1966.

Table 14

Other Insects of Current Minor Significance

Insect	Host	Location	Remarks
Anoplonyx spp. Native larch sawflies	wL	Cranbrook	Defoliator; increase, maximum of 17 larvae per collection.
Choristoneura fumiferana (Clem.) Spruce budworm	D	Elko	Defoliator, very scarce; maximum collection of 2 larvae at Elko.
Ips spp.	pP, eS	Fernie	Bark beetles, common in right-of-way logs, logging slash, and windfalls throughout south half of District.
Lambdina f. lugubrosa (Hulst) Hemlock looper	D, eS, alF	Wide-spread	Defoliator; very scarce; only 4 larvae collected.
Neyptia freemani Munroe A looper	D, wL	Brisco Ft. Steele	Defoliator, very scarce.
Semiothisa granitata Gn. complex Green spruce looper	alF, D, wL	Elko	Defoliator, scarce, maximum of 3 larvae per collection at Elko, Cranbrook and Invermere.
Tetropium cinnemopterum Kby. A round-headed borer	eS	Natal	Wood borer, small number in windfalls in Fernie District.
Zeiraphera fortunana Kft. A spruce tip moth	eS	Canal Flats	Defoliator, 8 and 3 larvae collected at Whiteswan Lake and Coyote Creek respectively.

FOREST DISEASE CONDITIONS

Currently Important Diseases

Foliage Diseases

Larch Needle Cast, Hypodermella laricis Tub.

Light to moderate damage to western larch needles by this needle cast was noted throughout most of the range of western larch in the East Nelson District. Damage was heavy in the Sunrise Creek and Yahk River systems and light in the St. Mary's River and Bull River systems. Most of the infected trees had partially refoliated before the middle of August.

Pine Needle Cast, Elytroderma deformans (Weir) Darker

A needle cast on lodgepole pine caused by Elytroderma deformans was generally moderate to heavy in the area south and west of Canal Flats. Damage was heavy on pole size lodgepole pines along Findlay Creek.

Douglas-fir Needle Rust, Melampsora medusae Thuem.

Light damage to Douglas-fir foliage was caused by this rust in the Christmas tree cutting areas near Canal Flats in 1966.

Spruce Needle Rust, Chrysomyxa ledicola Lagerh.

Heavy infection by this rust occurred on a few acres of regeneration Engelmann spruce east of Golden; infected needles gave the branch tips a bright yellow-orange color.

Mistletoe Diseases

Dwarf Mistletoe, Arceuthobium americanum Nutt. ex Engelm.

Moderate to light damage, caused by dwarf mistletoe, was widespread on pole size lodgepole pine in the southern portion of the East Nelson District.

Animal Damage

Porcupines, Erethizon dorsatum L., again caused light damage to lodgepole pine stands in the Lodgepole Creek, Bull River, Kootenay River, and Yahk River watersheds.

Exotic Plantations

One of the three exotic plantations in this District was examined during the last week in August. Two other plantations were not located.

In plantation XP 171 no insects or diseases were found on the European larch, Larix decidua Mill. Trees had produced up to 28 inches of current year's terminal growth even through they were completely over-topped by an aspen copse.

Disease Progress Plots

Douglas-fir Dieback

The number of dead laterals increased significantly in each of the three Douglas-fir dieback plots in 1966 (Table 15).

Table 15

Progress of Douglas-fir Dieback at Three Permanent Sample Plots East Nelson District

Location	Year	No. of trees exam.	No. healthy	No. with dead		No. dead
				Laterals	Terminals	
Premier L. Rd.	1964	91	53	33	10	3
	1965	91	47	34	9	5
	1966	80	42	30	4	3
Canal Flats	1964	98	83	7	2	4
	1965	98	81	8	5	4
	1966	94	33	44	7	0
Invermere	1964	93	63	30	1	1
	1965	93	61	31	1	2
	1966	89	36	51	2	1

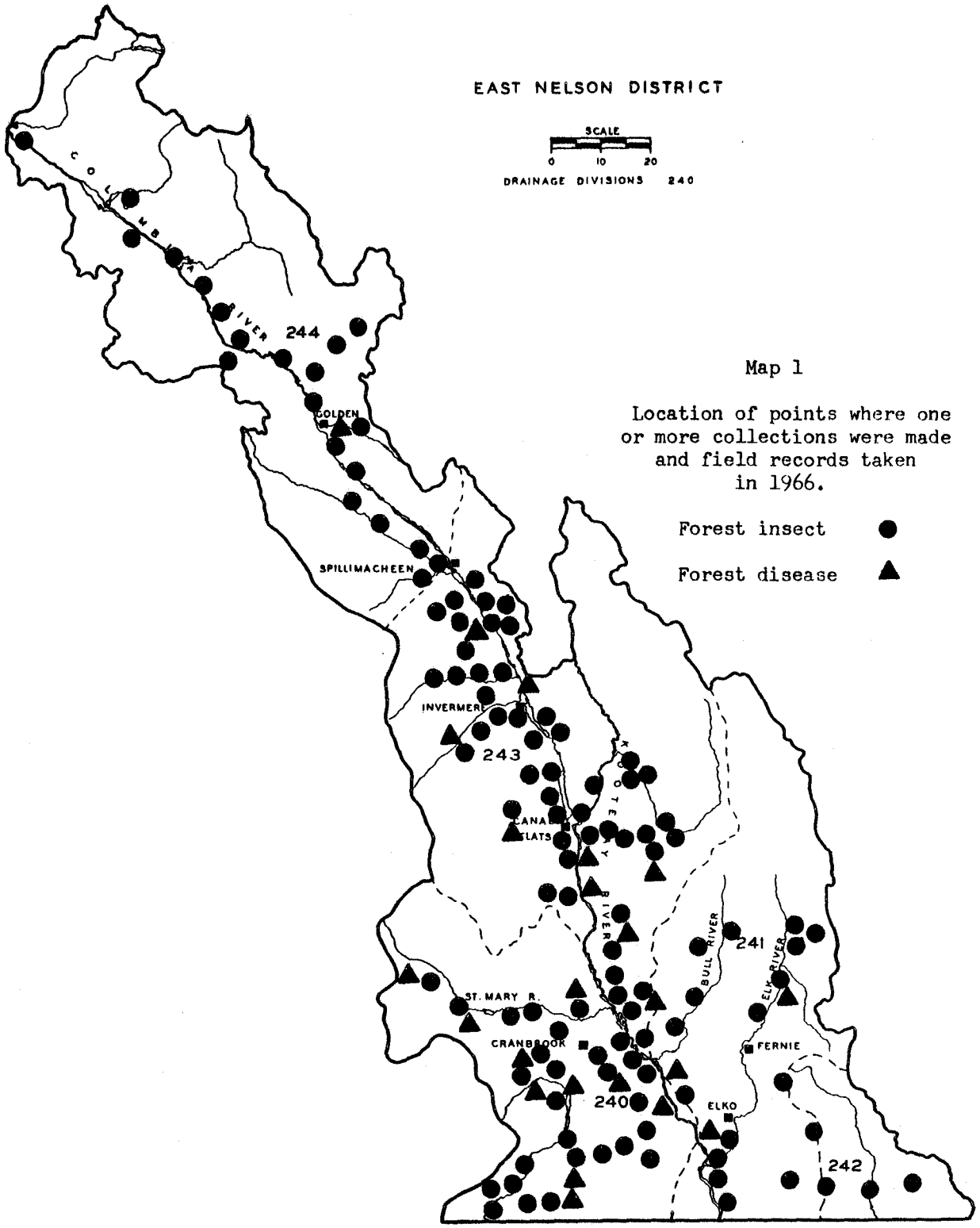
Table 16

Other Diseases of Current Minor Significance

Organism and disease	Hosts	Location	Remarks
Chrysomyxa weirii Jacks. Spruce needle rust	eS	Coyote Creek, Canal Flats	Common on Engelmann spruce reproduction.
Delphinella sp. Shoot blight	alF, eS	Kimberley Invermere	Light.
Fume Damage	all species	Kimberley	Appears to be decreasing.
Hendersonia pinicola Wehm.	wL	Yahk River	Hyperparasite on Hypodermella laricis, low populations.
Melampsora epitea Thuem. Needle rust	alF	Invermere	Trace.

Table 16 continued

Organism and disease	Hosts	Location	Remarks
Peridermium harknessii J. P. Moore Gall Rust	lP.	Kimberley	Light.
Pucciniastrum spp. Needle rust	eS, alF	Kimberley Invermere	Trace to light.

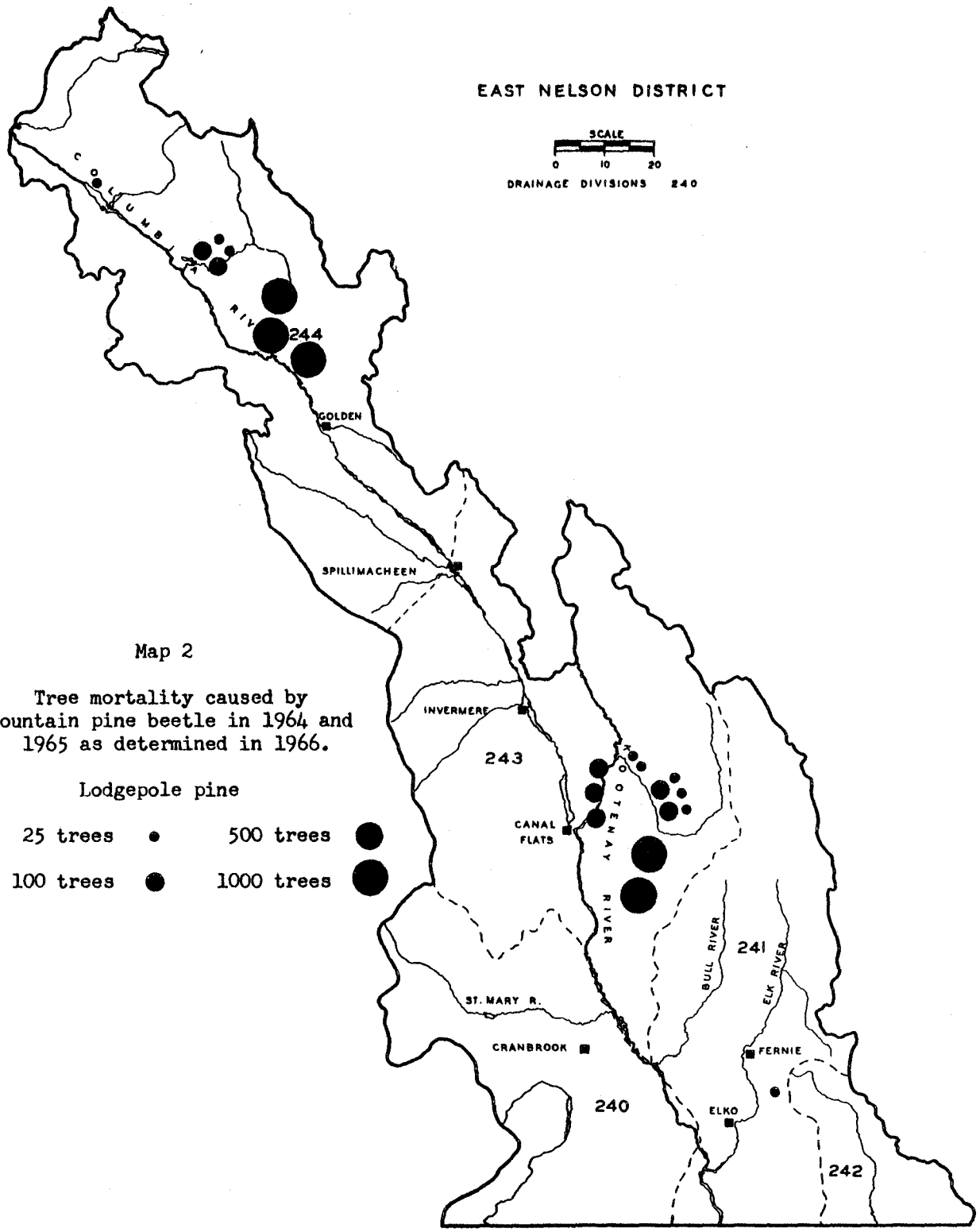


Map 1

Location of points where one or more collections were made and field records taken in 1966.

Forest insect ●

Forest disease ▲



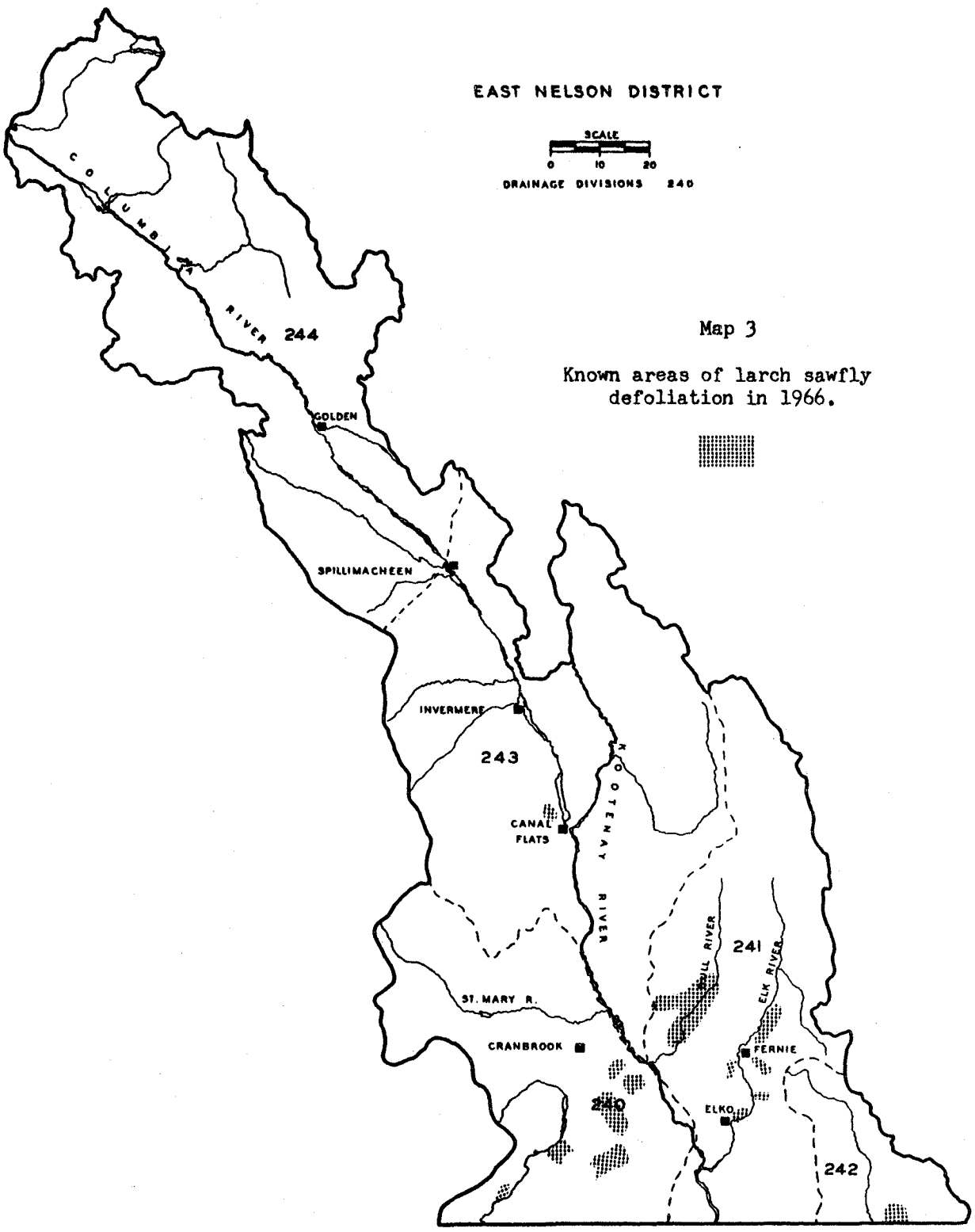
Map 2

Tree mortality caused by mountain pine beetle in 1964 and 1965 as determined in 1966.

Lodgepole pine

25 trees ● 500 trees ●

100 trees ● 1000 trees ●



Map 3

Known areas of larch sawfly defoliation in 1966.

FOREST INSECT AND DISEASE SURVEY

BRITISH COLUMBIA

1966

PRINCE GEORGE FOREST DISTRICT

FOREST INSECT AND DISEASE SURVEY

BRITISH COLUMBIA

1966

PRINCE GEORGE FOREST DISTRICT

J. Grant 1/

There was a complete change in Survey personnel in the Prince George District in 1966: J. Grant replaced C. B. Cottrell in South Prince Goerge, D. F. Doidge replaced J. C. Holms in West Prince George and D. Lund replaced R. O. Wood in North Prince George.

Spruce beetle attacks on standing trees were scarce in 1966 but prevalence of infested windfalls constituted a continuing hazard in some areas.

Mountain pine beetle populations were reduced in the Takla Lake region, although some infestations persisted. Increasing numbers of lodgepole pines have been killed in recent years south of Quesnel.

Douglas-fir beetles caused little tree mortality.

The one-year-cycle spruce budworm infestation in northeastern British Columbia declined greatly in both extent and severity in 1966. Noteworthy damage was restricted to the Prophet River area; egg sampling indicated that defoliation may be expected again in 1967.

Two-year-cycle spruce budworm populations were very low in 1966.

Larch sawflies caused moderate defoliation of tamarack in the Fort Nelson area.

Extreme temperature fluctuations early in April were responsible for varying degrees of damage to forest trees. Douglas-fir in the southern part of the District were discolored and sustained heavy bud mortality, but few were believed to have suffered permanent injury.

The following is a list of standard abbreviations for tree species mentioned in this report.

1/ Forest Research Technician, Forest Insect and Disease Survey Senior Ranger, Vernon.

Host Tree Abbreviations

Abbreviation	Common name	Abbreviation	Common name
alF	alpine fir	tA	trembling aspen
D	Douglas-fir	bCo	black cottonwood
tL	tamarack	bPo	balsam poplar
lP	lodgepole pine	Al	alder
bS	black spruce	W	willow
wS	white spruce		
wH	western hemlock		

Spruce Beetle, Dendroctonus obesus (Mann.) J. Grant and D. F. Doidge

INTRODUCTION. Surveys conducted in the Prince George Forest District in 1965 showed that an estimated 444 million cubic feet of spruce on 555 thousand areas had been killed by spruce beetles in the current outbreak, but that losses had decreased sharply in 1964 and 1965.[1/] In 1966, aerial and ground surveys were conducted on a reduced scale, and observations on the beetle's life history were continued.

METHODS. Overwintering mortality of beetles during the winter of 1965-66 was assessed in May 1966 at eight plots located at Tudyah, [illegible] Merton, McLeod, Keary, Aleza, Pitoney and 16-Mile lakes and near Wells. As no standing trees were attacked in the vicinity of the plots in 1964 or 1965, sampling was confined to log bolts and windfalls. Square-foot bark samples were removed, and the living and dead beetles counted.

An aerial survey was conducted in August. Location of trees with discoloured foliage indicating 1965 attack was plotted on 2-mile per inch Forest Cover Series maps. Volumes were estimated by applying the average figure per acre for light infestations established in previous years to the acreage mapped in 1966. In many cases trees with fading foliage were so scattered that they were counted individually.

Six permanent ground strips one mile long and one chain wide were cruised in September to detect freshly attacked trees, to obtain infor-

1/ Cottrell, C. B., J. C. Holms and D. A. Ross. 1965. Status of the spruce beetle, Prince George District, 1965. Can. Dep. Forest,, Forest Entomol Lab., Vernon. Inform. Rep. B.C.-X-3.

mation on the prevalence of windfall and to determine the extent to which windthrown trees were infested. Only those windthrown trees which had been standing within the strips were sampled.

Life history studies were continued at seven localities. Late in May trees were felled at each plot and four-foot bolts left lying on the ground, two from each tree being in an open location and two in the shade. In September the number of larvae, pupae and adults in 2-square-foot bark samples from each bolt were recorded in order to determine the stage of development attained by broods established in 1966. Similar data were obtained from log sections cut at five localities in May 1965.

RESULTS.

Overwintering mortality - Mortality of overwintering spruce beetles in bark samples at eight plots averaged 27%; however, there was considerable variation between localities, between logs in different situations on the same plot, and between the adult and larval stages. Teneral adults in 1964-felled logs had a higher survival rate than those in 1965 material; these latter presumably had reached adulthood later in the season. Table 1 shows the average number of living and dead adults and larvae per square foot in logs at eight localities.

Table 1

Average Number of Living and Dead Spruce Beetles and Larvae per Square Foot in Felled Spruce at Eight Localities, Prince George District, May, 1966

Locality	Year felled	No. of samples	Av. no. per sq. ft.			
			Adults		Larvae	
			Livin	Dead	Living	Dead
Tudyah Lake	1965	34	1.2	0.2	3.0	0.3
McLeod Lake	1965	13	0.3	3.3	15.0	12.3
Kerry Lake	1964	19	6.1	1.7	0.0	0.0
	1965	20	1.6	1.0	5.8	1.3
Merton Lake	1965	15	0.6	0.1	15.3	2.5
Aleza Lake	1964	16	5.1	0.3	0.0	0.0
	1965	26	4.4	1.1	2.4	0.1
Pitoney Lake	1964	10	1.2	0.3	0.9	0.2
	1965	42	1.3	0.5	7.0	0.8
Naver Road	1964	30	21.0	5.7	5.2	3.3
	1965	32	1.2	0.8	7.5	2.4
Kenny Lake	1965	17	1.2	0.1	15.5	3.5
Wells	1965	10	0.3	0.0	22.0	10.3

Aerial Survey - Aerial surveys in 1966 showed that spruce beetle attacks had been much lighter in 1965 than in 1964; the largest numbers of

trees with fading foliage were in those localities where high beetle populations had persisted in 1964. No 1965-attacked trees were seen in areas not previously infested, and vast areas affected during the outbreak period had no evidence whatever of recent infestation. Ground observations in Naver S.Y.U. showed that some trees with fading foliage, which would have been classified from the air as 1965 attack, had actually been partially attacked previously and had finally succumbed to infestations of Ips, or from other causes. Mortality of these partially-attacked trees suffering extensive cambium damage during the outbreak may be expected to continue for several years. Table 2 shows estimated acreage and volume of white spruce killed by spruce beetles in 1965, as determined by aerial surveys in 1966.

Table 2

Estimated Acreage and Volume of White Spruce Killed by Spruce Beetles in 1965, Prince George Forest District, 1966

Location	No. acres	Est. volume killed (cu. ft.)
Parsnip S.Y.U.	170	38,500
Crooked S.Y.U.	200	44,800
T.F.L. 30	30	6,700
T.F.L. 34	330	6,700
Monkman S.Y.U.	560	125,400
Longworth S.Y.U.	30	6,700
Willow S.Y.U.	20	4,500
Naver S.Y.U.	40	9,000
Big Valley S.Y.U.	60	13,400
Totals	1,140	255,700

Cruise Strips - Strips at McLeod Lake, Barney Creek, Aleza and Pitoney lakes, Naver Creek and Wingdam were cruised in September. No trees were infested in 1966, with the exception of one abortive attack at Wingdam.

Quantities of fresh windfall varied greatly, ranging from nil at Barney Creek to an average of 2.6 windthrown trees per acre at Pitoney Lake. Sampling of these windfalls revealed that some were quite heavily infested (Table 3).

Table 3

Average Number of Fresh Windfalls per Acre, Percentage of Bark Samples Infested, and Average Number of Brood per Square Foot at Six Localities, Prince George District, September, 1966

Locality	Av. no. fresh windfalls per acre	% samples infested	Av. no. brood per sq. ft.
Davie Lake	0.3	83	19
Barney Creek	0.0	-	-
Aleza Lake	0.3	89	28
Pitoney Lake	2.6	32	8
Naver Access Rd.	0.6	80	17
Wingdam	0.5	44	14

Although attack on standing trees apparently was negligible in 1966, data from the cruise strips showed that substantial numbers of beetles persisted in windfalls in some localities.

Life History Studies - Summer temperatures in 1966 averaged slightly below the long-term average at the Prince George and Quesnel weather stations, and beetle broods in log bolts cut at seven life history plots developed slowly. Only a small percentage of the population had reached the adult stage by mid-September (Table 4). Because of slow larval development, it is expected that except for an insignificant minority, the broods established in 1966 will reach adulthood in 1967 but will not attack until 1968.

Table 4

Average Number of Living Spruce Beetles per Square Foot in Log Sections Cut in May 1966 and Examined in September 1966, Prince George Forest District

Location	No. per sq. ft.			
	Larvae	Pupae	Teneral adults	Parent adults
Tudyah Lake	31.9	0.1	0.0	4.4
McLeod Lake	37.2	0.0	0.0	1.3
Kerry Lake	10.9	0.1	0.0	0.6
Aleza Lake	57.5	1.3	0.2	2.3
Pitoney Lake	16.2	0.0	0.0	0.5
Naver Access Road	35.6	0.0	0.0	2.5
Wells	34.7	0.2	0.0	1.4

Beetle populations in log sections cut at five localities in 1965 had mostly reached the adult stage by September 1966 (Table 5). At Pitoney Lake, however, the majority were still in the larval stage. This indicates that part of the broods established in 1965 will not attack until 1968.

Table 5

Average Number of Living Spruce Beetles per Square Foot in Log Bolts Cut in May 1965 and Examined in September 1966, Prince George Forest District

Location	No. per sq. ft.			
	Larvae	Pupae	Teneral adults	Parent adults
Tudyah Lake	0.0	0.0	4.7	0.0
McLeod Lake	0.6	0.7	16.2	0.0
Aleza Lake	1.4	0.6	0.5	0.0
Pitoney Lake	32.0	1.4	7.8	0.0
Wells	1.0	1.9	7.5	0.0

SUMMARY. Except for a few localities where infestations had persisted in 1964, very few standing spruce trees were attacked in 1965. Ground surveys indicated that most of the 1966 flight was absorbed by freshly windthrown trees.

Beetle populations remained high in windfall and where this material is abundant a hazard may be expected to continue.

FOREST INSECT AND DISEASE SURVEY

SOUTH PRINCE GEORGE DISTRICT

1966

FOREST INSECT AND DISEASE SURVEY

SOUTH PRINCE GEORGE DISTRICT

1966

J. Grant

INTRODUCTION

Field work began on May 10 and ended on September 28. Special surveys within the District were as follows: May 10 to 18, survey of overwintering mortality of spruce beetle; August 22 to 26, aerial surveys in South and West Prince George; September 7 to 14, cruising permanent spruce beetle strips and studies at spruce beetle life history plots. The period July 17 to 29 was spent in the North Prince George District on a survey of one-year-cycle spruce budworm infestations.

Table 1 lists by host the forest insect and disease collections made in the District; Map 1 shows drainage divisions and the location of points where collections or field records were taken. The principal problems in each drainage division are shown in Table 2.

Table 1

Collections by Hosts

South Prince George District, 1966

Coniferous hosts	Forest insects	Forest diseases	Broad-leaved hosts	Forest insects	Forest diseases
Cedar, western red	1	1	Alder, mountain	2	1
Douglas-fir	38	5	Alder, Sitka	2	-
Fir, alpine	78	11	Aspen, trembling	10	1
Hemlock, western	13	2	Birch, western white	3	1
Juniper, common	1	1	Cottonwood, black	1	2
Juniper, Rocky Mtn.	1	-	Chokecherry	-	2
Larch, Siberian	1	-	Willow species	11	1
Pine, lodgepole	29	3	Miscellaneous	7	3
Pine, white	1	1			
Spruce, black	16	-			
Spruce, white	96	5			
Tamarack	1	-			
Totals	276	29	Totals	36	11
			GRAND TOTALS	312	40

Table 2

Currently Important Insect and Disease [1] Problems by Drainage Divisions, South Prince George District, 1966

Insect and disease problems	Principal hosts [2]	Importance by drainage divisions [3] 260	261	262
BARK BEETLES				
Spruce beetle	wS	1	3	3
Mountain pine beetle	lP	3	3	1
Douglas-fir beetle	D	2	1	2
Western balsam bark beetle	alF	1	2	4
DEFOLIATORS				
Two-year cycle spruce budworm	wS, alF	1	1	1
WEATHER DAMAGE				
Frost damage	D, bPo, wS	4	4	2

1/ Includes only weather-induced and foliage diseases subject to annual fluctuations.

2/ Host code abbreviations are listed in Prince George Forest District introduction.

3/ High population and/or widespread outbreak in progress - 5

Scattered high populations, and/or significant damage in restricted areas - 4

Rising population, and/or moderate numbers of insects, and/or potential problem - 3

Static or falling populations and/or moderate numbers of insects and/or no problem at present - 2

Endemic population, and/or no significant damage - 1

Not sampled, or no host or not found - 0

FOREST INSECT CONDITIONS

Currently Important Insects

Bark Beetles

Spruce Beetle, Dendroctonus obesus (Mann.)

A report on the status of the spruce beetle follows the introduction to the Prince George Forest District.

Mountain Pine Beetle, Dendroctonus ponderosae Hopk.

The only localities where mountain pine beetles caused noteworthy mortality of lodgepole pine were in the extreme southern part of the District south of Quesnel.

Approximately 2,000 red-tops scattered over 300 acres west of Cuisson Lake were counted on an aerial survey in August. In October, cruises totalling eight acres showed that 17% of the stems over six inches dbh, representing 26% of the volume, had been killed. The average volume per infested tree was 30 cubic feet, compared with 16 cubic feet for healthy trees. Of 1,482 stems tallied, 3.2% had been attacked in 1966, 9.2% in 1964 or 1965, and 4.3% had been killed prior to 1964. Part of the infestation adjacent to the area cruised was logged in 1966.

An infestation in mature lodgepole pine between the Fraser River and the upper reaches of Narcosli Creek northwest of Alexandria covered approximately 800 acres and totalled about 1,000 red-tops.

Table 3 shows by locality the number of trees and volume killed by mountain pine beetles in 1964 and 1965, as determined by aerial surveys in 1966.

Table 3

Number of Lodgepole Pine and Volume Killed by Mountain Pine Beetles in 1964 and 1965 in South Prince George District, as Determined by Aerial Surveys, 1966

Locality	No. of trees	Volume (cu. ft.)
Cuisson Lake	2,000	60,000
Narcosli Creek	1,000	30,000
Tingley Creek	50	1,500
Eveline Lake	60	1,800
Puntataenkut Lake	10	300
Totals	3,120	93,600

Douglas-fir Beetle, Dendroctonus pseudotsugae Hopk.

The number of Douglas-fir red-tops killed by bark beetles decreased greatly from the 1965 level. Aerial surveys over the Quesnel and Hixon districts, where more than 1,000 red-tops were seen in 1965, revealed only negligible numbers of recently-killed trees.

The only locality where noteworthy damage had occurred was in Castle Creek Valley in the McBride district. About 450 mature trees, mostly on inaccessible rocky slopes, had been killed in the last two years.

Western Balsam Bark Beetle, Dryocoetes confusus Sw.

Red-topped alpine firs believed to have been killed by the western balsam bark beetle associated with a lesion-causing fungus Ceratocystis dryocoetidis Kendrick and Molnar were noted in several localities. Most of the tree mortality was in the northern and eastern parts of the District; the largest single infestation was in the Morkill River Valley where there were an estimated 1,200 red-tops. Smaller infestations were in the Upper Slim Creek, McGregor, Raush and Canoe River valleys and near George Creek.

Defoliators

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

Spruce budworm populations were extremely low in 1966 and none of the white spruce-alpine fir stands in the District suffered any noticeable damage.

Four permanent plots, situated in localities where defoliation occurred in recent years, were sampled in June. Branches were cut from mid-crown of 10 trees at each plot, and examined for damage and larvae. Results are compared with those from two previous flight years in Table 4.

Table 4

Mortality of Alpine Fir Tips Caused by Spruce Budworm, and Number of Larvae per Square Foot of Foliage, South Prince George District.

Locality	% tips killed			No. of larvae per sq. ft. foliage		
	1962	1964	1966	1962	1964	1966
George Mountain	13.4	4.0	0	2.5	0.3	0.3
Strathnaver	8.4	1.0	0	0.9	0.1	0.1
Hay Lake	30.0	4.4	0	1.3	0.2	0.2
Genevieve Lake	9.9	5.1	0	0.6	0.4	0.2
Barkerville	22.4	24.1	0	1.1	1.2	0

Decline of spruce budworm populations throughout the District is illustrated in the following summary of three-tree random collections taken during the larval period in the flight years 1962, 1964 and 1966:

Host	No. of samples taken during larval period			% samples containing larvae			Av. no. larvae per positive sample		
	1962	1964	1966	1962	1964	1966	1962	1964	1966
wS	51	66	53	90	42	17	10.7	20.7	1.8
alF	38	51	39	79	45	41	19.9	26.8	2.9

In spite of its scarcity in 1966, the spruce budworm is a chronic pest and a trend towards higher populations may be expected in the next few years.

Other Noteworthy Insects

Black-headed Budworm, Acleris variana (Fern.)

Black-headed budworm populations increased throughout the District in 1966 but remained below infestation level (Table 5). Hosts were white spruce, alpine fir, western hemlock, and rarely, Douglas-fir.

Table 5

Summary of Black-headed Budworm Collections,
South Prince George District, 1964 to 1966

Host	No. of samples taken during larval period			% samples containing larvae			Av. no. of larvae per positive sample		
	1964	1965	1966	1964	1965	1966	1964	1965	1966
wS	82	65	71	24	23	41	2.7	2.9	4.0
alF	61	46	61	16	24	38	1.3	1.5	2.5
wH	11	9	13	18	33	69	2.5	1.3	2.8
D	37	19	24	8	0	4	1.0	-	1.0
Totals	191	139	169	18	21	36	2.2	2.2	3.5

Although there has been a gradual increase from 1964 to 1966, no major outbreaks are anticipated in 1967.

A Spruce Tip Moth, Aphelia alleniana (Fern.)

Ten per cent of 1,500 provenance trial white spruce seedlings in a plot near Aleza Lake were infested by tip moth larvae in June. Damage would have been unimportant except that precise measurements of stock from widespread sources were required. Larvae of this insect, which have seldom been taken previously, were common on native spruce seedlings up to two feet in height in the vicinity of the plot; they were also collected from young mountain alder, trembling aspen and willow.

Western Hemlock Looper, Lambdina fiscellaria lugubrosa (Hlst.)

Populations of the western hemlock looper remained low in 1966, and larvae were scarce in collections from white spruce, alpine fir, western hemlock and Douglas-fir (Table 6).

Table 6

Summary of Western Hemlock Looper Collections,
South Prince George District, 1964-1966

Host	No. of samples taken during larval period			% samples containing larvae			Av. no. of larvae per positive sample		
	1964	1965	1966	1964	1965	1966	1964	1965	1966
wS	91	84	75	45	5	5	14.9	1.0	1.2
alF	65	62	59	49	15	8	11.5	1.4	1.8
wH	13	18	13	62	28	23	4.6	3.0	1.0
D	40	27z	23	13	0	0	1.2	-	-
Totals	209	191	170	41	9	7	11.9	1.7	1.4

Aspen Leaf Miner, Phyllocnistis populiella Cham.

Aspen leaf miners were scarce throughout the District in 1966. Four plots were sampled by examining the leaves from 1-foot branches cut from each of 10 trees. Table 7 shows percentage of leaf surfaces mined and number of adults produced per 100 leaf surfaces. Miners were too scarce to provide data on mortality in the cocoon stage.

Table 7

Aspen Leaf Surfaces Mined and Number of Adults Produced per 100 Leaf Surfaces, South Prince George District

Locality	% leaf surfaces with mines			No. of adults produced per 100 leaf surfaces		
	1964	1965	1966	1964	1965	1966
Cale Creek	13	1.9	0.7	5.5	0.1	0
Stone Creek	6	1.2	0.3	1.6	0.2	0
Woodpecker	10	6.4	1.6	5.3	0.1	0.5
Hixon	20	1.3	1.2	8.0	0.1	0.1

Table 8

Other Insects of Current Minor Significance

Insect	Host	Locality	Remarks
Adelges cooleyi (Gill.) Cooley spruce gall aphid	D, wS	Quesnel, Hixon	Sucking insect on needles. Abundant on regeneration.
Hylobius warreni Wood A root weevil	lP	Quesnel	A root feeder, occasional saplings killed.
Ips spp. Engraver beetles	wS	general	Some wS surviving partial attack by Dendroctonus were killed by Ips in 1966.
Mindarus abietinus Koch Balsam twig aphid	alF	Prince George, Hixon, Quesnel	Sucking insect on young twigs. Very common in early summer, causing needle deformities.
Phyllophaga spp. White grubs	wS	Red Rock	Root feeder, 3% of seedlings in nursery killed in June and early July.
Pissodes terminalis Hopp. Pine terminal weevil	lP	Hixon	Terminal borer; 12% of reproduction on 12 acres infested.

Table 8 - continued

Insect	Host	Locality	Remarks
Pristiphora erichsonii (Htg.) Larch sawfly	tL, Siberian larch	Aleza L., Prince George	Defoliator, Medium defoliation of 1 tree at Aleza Lake, light damage on 8 trees near Prince George.

FOREST DISEASE CONDITIONS

Currently Important Diseases

Weather Damage

Late Frost Injury

Damage to several species of trees was attributed to near-zero temperatures in mid-April 1966 following two weeks of abnormally warm weather. The most severe injury was confined closely to the Fraser River Valley from Prince George south to Macalister, and to trees at low elevations and on south-facing slopes. Douglas-fir in the region south of Quesnel were conspicuously discoloured by dead foliage and some suffered heavy bud mortality; however, by late summer it appeared that there would be little tree mortality directly attributable to frost injury. White spruce, absent from the dry slopes where major Douglas-fir damage occurred, suffered heavy needle drop in exposed locations north of Quesnel but bud mortality was negligible. Black cottonwood sustained more severe damage than any other species; many pole-sized and mature trees as far north as Prince George had the branches of the upper crown killed back several feet. Both cottonwoods and trembling aspens were late leafing out due to bud mortality, and exhibited abnormal "clumping" of foliage.

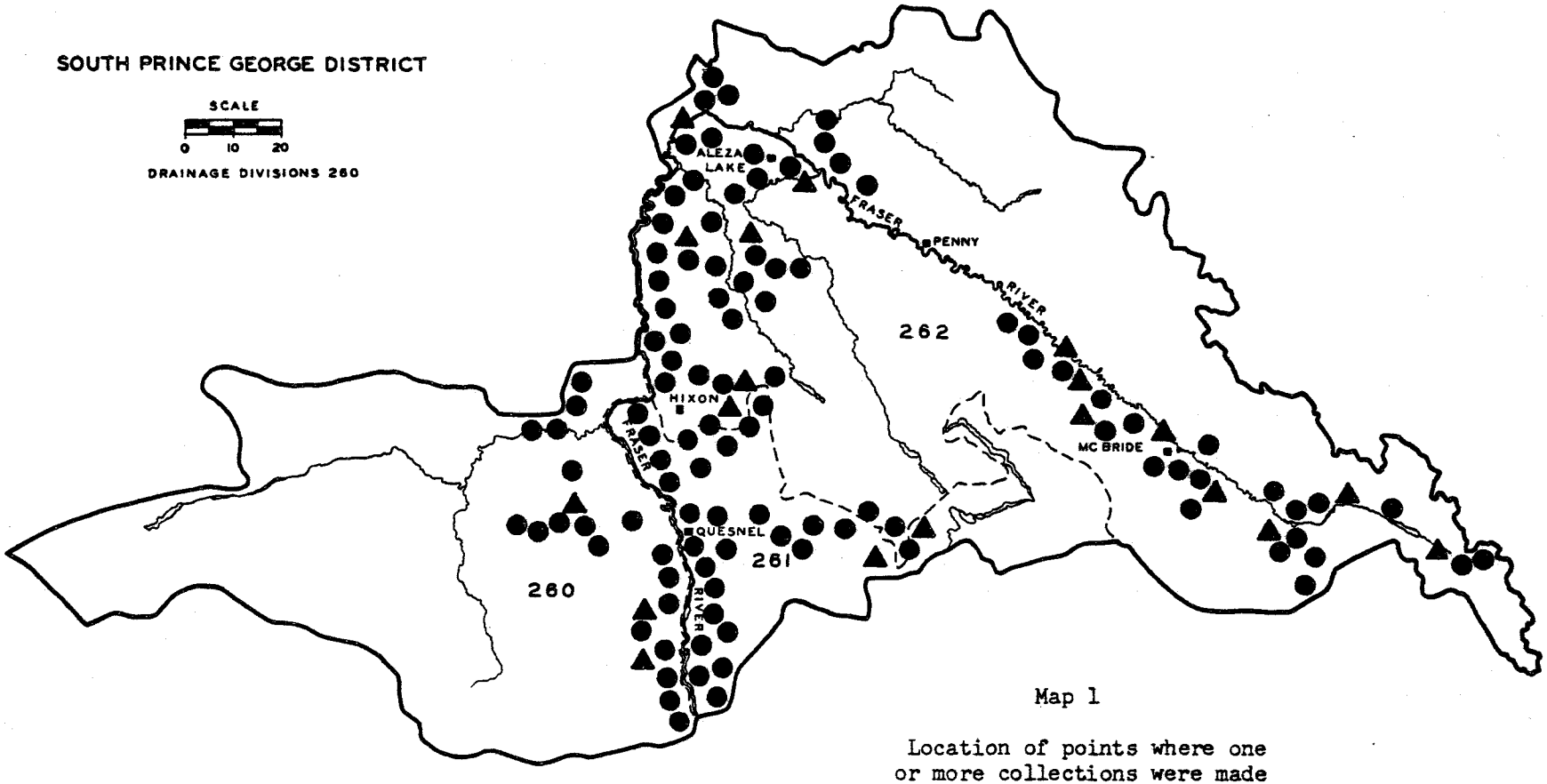
Exotic Plantations

XP Number	Location	Exotic species	Remarks
50	Aleza Lake	Pinus sylvestris	All trees healthy.
117	Prince George	mixed conifers	One dead Pinus strobus shoot infected by Scleroophoma sp. Pinus sylvestris doing poorly on exposed, wet site. Larix sibirica lightly infested with Pristiphora erichsonii (Htg.)

Table 9

Other Diseases of Current Minor Significance

Organism and disease	Host	Locality	Remarks
Chrysomyxa ledicola Lagerh. Spruce needle rust	wS	Crescent Spur	Heavy infection.
Delphinella abietis (Rostr.) E. Muell. Fir tip blight	alF	Wells	Repeated heavy infections have apparently caused branch deformities and sparse foliage.
Delphinella sp. Fir tip blight	alF	Giscome, McBride	Repeated infections causing sparse foliage.
Elytroderma deformans (Weir) Darker Pine needle cast	lP	Crescent Spur, McBride	No widespread infections.
Hypodermella abietis-concoloris (Mayr) Dearn. Fir needle cast	alF	Upper Fraser	Light infection.
Hypodermella concolor (Dearn.) Darker Pine needle cast	lP	Yellowhead	Scattered trees heavily infected.
Lophodermium decorum Darker Fir needle cast	alF	Lamming Mills	On suppressed trees.
Pucciniastrum epilobii Otth Fir needle rust	alF	Lamming Mills	Light infection, needles and cones.
Pucciniastrum vaccinii (Wint.) Joerst. Hemlock needle rust	wH	Lamming Mills	Light infection, needles and cones.
Rhabdocline pseudotsugae Syd. Douglas-fir needle cast	D	McBride	Light infection.
Venturia populina (Vuill.) Fabric. Poplar leaf and shoot blight	bCo	Shelley, Bowron R.	Scattered trees and saplings heavily infected.



Map 1

Location of points where one or more collections were made and field records taken in 1966.

Forest insect ●

Forest disease ▲

FOREST INSECT AND DISEASE SURVEY

WEST PRINCE GEORGE DISTRICT

1966

FOREST INSECT AND DISEASE SURVEY

WEST PRINCE GEORGE DISTRICT

1966

D. F. Doidge

INTRODUCTION

The 1966 field season in the West Prince George District began on May 9 and continued until September 29. Spruce beetle mortality, brood development plots at several locations and a spruce beetle strip along the Crooked River were checked. Eight hours flying time was used in an aerial survey of the northern part of the District to map spruce, mountain pine and Douglas-fir beetles and balsam mortality. Two weeks in September were spent assisting with the spruce beetle survey in the South Prince George District.

Table 1 shows the forest insect and tree disease collections by host; Map 1 shows the distribution of the collections and field records taken. The principal problems in each Forest Insect and Disease Survey Drainage Division are shown in Table 2. These Drainage Divisions are illustrated on Map 1.

Table 1

Collections by Hosts

West Prince George District, 1966

Coniferous hosts	Forest insects	Forest diseases	Broad-leaved hosts	Forest insects	Forest diseases
Douglas-fir	19	3	Alder species	4	-
Fir, alpine	51	6	Ash, Sitka, Mtn.	1	3
Pine, lodgepole	51	4	Aspen, trembling	14	5
Spruce, black	14	-	Birch, western white	4	-
Spruce, white	113	9	Cottonwood, black	2	1
Larch, eastern	2	1	Willow	8	2
			Miscellaneous	1	1
Totals	250	23	Totals	34	12
			GRAND TOTALS	284	35

1/ Forest Research Technician, Forest Insect and Disease Survey, Vernon.

Table 2

Currently Important Insect and Disease [1/] Problems by Drainage Divisions, West Prince George District, 1966

Insect and disease problems	Principal hosts [2/]	Importance by drainage divisions [3/]					
		280	281	282	283	284	285
BARK BEETLES							
Spruce beetle	wS	1	1	3	3	3	3
Mountain pine beetle	lP	1	1	2	1	1	1
Western balsam bark beetle	alF	1	0	4	4	2	2
Douglas-fir beetle	D	1	1	1	1	0	0
DEFOLIATORS							
Two-year-cycle spruce budworm	wS, alF	1	1	1	2	0	0
WOOD BORERS							
A round-headed borer, Tetropium cinnemopterum Syn.	wS	1	0	2	2	0	0
LEAF MINERS							
Aspen leaf miner	tA	1	1	1	1	0	0
SAP-SUCKING INSECTS							
Cooley spruce gall aphid	wS	2	2	2	2	0	0
WEATHER DAMAGE							
Late frost injury	tA, bCo	4	4	4	4	0	0
FOLIAGE DISEASES							
A foliage disease on aspen	tA	4	4	4	4	0	0
STEM DISEASES							
Disease--western balsam bark beetle complex on alpine fir	alF	1	0	4	4	2	2
MISTLETOE DISEASES							
Lodgepole pine dwarf mistletoe	lP	3	0	3	4	0	0

1/ Includes only weather-induced and foliage diseases subject to notable annual fluctuation.

2/ Refer to host code in Forest District introduction.

3/ High population and/or widespread outbreak in progress - 5

Scattered high populations and/or significant damage in restricted areas - 4

Rising population and/or moderate numbers of insects and/or potential problem - 3

Static or falling population and/or moderate numbers of insects and/or no potential problem - 2

Endemic population and/or no significant damage - 1

Not sampled and/or no host and/or not found - 0

FOREST INSECT CONDITIONS

Important Insects

Bark Beetles

Spruce Beetle, Dendroctonus obesus (Mann.)

See special section following introduction to the Prince George Forest District.

Mountain Pine Beetle, Dendroctonus ponderosae Hopk.

Mountain pine beetle damage decreased 79%, based on comparison of 1965 and 1966 aerial surveys of red-topped lodgepole pine trees. The largest single infestation, having an estimated total of 6,000 red-tops, was in the region of the Sakeniche River and Bivouac Creek on the west side of Takla Lake. A landing was made at Bivouac Creek to check on the ground for 1966 beetle attack, but no infested trees were found. There were only 220 red-topped trees at the mouth of the Kuzkwa River and 250 at the east end of Inzana Lake.

Table 3 compares, by general location, the numbers of lodgepole pine trees killed in the periods 1963-64 and 1964-65 as determined by aerial surveys in 1965 and 1966.

An average volume of 40 cubic feet per tree was used to calculate the volume of timber killed. It is expected that the 1966 attack was light, but the location or severity of damage cannot be determined until 1967.

Table 3

Numbers and Volume of Lodgepole Pine Trees Killed by Mountain Pine Beetle, 1963-64 and 1964-65, as Determined by Aerial Surveys, West Prince George District, 1965 and 1966

Locality	Est. no. trees killed		% decrease	Est. gross vol. (cu. ft.)	
	1963-64	1964-65		1963-64	1964-65
Kuzkwa R.	12,200	220	98	488,000	8,800
Tarnezell Cr.	75	0	100	3,000	0
Trembleur L.	200	0	100	8,000	0
Tochcha L.	115	0	100	4,600	0
Takla L.	18,300	6,000	67	732,000	240,000
Natowite L.	600	220	63	24,000	8,800
Inzana L.	-	250	-	-	10,000
Totals	31,490	6,690		1,259,600	267,600

Western Balsam Bark Beetle, Dryocoetes confusus Sw.

Aerial surveys in August 1966 indicated that this beetle continued to cause widespread light to heavy mortality of alpine fir in inaccessible areas between 3,000 to 5,000 feet elevation.

The majority of the red-tops occurred over much the same areas as in 1965. Heavy infestations were noted north of Takatoot Lake, at Inzana and Tchentlo lakes, on Brule Hill and along the Parsnip River Valley between Misinchinka River and Mischinsinlika Creek. There were light infestations south and west of Takatoot Lake, at Purvis, Airline, Kloch, Ogston and Tudyah lakes, and near Finlay Forks and Reynolds Creek.

No significant changes in acreage of alpine fir red-tops were noted from the 1965 survey and no great increase is expected in 1967.

Douglas-fir Beetle, Dendroctonus pseudotsugae Hopk.

Douglas-fir trees killed by the Douglas-fir beetle were almost non-existent in 1966. An aerial survey in August disclosed only 30 red-topped trees near the south end of Pinchi Lake. In all other areas it appeared that the bark beetle population had been reduced to endemic status.

Defoliators

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

The spruce budworm population was at low level throughout the District in 1966, a flight year, and data indicate that defoliation will be light in 1967 and 1968.

When examined in June budworm study plots at Davie Lake, Tudyah Lake, Pine Pass, and Big Creek showed a decrease in numbers of larvae from the 1964 flight year. One 18-inch branch sample was taken from the mid-crown of each of the 10 sample trees at each plot, and the branch area was measured. Buds were classified as infested, not infested, and killed, and the larvae were counted on each branch sample. Adventitious buds were noted if present. Plots contained both alpine fir and white spruce. Table 4 indicates the comparative number of larvae per square foot and the percentage of tips killed at each of the four plots for the last three flight years.

Table 4

Number of Spruce Budworm Larvae per Square Foot of Foliage and Percentage Tips Killed in June 1962, 1964 and 1966, West Prince George District.

Locality	No. larvae per sq. ft.			% tips killed		
	1962	1964	1966	1962	1964	1966
Davie Lake	0.75	0.18	0	2	1	0
Tudyah Lake	2.58	0.56	0	17	1	0
Pine Pass	21.33	2.85	0.04	45	10	0
Big Creek	2.10	1.31	0.15	18	2	0

In random collections, spruce budworm larvae decreased markedly in both frequency and abundance from the 1964 level. The incidence of larvae in three-tree beating collections from white spruce and alpine fir during the larval period June 4 to July 10 for 1962, 1964 and 1966 is shown below.

Host	No. of collections during larval period			% containing larvae			Av. no. of larvae per positive sample		
	1962	1964	1966	1962	1964	1966	1962	1964	1966
White spruce	62	40	39	39	32	0.02	5.1	2.4	6
Alpine fir	20	10	8	90	70	0.25	5.9	16	4

In mid-August the sample plots were re-examined to obtain data on defoliation, number of pupae emerged, parasitized and number of egg masses. The same sampling method was used to obtain these data as was used in the larval counts in June. Defoliation ranged from nil to trace at all four plots; pupae and egg masses were lacking.

The 100-tree mortality plots at Davie Lake, Tudyah Lake, Pine Pass and Big Creek were examined to assess the damage to alpine fir and white spruce understory trees by spruce budworm feeding. There was no noticeable defoliation at any of the plots. Generally, the understory sample trees on the plots were in poor condition due to past budworm feeding and suppression. The greatest amount of damage appeared to have been caused by winter moose browsing.

Wood Borers

A Round-headed Borer, Tetropium cinnemopterum Syn.

This wood borer was found in varying numbers in wind-thrown white spruce and log decks throughout the District. Heaviest attack was general on the lower side of logs. On September 20 a check of white spruce decks at Fort St. James and MacKenzie supplied the following information:

Locality	No. sq. ft. bark examined	No. of entrance holes	Av. no. entrance holes per sq. ft.	Av. no. larvae 1/ under bark only
Ft. St. James	70	202	2.9	0
MacKenzie	50	299	6.0	0.9

1/ Not all the larvae had penetrated the wood.

Leaf Miners

Aspen Leaf Miner, Phyllocnistis populiella Cham.

Aspen leaf miner populations remained at a low level in 1966 as evidenced by samples taken at seven leaf miner plots. One 12-inch branch sample was taken from each of 10 tagged sample trees at each plot and the leaves examined (Tables 5 and 6).

Table 5

Percentage of Aspen Leaf Surfaces Mined and Numbers of Aspen Leaf Miner Adults Produced per 100 Leaf Surfaces, West Prince George District 1964-1966

Locality	% of leaf surfaces with mines			No. of adults produced per 100 leaf surfaces		
	1964	1965	1966	1964	1965	1966
Hart Hwy. Mi. 16	4	1	2	1.7	0	0.1
Hart Hwy. Mi. 79	64	2	0.4	43.4	0.3	0
Hart Hwy. Mi. 103	50	2	0.4	25.9	0	0.3
Shelley	25	3	4	12.7	0.2	0.07
Uslika L. Rd. Mi. 15	79	9	8	63.9	0.6	0
Vanderhoof	7	0	0	3.4	0	0
Endako	23	7	13	14.3	2.2	5

Table 6

Mortality of Aspen Leaf Miner in Cocoons, Based on 100-Cocoon Samples at Seven Plots, West Prince George District, 1964-1966

Locality	Percentage mortality					
	Parasitism			Other causes		
	1964	1965 [1]	1966 [1]	1964	1965 [1]	1966 [1]
Hart Hwy. Mi. 16	28	0	25	10	50	50
Hart Hwy. Mi. 79	24	20	25	3	20	0
Hart Hwy. Mi. 103	24	0	0	16	75	0
Shelley	10	33	20	6	0	20
Uslika L. Rd. Mi. 15	2	30	12	6	50	73
Vanderhoof	17	-	0	8	-	0
Endako	4	16	16	8	24	12

[1] Based on less than 100 cocoons.

A slight population increase may be expected in some areas in 1967, although the 1966 population was generally too low to permit the gathering of 100-cocoon samples for an accurate estimate of the population trend.

Sap-sucking Insects

Cooley Spruce Gall Aphid, Adelges cooleyi (Gill.)

This gall aphid was again common on white spruce and Douglas-fir throughout the southern portion of the West Prince George District. It was especially noticeable along the Vanderhoof Highway and the Blackwater Road in the Vanderhoof Ranger District. White spruce in Fraser Lake Ranger District were affected along Highway 16 and Francois Lake Road; in the Summit Lake Ranger District damage was heavy along the Merton Lake Road and intermittent along the Hart Highway as far north as the range of Douglas-fir. Douglas-fir and white spruce shade trees and ornamentals in the city of Prince George were especially heavily affected; both species of host trees were often planted side by side. It is expected the population of this gall aphid will remain the same in 1967.

Other Noteworthy Insects

Yellow-headed Spruce Sawfly, Pikonema alaskensis Roh.

This species is a defoliator of white spruce occurring generally throughout the West Prince George District. Small numbers of larvae were collected throughout the range of the host. The following data shows a continuing decline in population since 1964:

No. collections during larval period			% collections containing larvae			Av. no. larvae per positive collection		
1964	1965	1966	1964	1965	1966	1964	1965	1966
78	128	53	60	36	13	1.8	1.8	1.4

Green-headed Spruce Sawfly, Pikonema dimmockii (Cress.)

Although more abundant on white spruce, this defoliator occurs on black spruce also. Low populations persisted throughout the District. The following data show that the average number of larvae per collection was down in 1966 as compared with 1964 and 1965.

No. collections during larval period			% collections containing larvae			Av. no. larvae per positive collection		
1964	1965	1966	1964	1965	1966	1964	1965	1966
84	128	60	45	34	35	1.7	1.6	1.4

Engelmann Spruce Weevil, Pissodes engelmanni Hopk.

The larvae of this weevil kill the terminals of young white spruce. Damage in 1966 was light throughout the District. One hundred young white spruce were examined at Mile 13 Merton Lake Road for the second successive year to determine trends in the weevil population. No new attacks were found, as shown below:

Locality	Av. ht. (ft.)		% trees with new attack		% trees with old attack	
	1965	1966	1965	1966	1965	1966
Merton L. Rd.	8	11.5	5	0	8	12

A Spruce Bud Moth, Zeiraphera fortunana Kft.

Spruce bud moth populations declined in 1966. The collection data is shown below:

No. collections during larval period			% collections containing larvae			Av. no. larvae per positive collection		
1964	1965	1966	1964	1965	1966	1964	1965	1966
65	38	52	21	55	25	3.8	3.9	1.6

Table 7

Other Insects of Current Minor Significance

Insect	Hosts	Locality	Remarks
Acleris variana (Fern.) Black-headed budworm	wS, alF, D, bS	Widespread	Defoliator. Average 3.3 larvae per positive sample.
Asemum atrum (Esch.) Black spruce borer	wS	Blackwater area	Wood borer of white spruce. Little damage to log decks in 1966, no adults were reared in 1966.

Other Insects of Current Minor Significance - Continued

Insect	Hosts	Locality	Remarks
Contarinia spp. Douglas-fir needle midges	D	Cluculz L.	Light population on Douglas-fir reproduction.
Epirrita a. omissa Harr. Green velvet looper	alF, wS	Punchaw	Defoliator. Average 1.2 larvae per positive sample, slightly higher than 1965.
Griselda radicana Wlshm. A spruce budworm	wS	Punchaw	Defoliator. 1.0 larva per positive collection, down slightly from 1965.
Oligonychus ununguis Jacot Spruce spider mite	wS	Prince George City	Discolors needles of white spruce and causes them to shed.
Pissodes terminalis Hopk. Lodgepole pine terminal weevil	lP	Nation R.	Terminal borer. Seven larvae collected from dead terminals in three trees.
Pristiphora erichsonii (Htg.) Larch sawfly	eL	Cluculz L.	Defoliator. None collected in 1966, although defoliation and egg crooks were noted.
Trypodendron sp. Ambrosia beetle	wS	Ft. St. James	Wood borer. Light attack in log decks at Ft. St. Jam James; none found in log decks at MacKenzie.

FOREST DISEASE CONDITIONS

Currently Important Diseases

Weather Damage

Late Frost Injury

An extremely cold period in April 1966 (temperatures of -5°F.) caused widespread damage to deciduous trees; aspen and cottonwood in par-

ticular. Areas affected were Vanderhoof, Kenny Dam Road, Fort St. James Road and along the Hart Highway from Salmon River to Summit Lake. Damage occurred in patches on south slopes and at low elevations. Vanderhoof area was the hardest hit with trees just beginning to put out sparse foliage by the end of June.

Foliage Diseases

A Foliage Disease on Aspen.

On June 25, 1966, a disease causing aspen leaves to wither was first noticed. Intermittent areas of infection occurred in the Vanderhoof and Fraser Lake Ranger districts and along the Hart Highway from the south end of McLeod Lake north to the Parsnip River. Samples of diseased foliage were sent to Victoria for identification, but the causal agent has not yet been identified.

Stem Diseases

Disease-Western Balsam Bark Beetle Complex on Alpine Fir

The current status of the western balsam bark beetle is discussed in the insect portion of this report. At present it is not known to what extent the disease organism, Ceratocystis dryocoetidis Kendrick and Molnar, contributes to the overall alpine fir mortality. Research into the problem is being carried on by the Department of Forestry and Rural Development at the Regional Laboratory at Victoria.

Mistletoe Diseases

Lodgepole Pine Dwarf Mistletoe, Arceuthobium americanum Nutt. ex Engelm.

Light to heavy infections of this parasite on young and mature lodgepole pine occurred over much of this tree's range. Collections made at MacKenzie in the Rocky Mountain Trench constituted a new locality record. At Bear Lake the infection was generally severe in trees averaging 6 inches dbh in a mature two-story stand. At both localities lodgepole pine comprised more than 90% of the stand.

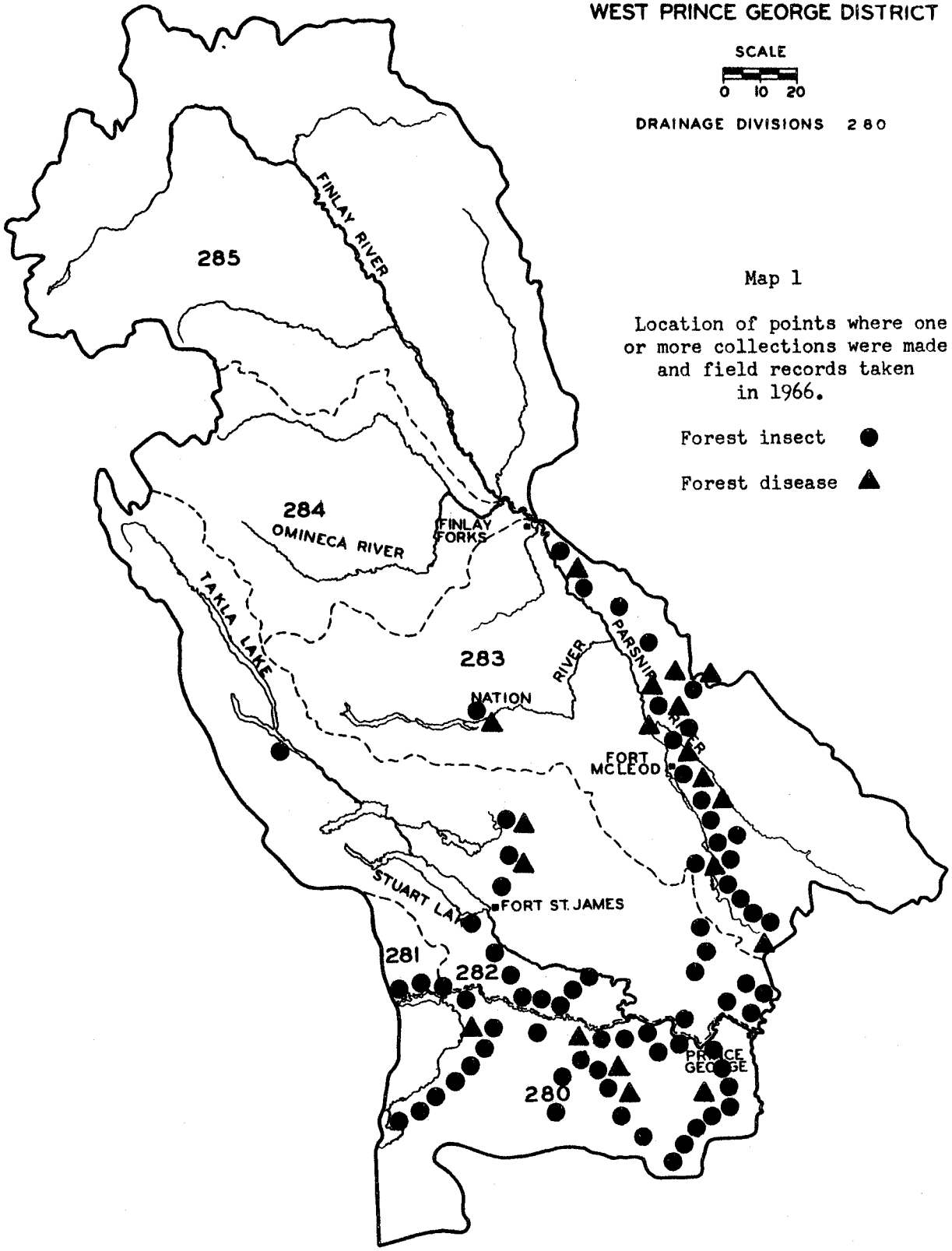
Table 8

Other Diseases of Current Minor Significance

Organism and disease	Host	Locality	Remarks
Bifusella abietis Dearn. Needle cast	alF	Morfee Mt.	On scrub alpine fir at about 5,000 ft.
Chrysomyxa pirolata Wnt. Spruce cone rust	wS	Blackwater Road	Not prevalent.

Other Diseases of Current Minor Significance - Continued

Organism and disease	Host	Locality	Remarks
Hypodermella abietis-concoloris (Mayr) Dearn. Needle cast	alF	Pine Pass	Light infection. In the Rocky Mountains.
Hypodermella concolor (Dearn.) Darker Needle cast	lP	Punchaw	Light infection. One of the most virulent needle cast fungi on lodgepole pine.
Lophederminum macro-sporum (Hartig) Rehm Spruce needle cast	wS	Pine Pass	Light infection.
Melampsora epitea Thuem. Leaf rust	W	Blackwater Road	Alternate host for rust on conifers.
Phacidium abietis (Dearn.) Reid and Cain Snow blight of conifers	alF	Pine Pass	New host record for B.C.



Map 1

Location of points where one or more collections were made and field records taken in 1966.

Forest insect ●

Forest disease ▲

FOREST INSECT AND DISEASE SURVEY

NORTH PRINCE GEORGE DISTRICT

1966

FOREST INSECT AND DISEASE SURVEY

NORTH PRINCE GEORGE DISTRICT

1966

D. G. Lund [1]

INTRODUCTION

Regular field work in the District began on June 8 and ended on August 11. Thirty-six permanent sampling stations were sampled at least once during the season. Special aerial and ground surveys for spruce budworm damage were made in the Liard and Fort Nelson drainages from July 17 to July 29. A total of seven hours and twenty minutes flying time was utilized in this survey. One hour and forty-five minutes was provided by the B. C. Forest Service at Fort Nelson.

Insect and disease collections made in the District are shown by host in Table 1; collection localities and drainage divisions are shown on maps 1 and 2. The specific problems in each of the drainage divisions covered are shown in Table 2.

Table 1

Collections by Host

North Prince George District, 1966

Coniferous hosts	Forest insects	Forest diseases	Broad-leaved hosts	Forest insects	Forest diseases
Fir, alpine	13	1	Aspen, trembling	31	6
Larch, eastern	31	0	Birch species	8	0
Pine, lodgepole	38	5	Cottonwood, black	8	2
Spruce, black	12	2	Poplar, balsam	4	2
Spruce, white	119	13	Willow species	19	1
			Miscellaneous	8	7
Totals	213	21	Totals	78	18
			GRAND TOTALS	291	39

[1] Forest Research Technician, Forest Insect and Disease Survey, Vernon, B. C.

Table 2

Currently Important Insect and Disease [1] Problems by Drainage Divisions, North Prince George District, 1966

Insect and disease problems	Principal hosts [2]	Importance by drainage divisions [3]				
		300	301	302	303	304
DEFOLIATORS						
One-year-cycle spruce budworm	wS, alF, tL	0	1	4	0	2
Two-year-cycle spruce budworm	wS, alF	2	0	0	0	0
Larch sawfly	tL	1	2	3	0	1
WEATHER DAMAGE						
Frost damage	bPo, lP, bS, alF	5	2	1	0	2
FOLIAGE DISEASES						
A spruce needle rust Chrysomyxa ledicola Lagerh.	wS	4	1	1	0	2
Ink spot on aspen Ciborinia whetzelii (Seaver) Seaver	tA	0	0	4	0	0

1/ Includes only weather-induced and foliage diseases subject to notable annual fluctuations.

2/ Refer to host code in the Prince George Forest District introduction.

3/ High population and/or widespread outbreak in progress - 5
Scattered high populations and/or significant damage in restricted areas - 4

Rising population and/or moderate numbers of insects and/or potential problem - 3

Static or falling population and/or moderate numbers of insects and/or no problem at present - 2

Endemic population and/or no significant damage - 1
Not sampled and/or not found and/or no host - 0

FOREST INSECT CONDITIONS

Important Insects

Defoliators

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

The infestation of spruce budworm in the North Prince George District abated considerably in most areas. A summary of collections is shown in Table 3. Aerial and ground surveys showed a marked decrease in defoliation of current year's growth (Table 4). Defoliation in the Fontas, Fort Nelson, Liard and Muskwa rivers and the Kotcho Lake area was light to moderate, but in most of these areas, it was attributed to previous infestations. Heavy defoliation occurred in 1966 along the Prophet River with the most severe defoliation at Parker Creek. The infestations at Smith and Kledo rivers declined sharply from 1965. The preferred host was white spruce although lodgepole pine and alpine fir were fed upon occasionally.

Table 3

Summary of One-year-cycle Spruce Budworm Collections on White Spruce by Drainage Divisions, North Prince George District

Drainage division	Number of samples taken during larval period			% samples containing larvae			Average number of larvae per positive sample		
	1964	1965	1966	1964	1965	1966	1964	1965	1966
300	0	0	0	-	-	-	-	-	-
301	0	2	2	-	0	0	-	-	-
302	31	33	19	39	42	47	53	43	13
304	8	8	16	13	0	0	1	0	-
Total	39	43	37	33	33	27	49	43	13

Table 4

Percentage Defoliation of Current Year's Growth of White Spruce by One-year-cycle Spruce Budworm, North Prince George District

Mileposts, Alaska Highway	% defoliation 1964	1965	1966
247	-	90	74
270	0	30	4
321	42	80	22
327	58	10	6
335	30	95	22
342	88	70	13
494	-	95	12
502	100	95	0
506	85	90	4
514	89	95	Tr.
528	100	75	3
538	77	95	25
Averages	74	77	19

Egg sampling was carried out at 12 permanent sampling stations established in 1965, along the Alaska Highway between miles 247 and 538. Two sample branches were taken from the south side of the upper crown of one tree at each of the 12 sampling stations. The branch area was computed, current defoliation determined, and new egg masses were counted for population estimates for 1967 (Table 5). Egg sampling indicates that populations will decline in 1967 in most areas. A slight increase in population is expected along the Prophet and Liard rivers.

Table 5

Defoliation of Current Year's Growth, Number of Adults Emerged and Number of Egg Masses per 100 Square Feet of White Spruce Foliage, North Prince George District, 1966

Mileposts, Alaska Highway	% defoliation current growth	No. adults emerged per 100 sq. ft.	No. egg masses per 100 sq. ft.
247	74	480	1,426
270	4	0	40
321	22	25	25
327	6	0	0
335	22	0	10
342	13	15	46
494	12	0	0
502	0	0	0

Table 5 continued

Mileposts, Alaska Highway	% defoliation current growth	No. adults emerged per 100 sq. ft.	No. egg masses per 100 sq. ft.
506	4	0	0
514	Tr.	0	43
528	3	0	26
538	25	29	246

Larch Sawfly, Pristiphora erichsonii (Htg.)

Populations of this sawfly increased slightly over 1965 but remained at a low level in most localities. Light to moderate defoliation occurred between miles 247 and 264 Alaska Highway. Larch stands southwest of Dawson Creek and in the Hudson Hope area were lightly infested. A comparison of larval occurrence in beating samples from 1964 to 1966 is shown below:

No. of samples taken during larval period			% samples containing larvae			Average number of larvae per positive sample		
1964	1965	1966	1964	1965	1966	1964	1965	1966
21	29	29	62	59	61	50	12	14

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

Populations were very low in 1966. Only one egg mass was found on the sample branches from ten trees at the permanent plot at Link Creek.

Other Noteworthy Insects

Black-headed Budworm, Acleris variana (Fern.)

The percentage of collections containing black-headed budworm larvae increased from 43% in 1965 to 62% in 1966 although the average number of larvae per collection dropped from 3.3 to 2.0. White spruce was the principal host.

A Native Larch Sawfly, Anoplonyx laricivorus Ross

The number of larvae collected from eastern larch along the Hart and Alaska highways has been increasing over the past two years. No larvae were identified from beatings taken in 1964; 17 larvae were collected in 1965 and 38 larvae were collected in 1966. The following data show an increase in population from 1964 to 1966.

No. of samples taken during larval period			% samples containing larvae			Average number of larvae per positive sample		
1964	1965	1966	1964	1965	1966	1964	1965	1966
18	20	15	0	30	40	0	2.8	6.3

Spruce Beetle, Dendroctonus obesus (Mann.)

There was little spruce beetle activity observed in accessible stands of white spruce in the District. Aerial reconnaissance indicated some mortality in trees along the Liard River where spruce budworm feeding had weakened them.

Western Balsam Bark Beetle, Dryocoetes confusus Sw.

The infestation of this insect in the Pine Pass area declined further in 1966. Only a few red-topped trees were noted north of Azouzetta Lake.

Aspen Leaf Miner, Phyllocnistis populiella Cham.

Populations remain light except along the Yukon border where heavy infestations occurred. Three permanent plots were sampled in mid-July but there were insufficient cocoons at Prochniac Creek and Smith River to obtain complete data. There was an increase in population from 1965 at the Hyland River plot; in the 100 cocoon sample, 90% of the adults had emerged successfully and only 5% were parasitized and 5% were dead from unknown causes. Following is a comparison of leaf surfaces mined and adults produced for the last 3 years.

Location	Percentage of leaf surfaces mined			No. of adults per 100 leaf surfaces		
	1964	1965	1966	1964	1965	1966
Prochniac Creek	.7	0	0	0	0	0
Smith River	12.9	7.9	0	0	.9	0
Hyland River	5.3	7.9	31	2	4.3	26.3

Table 6

Other Insects of Current Minor Significance

Insect	Hosts	Location	Remarks
Chrysobothris harrisii (Henz.) A flat-headed borer	lP, tL	Mile 220 Alaska Highway	Wood borer; rare; only three known to have been collected in B.C.

Table 6 continued

Insect	Hosts	Location	Remarks
Operophtera bruceata (Hulst) Bruce spanworm	tA	Widespread	Common defoliator
Pikonema alaskensis (Roh.) Yellow-headed spruce sawfly	wS	Widespread	Defoliator; decrease in populations from 1965.
Pikonema dimmockii (Cress.) Green-headed spruce sawfly	wS	Widespread	Common defoliator; populations declined in 1966.
Pissodes terminalis Hopp. Pine terminal weevil	lP	East Pine	Larvae feed in terminal shoots of pine.
Semiothisa sexmaculata Pack. Green Larch looper	tL	East Pine	Defoliator; population decreasing.
Zeiraphera fortunana Kft. Spruce tip moth	wS, tL bS, alF	Widespread	Common defoliator; slight increase in population.

FOREST DISEASE CONDITIONS

Currently Important Diseases

Weather Damage

Lodgepole pine, alpine fir, and black spruce were damaged by adverse weather conditions in the Fort Nelson area at high, exposed altitudes. The most severe damage was on Steamboat Mountain and around Irene Lake.

Early spring frost in the Dawson Creek and Fort St. John areas caused heavy bud mortality of balsam poplar trees. In many areas, foliage had failed to develop by mid-June. Trees north of Charlie Lake were only slightly affected.

Foliage Diseases

Broom Rust on Black Spruce, Chrysomyxa arctostaphyli Diet.

A common disease in the North Prince George District, this rust has reached epidemic levels at Mile 120 Alaska Highway where an estimated 50% of the trees in a 100 tree plot were infected.

A Spruce Needle Rust, Chrysomyxa ledicola Lagerh.

The current year's growth of white spruce was 70% infected with this rust at Mile 10 Gold Bar Road. Black spruce was present in the stand but was not affected by the disease.

Ink Spot on Aspen, Ciborinia whetzelii (Seaver) Seaver

An estimated 40 acres of immature trembling aspen at Mile 420, Alaska

Highway were infected with ink spot disease which caused severe discoloration of the foliage.

Gall Rusts

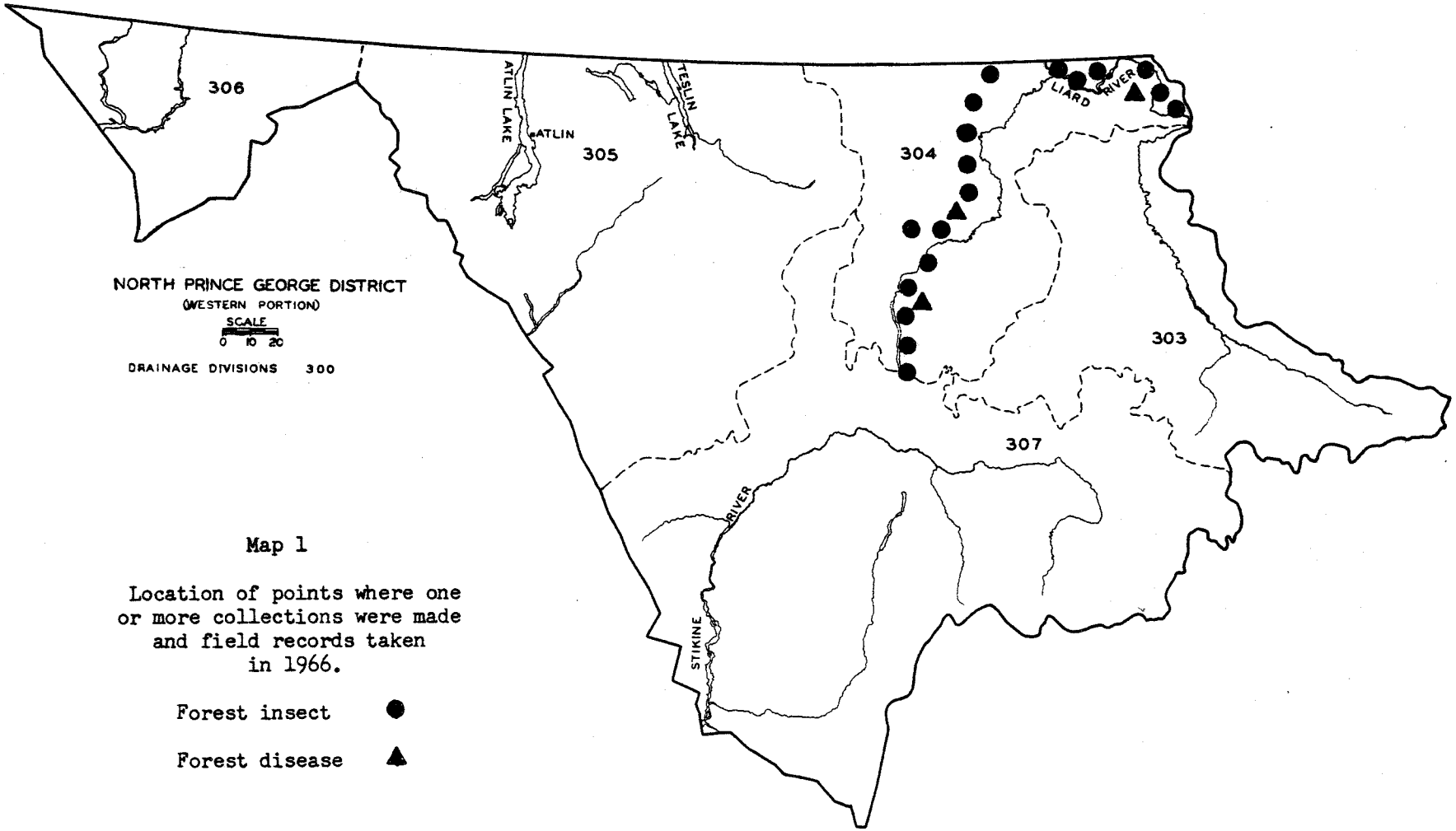
Western Gall Rust, Peridermium harknessii J. P. Moore

Lodgepole pines were heavily infected with western gall rust along the Alaska Highway from Mile 69.5 to Mile 120. At Mile 69.5 an estimated 10% of the trees had one or more galls on them. At Mile 120, an estimated 80% of a 100 tree sample plot contained one or more galls.

Table 7

Other Diseases of Current Minor Significance

Disease	Host	Locality	Remarks
Cronartium comandrae Peck Native blister rust	lP	Widespread	Light infection throughout District.
Epipolaeum tsugae (Dearn.) Shoem. Needle disease	wS	Mile 326, Alaska Highway	New host record.
Fomes igniarius (L. ex Fr.) Kickx. False tinder fungus	tA	General	Light infection in the Dawson Creek area.
Hypodermella concolor (Dearn.) Darker Lodgepole pine needle cast	lP	Mile 100, Alaska Highway	Light infection in immature pole stand.
Polyporus hirsutus Wulf. ex Fr. Hairy conk	wS	Tupper	New host record; attacks dead heartwood in living trees.



Map 1

Location of points where one or more collections were made and field records taken in 1966.

Forest insect ●

Forest disease ▲