Forest Insect and Disease Conditions

Prince Rupert Forest Region
1983

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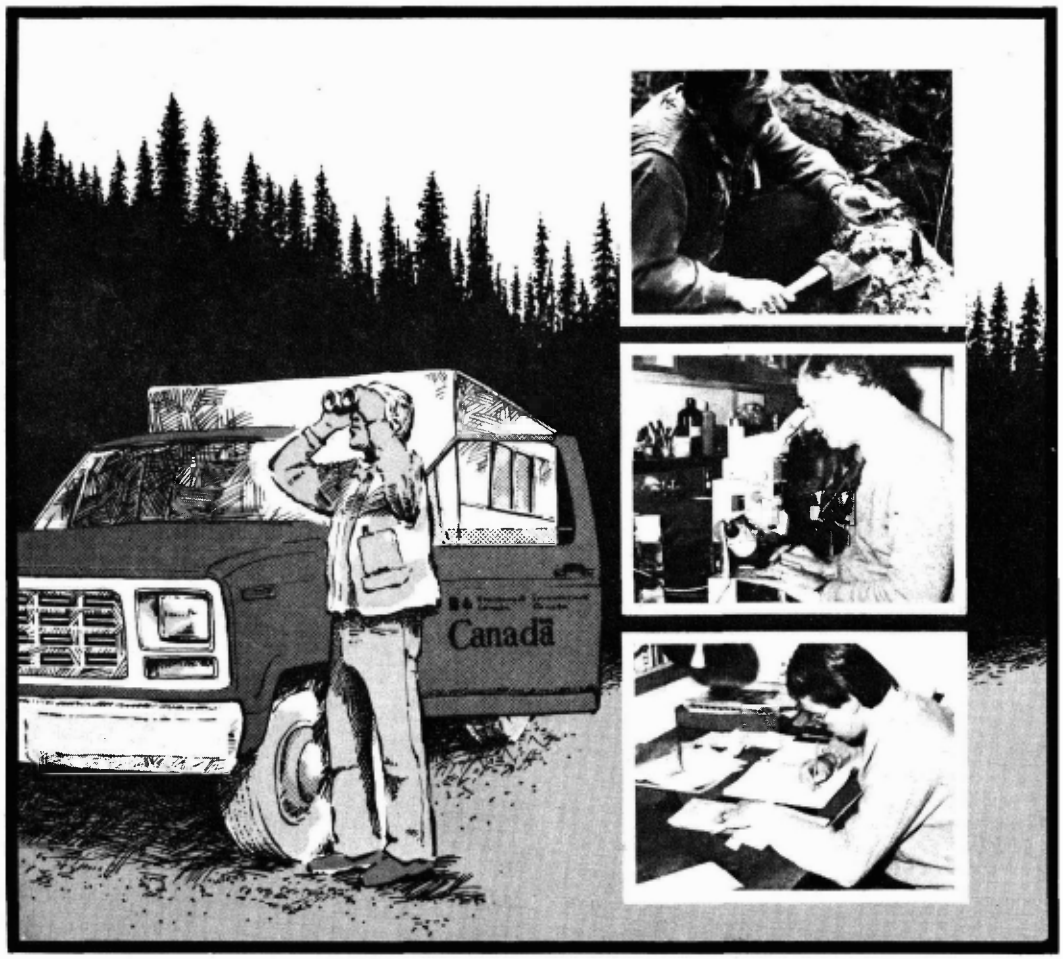

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APPENDICES (Available from Pacific Forest Research Centre)

Summary

This report outlines the status of forest pests in the Prince Rupert Forest Region in 1983, and attempts to forecast some of the pest population trends. Pests are listed by host in order of importance.

The number of trees attacked by the spruce beetle declined from 1982. Spruce budworm defoliated areas expanded to 153 000 ha in the Babine, Kispiox, Nass and Bell-Irving rivers. Black army cutworm destroyed over 140 000 recently planted seedlings in the Bristol, Chapman, and Francois lakes areas. Spruce aphid populations increased slightly in the coastal areas following one year of low activity. Cone and seed pests moderately infested a moderate Sitka spruce cone crop.

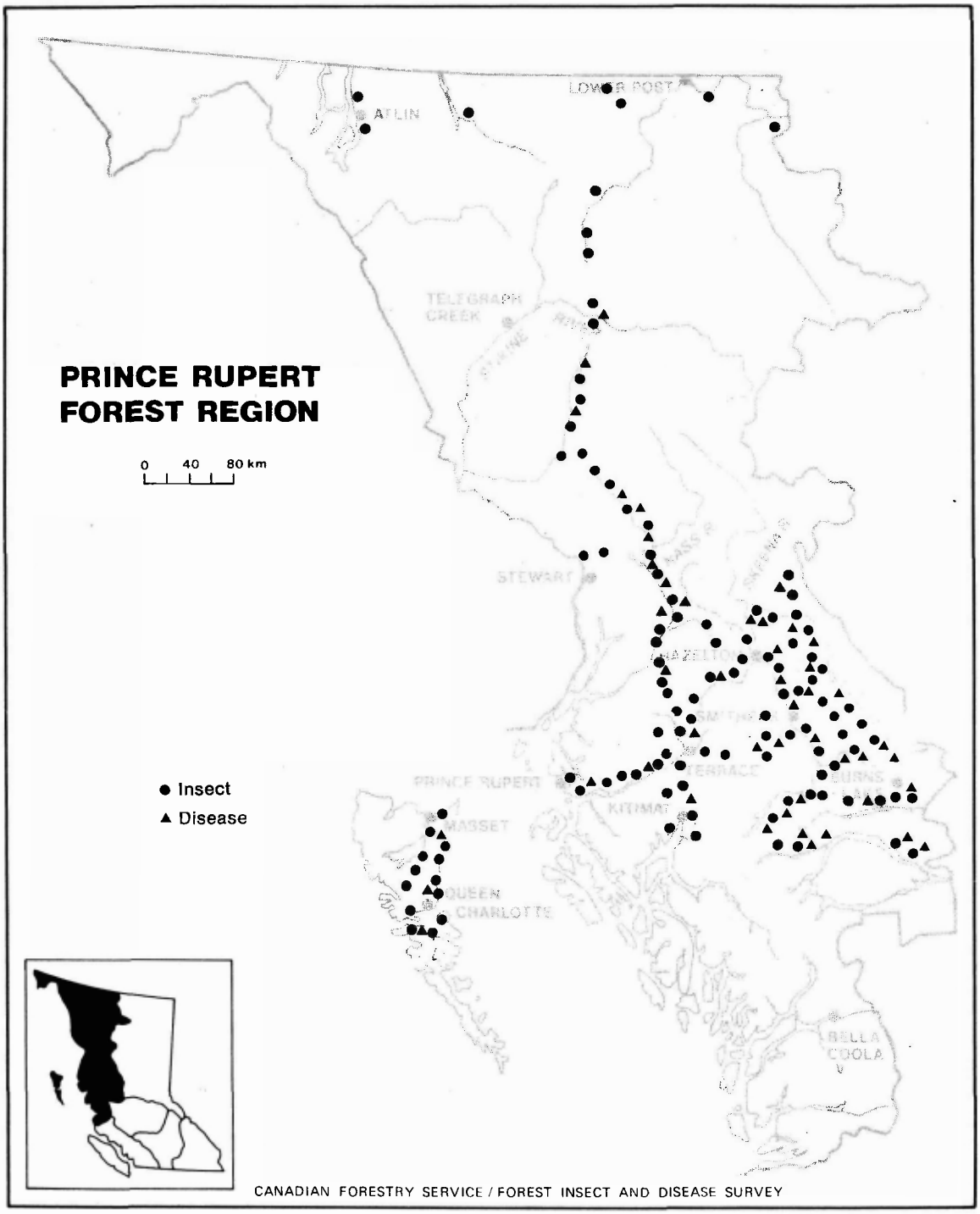
Mountain pine beetle attack levels decreased only slightly from previous years, but major increases were noted in several interior areas. Root collar weevil remains a persistent pest in young stands. Comandrae blister rust has caused up to 18% young pine mortality in plantations. Growth loss due to Western gall rust was measured at 14% in a young spaced stand. Lodgepole needle miner feeding resulted in terminal mortality on 25% of the trees in a spaced stand near Topley Landing.

Hemlock sawfly populations continued to rise near Hazelton and on the Queen Charlotte Islands. Porcupines have beome an ever more important pest problem in coastal hemlock and spruce stands.

Both forest tent caterpillar and western tent caterpillar populations increased dramatically in the Bulkley River Valley and in the Meziadin Lake areas.

The forest pest survey field season extended from late May to late September. A total of 313 insect and 158 disease collections were submitted to the Pacific Forest Research Centre by FIDS survey personnel. Map 1 shows the locations where one or more samples were collected. The percentage of collections containing potentially damaging insects was 76% compared to 81% in 1982. A total of 28 special collections for research programs were collected. Gypsy moth traps placed in 15 potential problem areas were all negative. Pest problems in accessible provincial parks were assessed.

Due to financial restraints aerial surveys were drastically reduced with only nine hours of flying time provided by the British Columbia Ministry of Forests, and none by CFS. Consequently, all the area figures for spruce beetle and mountain pine beetle killed trees were provided by the BCMF in Smithers.



Map 1

Locations where one or more forest insect and disease samples were collected, 1983

SPRUCE PESTS

Spruce beetle, Dendroctonus rufipennis

Spruce beetle destroyed an estimated 1 100 000[1] m^3 of mature spruce over 16 500 ha in the Region (Table 1). This represents no change in volume loss and only a slight decrease in area from 17 900 ha in 1982, over similar portions of the Region. The additional area and volume estimated in 1982 included Tweedsmuir Park and the Cassiar TSA, for which figures are not available in 1983.

A direct comparison of areas of beetle killed trees between 1982 and 1983 is not attempted because of different methods of mapping and area calculations used by CFS-FIDS and BCMF personnel. However, a general overview shows that in the Lakes TSA the area of spruce beetle killed trees increased in the Babine Lake, Intata Reach, Chelaslie Arm and Tetachuck Lake areas. Several smaller infestations in the Binta-Knapp lakes area were removed by logging.

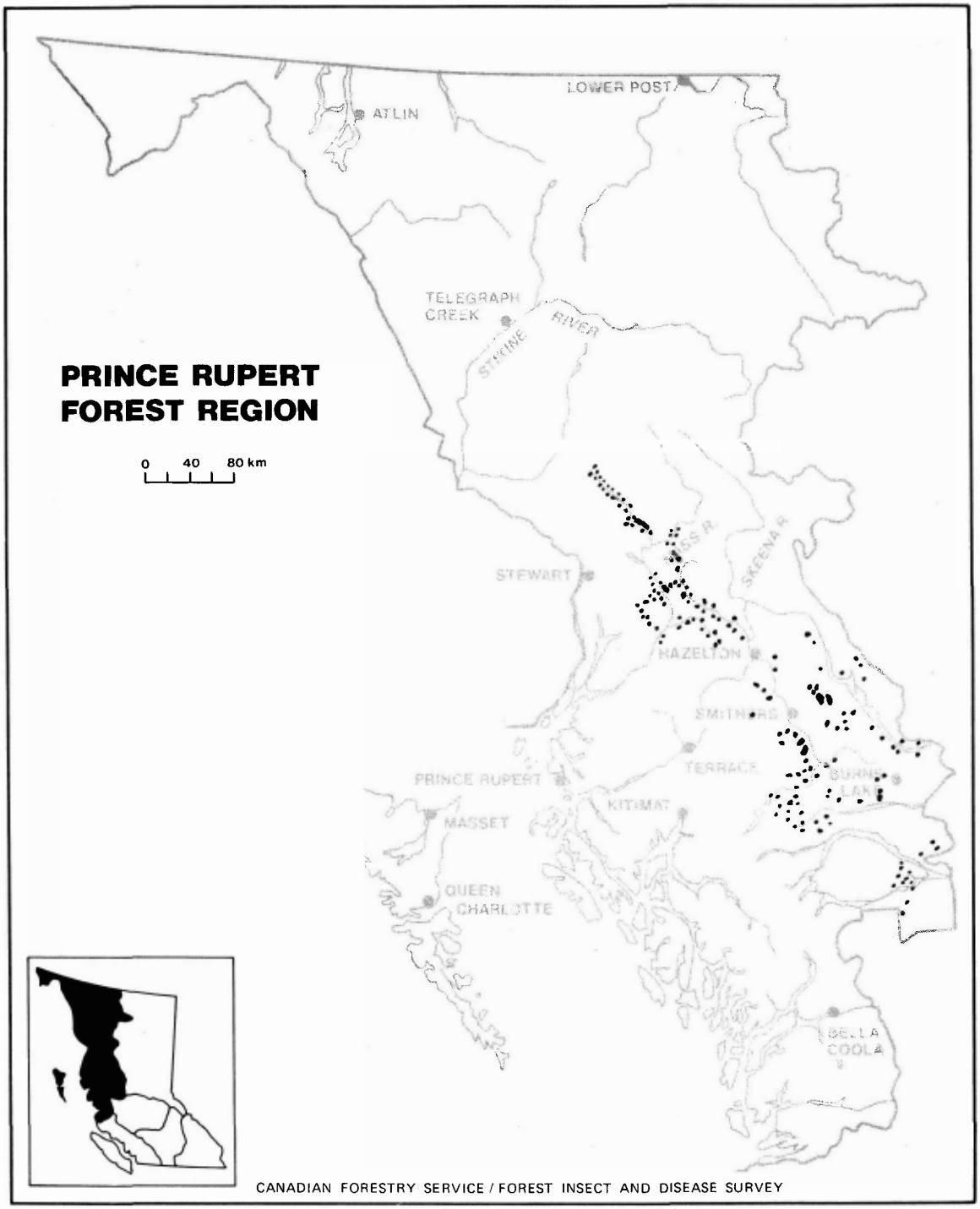
TABLE 1. Area and volume of spruce recently killed by spruce beetle in the Prince Rupert Forest Region, 1983.

Location (TSA)	Area (ha)[1]	Volume (m^3)[2]
Lakes	2 600	223 600
Morice	4 700	376 000
Bulkley	3 800	296 400
Kispiox	500	35 000
Kalum	4 900	166 600
TOTAL	16 500	1 100 000

[1]Areas are those provided by BCMF.
[2]Volumes include only the volume of trees attacked in 1982 as determined by CFS-FIDS cruise data.

In the Morice TSA area, increased tree mortality occurred in most of the 1982 infestation areas from Fulton Lake south to Ootsa Lake. However, some decrease due to concentrated logging was noted in the Morice River - Pimpernal Creek area. Within the Bulkley TSA, major increases in area occurred in the Chapman Lake - Harold Price Creek area. Logging directed at infestations in the Goathorn Creek and McDonell Lake vicinities eliminated several areas of beetle killed trees mapped in 1982.

[1]All area figures have been supplied by the BCMF; volume calculations are based on CFS-FIDS cruise data applied to the above area figures.



Map 2

Spruce Beetle

Areas of recently killed spruce as determined by aerial survey, 1983

In the Kispiox TSA, the only major area of spruce mortality occurred near Steep Canyon Creek in the Kispiox River drainage, where the area increased over 1982 figures. Additional small pockets of infestation were also recorded further south in the same drainage. In the Skeena - Babine rivers area currently attacked trees were commonly encountered although no discolored trees were aerially visible. The small infestation at Sharpe Creek persisted. In the Cranberry River area several infestations increased primarily northward into the Kalum TSA. In the Kalum TSA the area of beetle killed spruce remained identical to 1982. The spread was limited in most areas by host scarcity. However, spread occurred in numerous small pockets northward along the Bell-Irving River and in the Kinscush River areas.

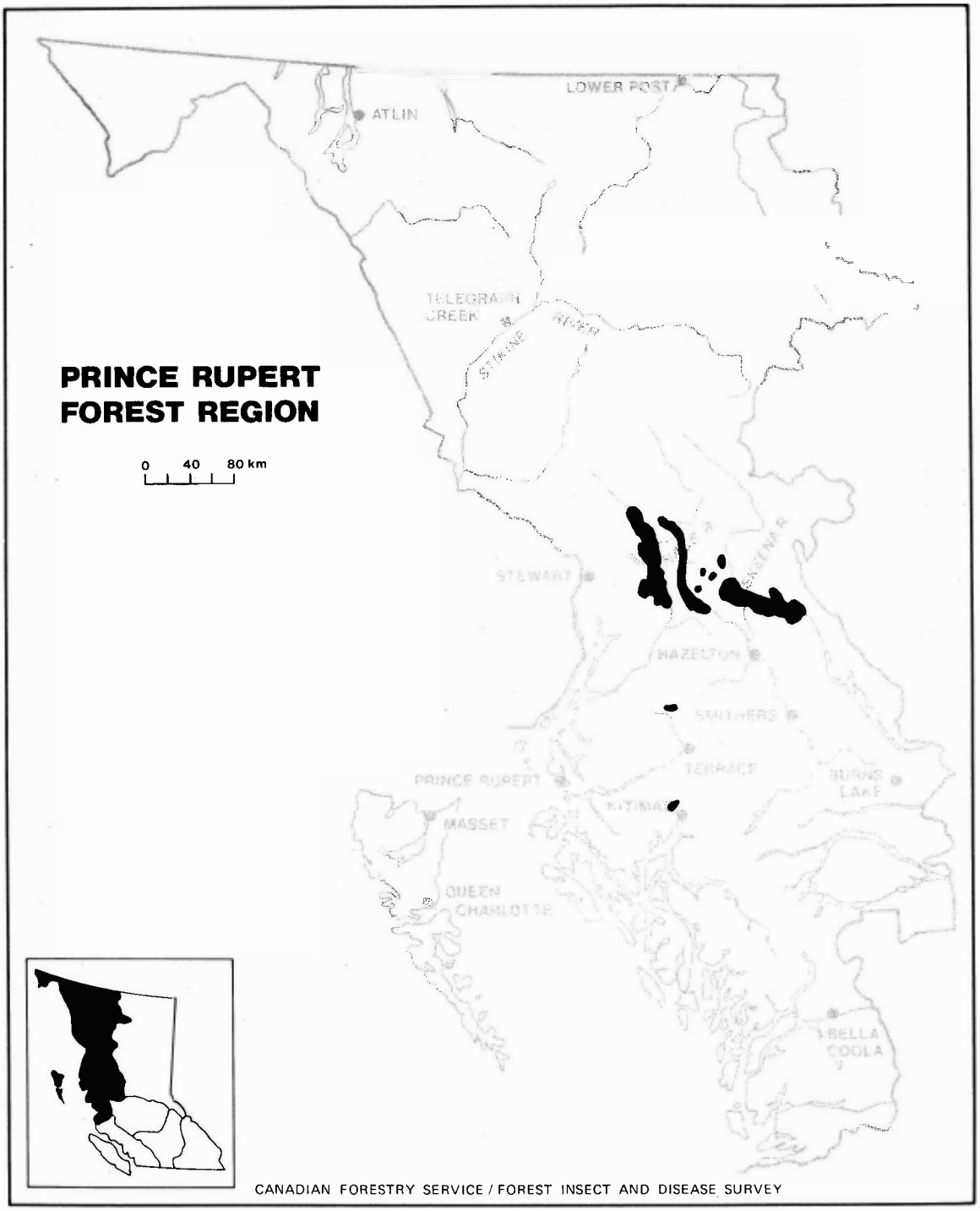
Trap tree and semiochemical trapping programs were used in conjunction with logging of currently infested trees to contain infestations and reduce volume losses.

Twelve stands were cruised in September to determine the current attack levels and the brood status (Table 2). Current attack levels were lower than in 1982 in all but two of the areas cruised: Coffin Lake and Richie Creek. These two locations, along with areas where attack levels remained similar to 1982, contained a large percentage of 1982 broods which developed in a one year cycle. One year cycling was most common in the main Bulkley River Valley, Kispiox River, Nass River and Bell-Irving River. In these areas the current attack exceeded the 1982 attack by 10% (from 22 to 12%) whereas in the interior areas current attack was 20% lower than in 1982.

The 1983 broods are primarily in a two year development cycle (80% in the interior and 50% from the Kispiox River west). Beetle attacks in 1984 in the interior should increase over the 1983 levels with 70 to 80% of the large 1982 broods flying in the spring of 1984. In the western areas (Kispiox R. west) the 1984 attack levels will increase slightly. However, with more one year cycling present in these areas, annual fluctuations of attack levels are less pronounced.

The forecasts may be affected by the influence of climatic factors on beetle development. In addition, increased incidence of pitchouts in 1983 may indicate a declining vigor within some of the populations.

Mortality of mature spruce continued along the Haines Road and is described in detail in "Special Report - Spruce Beetle - Haines Road - 1983", Appendix IV.



Map 3

Spruce Budworm

Areas of defoliated spruce-alpine fir stands as determined by aerial surveys, 1983

TABLE 2. Status of spruce stands infested by spruce beetle in the Prince Rupert Forest Region in 1983.

Location	Percent of stems attacked						Percent of Broods Flying in 1984	
	1983	1983 Partial	1983 Pitchout	1982	Prior to 1982	Healthy	Brood from 82	Brood from 83
Cross Cr.[1]	4	21	0	30	9	36	90	10
Maxan Cr.[1]	1+	3	6	20	24	47	60	-
Morice R.	4	5	2	27	18	44	80	15
Fulton Lk.	11	12	8	22	23	24	70	15
Babine Lk.	13	8	7	36	19	17	50	15
Nadina R.	7	8	6	32	9	38	85	15
Chapman Lk.	19	9	7	28	17	20	35	40
Coffin Lk.	32	4	8	22	12	22	65	30
Sweetin R.	12	5	13	15	9	46	15	50
Brown Bear Main	13	-	4	8	16	59	-	-
Richie Cr.	29	-	14	4	11	42	-	-
Cousins Cr.	25	-	7	12	43	13	-	-

[1]Near general area of semiochemical baiting trial.

Spruce Budworm, Choristoneura spp.

The area of alpine fir and white spruce defoliated by budworms almost doubled in the third consecutive year of infestation. Light to severe defoliation occurred on 153 000 ha in the same general areas as in previous years; Nass and Bell-Irving rivers, Kispiox River, and the Babine River. Three new infestations lightly defoliated more than 300 ha at Mayo Creek and Dahl Creek, and 20 ha at Cedarvale.

The main areas of expansion occurred north of the Kispiox River through to the Kwinageese and Taylor rivers along the Nass River. Defoliation increased to mainly moderate defoliation over the 30 400 ha, up from the 14 000 ha of mainly light defoliation in 1982. In the Nass and Bell-Irving rivers area 85 000 ha (up from 63 000 ha in 1982) were moderately defoliated. A coalescing of smaller infestations and an expansion into side valleys accounted for the increase. Infestations in the Babine River area increased to 37 000 ha (moderate/severe 25 800 ha and light over 12 000 ha) up from 11 000 in 1982. Infestations also expanded westward and northward along the Skeena River and eastward along the Babine River to Mount Horetzky. Larval populations increased in 1983 for the second consecutive year at Cedarvale resulting in light defoliation over 20 ha. Mature balsam and hemlock stands were severely defoliated at Dahl Creek and Sitka spruce in adjacent plantations were lightly defoliated. In the Mayo Creek Valley severe defoliation was

restricted to 300+ ha of native Amabilis fir stands in outbreaks between Km 4 and Km 12.

These infestation areas have a mixed composition of three Choristoneura species. In the southern areas around Mayo and Dahl creeks the major species is C. orae. In the eastern front along the Babine River, populations consist increasingly of C. biennis. The major central areas of the defoliation includes these two species as well as C. fumiferana.

Larval sampling indicated an increase in population levels throughout the Region. In non-infestation areas, 87% of the three tree beatings contained an average of 8 larvae. Areas where new damage could occur in 1984, based on larval sampling are as follows: Kitwanga, Seeley Lake, Harold Price Creek, and Nilkitkwa Lake.

Tree mortality is evident in localized areas where three to four consecutive years of defoliation has been recorded. During aerial surveys mortality of 5 to 10% of mature alpine fir and spruce was estimated over 1 500 ha in the White River, 500 ha Bell-Irving River, and 500 ha in the Kispiox River area. The latter two areas have high populations of spruce beetle also causing tree mortality. If defoliation remains at current levels, tree mortality could increase rapidly. Studies in eastern Canada indicate that tree mortality begins after three consecutive years of defoliation and increases to 60%+ of the fir species and 20%+ of the spruce after 7 - 8 consecutive years of defoliation.

Bud and twig mortality was evident on the alpine fir and spruce at all areas where branches were examined. Mortality ranged from 14% at Cedarvale to 93% near Mitten Main in the Kispiox River area. Extensive back feeding has occurred due to consecutive years of bud mortality, and only 1980 and older foliage remained on the understory alpine fir and white spruce.

The presence of Beauvaria bassiana-diseased larvae and pupae on branch samples was more prevalent in all areas than in 1982. Diseased insects were found in 40% to 100% of the samples. The greatest increase was at Kisgegas along the Babine River with an increase to 100% from only 18% in 1982. Correspondingly, this area also had the greatest decrease in the number of egg masses (from 743 to 23). Similar decreases in egg mass numbers occurred at Hanna Main (from 240 to 19) where the incidence of B. bassiana infected budworm increased to 100% from 60% in 1982 (Table 3). Egg mass counts were reduced considerably at all locations and moderate defoliation is predicted for most areas. Only in the Kispiox River area did the egg mass counts indicate severe levels of defoliation for 1984.

TABLE 3. Percent bud and larval mortality, and defoliation predictions in spruce budworm infestations, Prince Rupert Forest Region, 1983.

Location	% Bud mortality	% trees with Beauvaria infected budworm	Egg Masses per 10 m^2	Predicted defoliation[1]
Kisgegas	51	100	23	light
Mitten Main	93	80	170	severe
Footsore L.	87	40	185	severe
Hanna Main	26	100	19	light
Black Fly Main	42	60	112	moderate
Cedarvale	14	80	0	light[2]
Mayo Cr.	40	55	111	moderate
Dahl Cr.	64	65	109	moderate

[1] light - 1-50 egg masses per 10 m^2 of foliage
moderate - 51-150 egg masses per 10 m^2 of foliage
severe - 151+ egg masses per 10 m^2 of foliage

[2] This prediction is based solely on the increasing larval counts during the past two years.

Pheromone traps continued to be used in areas of potential budworm population buildup. Their major function is to identify areas where populations are increasing, before significant increases are detected by larval sampling. Due to the species combination in much of the current infestation area, the data from the Nass and Bell-Irving rivers do not provide a complete picture of population levels present. The different species of budworm are attracted to different pheromones and only the C. biennis pheromone was used. The low numbers of adults present in the traps indicates the non-adult year of a two year life cycle.

TABLE 4. Average number of spruce budworm moths caught in pheromone baited traps, Prince Rupert Forest Region, 1983.

Location	Pheromone Concentration by Percent		
	.001	.01	.1
Spruce Cr.	1	4	29
Nass R.	0	1	14
Doris Lk.	0	0	2
Nilkitkwa Lk.	0	0	0
Augier Ck.	0	0	1
Morice R.	0	0	0
Telkwa R.	0	0	0

Spruce weevil, Pissodes strobi

An average of 30% of the Sitka spruce leaders examined in six 5-40-year old plantations in the Prince Rupert-Terrace-Kitimat-Greenville area were killed by spruce weevil in 1983 (Table 5). Current attack ranged from a low of 5% at Andesite Creek to a high of 88% at the Exstew River. The reduction at Andesite Creek occurred in the last two years and is attributed in part to predation by Lonchea sp. This predator was present in all 50 examined weevil attacked leaders this year, with an average of 10 predators to every weevil larvae. The severe attack at Exstew River is partially a result of the spacing that was done in this stand three years ago; spruce weevils prefer more vigorous leaders resulting from well spaced trees.

Extensive spruce weevil surveys were conducted by the BCMF in the Kitimat Valley during the 1982-83 winter. The surveys used determined which stands would be included in a leader clipping program to start in the fall of 1983. The objective of the leader clipping program is to remove weevil progeny and thereby prevent a buildup of the insect population. The benefits of leader clipping are still under study.

TABLE 5. Incidence of spruce weevil attack in Sitka spruce for 1982 and 1983, Prince Rupert Forest Region, 1983.

Location	Stand Age	# of trees examined	% of 1983 attack	% 1982 attack
Sterling Creek	10	100	40	24
Sockeye Creek	12	100	14	12
Andesite Creek	15	100	5	18
Kitimat River	15	100	6	-
Exstew River	15	100	90	-
Greenville	20	100	22	-

Black army cutworm, Actebia fennica

Black army cutworm populations increased in 1983. Larval counts during early June averaged 30 and 20 per m^2 of duff in 1983 plantations at Bristol Lake and Francois Main, respectively. Lower population levels were found in numerous 1981 burned areas from Chapman Lake, south to Francois Lake.

Pupal counts at Bristol Lake, Chapman Lake, Guess Creek and the Row Fire averaged 1 to 3 per 1000 cm^2 of duff. However at Francois Main counts ranged from 5 to 300, averaging 40 pupae per sample.

Seedling mortality at Bristol Lake was estimated at 30 - 35% of the 400 000 lodgepole pine and white spruce seedlings planted. Planting of the remaining 600 000 seedlings scheduled for this site was stopped. At Francois Main insect development was further advanced at the time of planting, and only 5% of the 8 000 seedlings planted were killed. Tree mortality reached an estimated 5 - 10% near Chapman Lake on sites burned in 1981 and planted in the spring of 1982. Larvae fed on new shoots and had mined approximately 35% of the leaders in a partially burned 12 year old plantation near Perow (Row Fire, spring 1982). In all areas, close to 90% of the seedlings that were totally defoliated but with no bud damage, had recovered by late summer.

Adult populations were monitored through the use of attractant baited sticky traps located at fall 1982 or spring 1983 burns. The cutworm flight which occcurred in late July to early August was much smaller than that of 1982. The largest number of moths (13 in one trap), caught at Walcott, was significantly less than the average of 30 moths in the 1982 traps. Areas where moths were present in the traps only indicates that the black army cutworm is present. The attractant used is still in the early stages of research. It requires further development and calibration relating number of moths caught to potential damage the following spring before reliable predictions can be made. Other noctuid moths frequently caught in traps were Autographa ampla and Syngrapha sp., both of which are primarily herbaceous and shrub feeders.

The apparent decline in population was a result of infection by the nuclear polyhedrosis virus found in the larval and pupal samples collected from Bristol Lake and Francois Main. At the latter site, additional pupal mortality was due to unknown causes. However, 40% of the pupae were healthy and will continue to pose a threat in the surrounding burned site.

Climatic conditions during the summer allowed for extensive revegetation of most sites scheduled for planting. This combined with the apparent reduced population levels in most areas as indicated by pupal counts and suggested by the trap information should reduce seedling damage in 1984.

TABLE 6. Average number of black army cutworm moths caught in attractant baited traps. Prince Rupert Forest Region, 1983.

Location	Number of Traps	Average number of moths per trap
Helene Lk.	6	1
Cross Cr.	9	3
Parrott Lk.	2	1+
Nanika R.	6	1+
Duck Lk.	5	0
Nadina R.	3	0
Hilltout Rd.	3	1+
McBride Lk.	3	1+
Morice R.	5	1+
Guess Cr.	9	1
Walcott	5	5
Harold Price Cr.	16	1+
Telkwa R.	3	0
John Brown Cr.	4	1+
Cullon Cr.	2	0
Kitseguecla Lk.	2	0

Root and Butt Rots

Polyporus tomentosus, a red root and butt rot, was found in 57% of the 74 root rot sites examined (Table 7). An average of 13% of the trees in these stands had visible symptoms of root rot. The incidence of infection was based on the number of infected trees found along 100 to 200 meter strips at each site. Diseased trees were the only trees attacked by beetles in three - quarters of the areas where beetles were present. There is frequently a close correlation between the incidence of root rot, windfall, and spruce beetle population buildup. In addition, the long viability period of root rot organisms in stumps poses a problem in establishing a healthy stand in these sites.

TABLE 7. Distribution and incidence of *Polyporus tomentosus* root rot, Prince Rupert Forest Region, 1983.

TSA and Location	No. of Sites	% of Sites with *P. tomentosus*	% Incidence of *P. tomentosus*	Other rots present	% Sites with bark beetle
Lakes					
Pinkut Lk. Cross Cr.	8	50	7	*Haematostereum sanguinolentum*	12
South Bank Ootsa L.	5	40	12	*C. puteana*	0
Maxan L.	4	50	11		25
Morice					
Morice R. Owen L.	10	40	12	*H. abietinus*	80
Granisle Topley	3	33	15	*A. mellea* *C. puteana*	33
Houston Buck Cr.	5	60	16		0
Bulkley					
Chapman L. Babine Lk.	11	55	12	*A. mellea*	18
Telkwa McDonell Lk.	8	100	16	*H. sanguinolentum* *Hirschioporus abietinus*	75
Kitseguecla R.	1	100	20		100
Kispiox					
Suskwa R.	3	0	0	*A. mellea* *P. balsameus* *C. puteana*	67
Kispiox R.	5	60	15	*Polyporus sulphureus* *P. schweinitzii*	100
Lower Bulkley R.	6	50	22		33
Skeena R. Babine R.	5	100	13		40
SUMMARY	74	57	13		41

Spruce aphid, Elatobium abietinum

Spruce aphid defoliation of Sitka spruce was apparent again this year on the Queen Charlotte Islands and the coastal mainland in and around Prince Rupert. This pest remained at low levels in the Prince Rupert area, ornamental spruce sustained the only noticeable defoliation. Populations have increased slightly on the Queen Charlotte Islands causing light to moderate defoliation. The majority of damage was located on the north and east coasts of both Graham and Moresby Islands. Light defoliation of plantation Sitka spruce occurred as far as 10 km inland.

The prediction made last year, that 25% of the severely defoliated Sitka spruce would die, proved to be accurate. A permanent plot of mature trees established in 1982 at Miller Creek indicated that 20% tree mortality resulted from six successive years of aphid feeding. This figure would have been higher if smaller diameter trees had been included in the plot. The average dbh of the trees in this plot was 60 cm. A 1982 cruise indicated that mortality ranged from 48% of the trees less than 30 cm dbh to 7% of the trees over 51 cm dbh.

Population levels of this aphid appear to be directly related to the severity of the preceding winter. Populations will increase if the 1983-84 winter is a mild one. An insecticidal soap can be utilized to control the aphid on ornamental trees.

Cone and Seed Pests

Cone and seed pests destroyed 71% of the white spruce seeds in the seven areas examined (Table 8). An average of 27% of the cones were unaffected by insect feeding. When combined with rust, Chrysomyxa pirolata, damage (avg. 3%) the healthiest cones were in the Kispiox drainage where 43% of the cones were healthy. The least healthy cone crops were in the Pinkut Lake area where only 4% of the cones were unaffected. The major pests causing seed loss were Hylema sp., a spiral cone borer, (present in 56% of the cones) and Cydia sp., a spruce seed moth, (present in 26% of the cones). The increased levels of damage followed a moderate cone crop in 1982 during which the insect populations increased and led to a greater percentage of damage to the light 1983 cone crop.

Pests in Sitka spruce cones destroyed an average of 40% of the seeds, and caused damage to 50% of the cones (Table 8). Hylema sp., Cydia sp., and Choristoneura sp. were the most damaging insects. The maximum degree of cone rust, C. pirolata, infection was 6% at Shames River. Cone crop size was generally moderate to heavy.

TABLE 8. Percent of spruce cones infested by major pests. Prince Rupert Forest Region, 1983.

Location	Insect free		Hylema sp.		Cydia sp.		Choristoneura sp.		Rust
	cones	seeds	cones	seeds	cones	seeds	cones	seeds	
Nilkitkwa Lk. (wS)	30	32	65	53	15	15	0	0	3
Kispiox R. (wS)	50	44	50	55	0	0	0	0	7
Skins Lk. (wS)	15	16	65	55	55	27	0	0	0
Morice R. (wS)	30[1]	40	30	33	35	25	0	0	0
Telkwa R. (wS)	20	22	80	76	5	2	0	0	5
Smithers Ldg. (wS)	35	29	45	56	15	6	0	0	0
Pinkut Lk. (wS)	10	18	55	46	60	35	0	0	6
Average (wS)	27	29	56	53	26	16	0	0	3
Lava Beds (sS)	50	51	50	49	0	0	0	0	0
Terrace (sS)	35[2]	54	26	16	25	10	25	18	2
Shames R. (sS)	57[3]	74	25	17	3	3	6	2	6
AVERAGE (sS)	47	60	34	27	9	4	10	7	3

[1]Plus 5% with no seeds.
[2]Plus 2% with no seeds due to rust.
[3]Plus 6% with no seeds due to rust and no seed development.

Spruce Terminal Damage

The failure of spruce terminal buds to flush and develop is a widespread condition in the Region. On the Queen Charlotte Islands an estimated 10% of 10-30-year old Sitka spruce exhibited no new leader growth for 1983. This damage was not restricted to any particular stand or site; 5% of the leaders had started to grow then turned red and became bent over. These symptoms were very similar to spruce weevil damage, but no insect larvae or damage were visible. The majority of the terminal buds were killed before leader growth started. No insect damage was found in these dead buds. Lateral buds on 20% of the examined trees were defoliated by Zeiraphera sp., but this damage was not evident in the terminal buds. The fungus Acremonium sp. has been cultured from some of the dead buds, but it is not known if this fungus is capable of killing buds. The cause of the bud mortality remains unknown. Damage appraisal surveys will continue with examination starting in the early spring.

In the Kispiox and Suskwa river areas similar terminal failure persisted in 10-15 year old spruce plantations. Five to ten percent of the terminal buds were either dead or displaying only initial flush with no longitudinal growth. The mortality has been attributed to climatic injury caused by alternating freezing and thawing during the spring.

A spruce budmoth, Zeiraphera sp.

Damage by this pest was common on Sitka spruce throughout the Queen Charlotte Islands. The defoliation was restricted to lateral and terminal buds on trees of all ages. At Tow Hill 80% of the buds were destroyed on 50 scattered semimature Sitka spruce over a 20 ha area. This pest has been a persistent defoliator of Sitka spruce for 25 years on the Islands, with population levels remaining low.

A spruce foliage rust, Chrysomyxa weirii

The needle rust, Chrysomyxa weirii was the only commonly encountered foliage disease of spruce in 1983. Plantations at Guess Creek and Telkwa River had an average of 30% of the 1982 foliage infected on 20 and 80% of the trees respectively. The lower third of the trees were the most severely infected. Infection during the previous years had caused 100% loss of pre 1983 foliage in the plantation at Telkwa River. Robinson Creek has been a chronic infection area for several years. In 1983, 50% of the 1982 foliage was infected on 30% of all age class trees.

This rust directly infects new spruce foliage during the spring with no alternate hosts required. Consecutive years of severe defoliation reduces growth. This rust does not have a history of causing repeated severe defoliation in British Columbia. However, at both the Robinson Creek and the Telkwa River areas, intensity of infection has increased over the past three years.

A spruce gall aphid, Pineus sp.

Damage to new shoots caused by Pineus sp. decreased an average of 25% from 1982 levels. Five young spruce plantations from Guess Creek to the Kispiox River were examined. Damage ranged from 1% of the trees with 25% of the shoots damaged at Natlin Creek to 15% of the trees with 40% of the shoots damaged at Blunt Creek. The most severely attacked trees are usually small trees growing in open conditions in recently burned sites. The shoots of vigorous growing trees are usually not killed. Shoot and tree deformation can be severe on poor sites.

PINE PESTS

Mountain pine beetle, Dendroctonus ponderosae

An estimated 961 000 recently killed lodgepole pine (769 000 m^3) were mapped over 13 300 ha in the Region in 1983. This represents a threefold increase in the number of trees and volume, and double the area of 1982. Direct comparisons to 1982 within TSA's are not attempted due to 1983 data originating from the BCMF rather than CFS-FIDS.[1] However, some general comments of areas and trends are mentioned within TSA's.

TABLE 9. Area and volume of lodgepole pine recently killed by mountain pine beetle. Prince Rupert Forest Region, 1983.

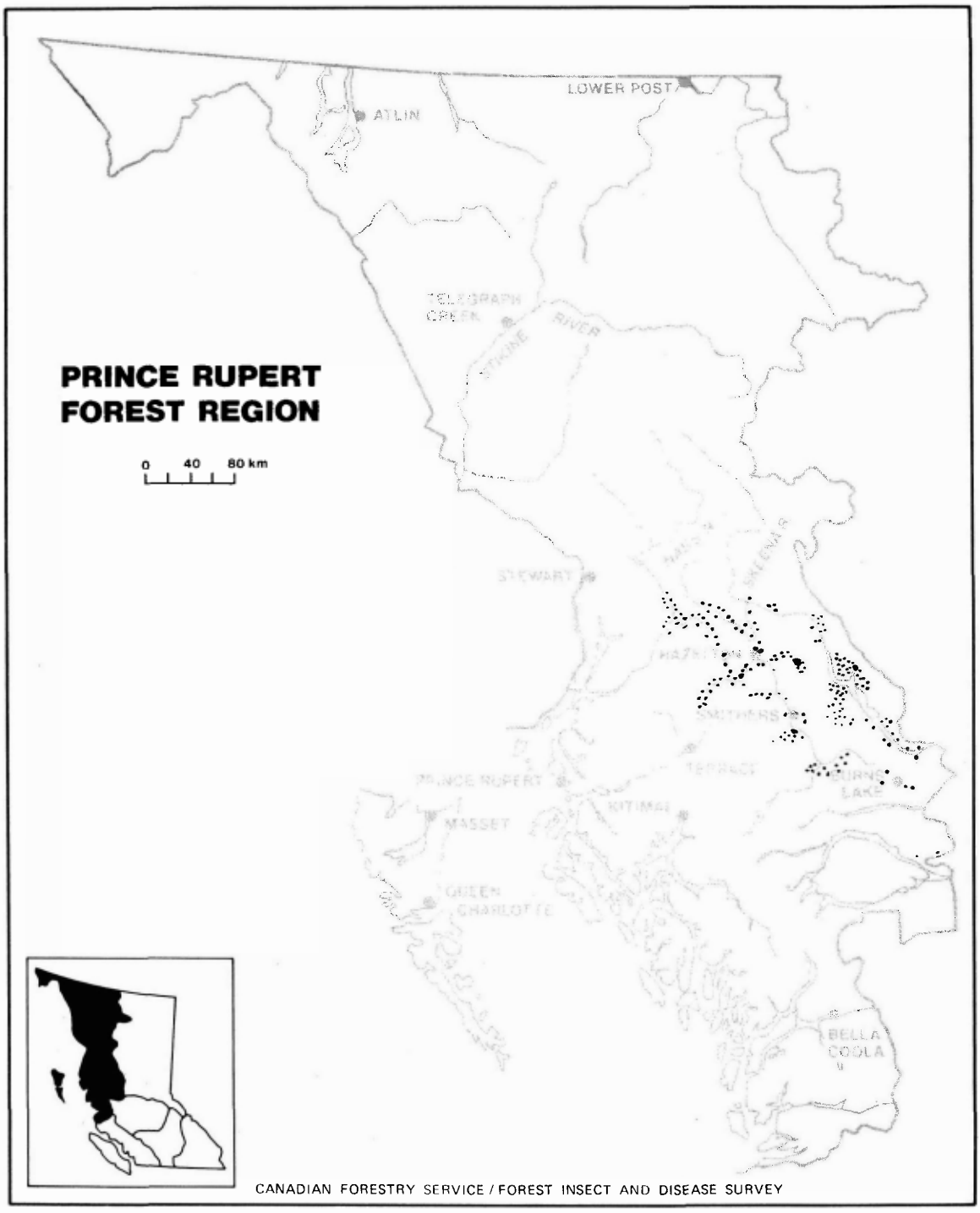
Location (TSA)	Area (ha)[1]	Volume (m^3)
Lakes	1 800	83 000
Morice	3 900	179 000
Bulkley	3 300	304 000
Kispiox	1 500	71 000
Kalum	2 800	132 000
TOTALS	13 300	769 000

In the Lakes TSA the main infestations continued to expand in the Babine Lake area, centering around Fleming Creek. Additionally, several new infestations were mapped along the southern end of Babine Lake. South of Francois Lake, small patches of discolored lodgepole pine persisted with very limited expansion. To the southeast in the Cariboo Forest Region, tree mortality has been spreading rapidly northward along the Dean River near Tweedsmuir Park towards the Lakes TSA.

In the Morice TSA, major beetle expansion continued in the Fulton-Babine-Morrison lakes area. Small pockets of beetle killed trees were evenly distributed from the northern end of Morrison Lake south to Fulton Lake. Beetle populations have been building in this area since 1979 when 125 ha were mapped near Morrison Lake.

In the Bulkley TSA, the most concentrated beetle activity continues in the Harold Price Creek area. New attacks that persisted within the older areas of the infestation were coupled with a major spread up the steeper side slopes. A more gradual increase to the east

[1]All area figures are those provided by the BCMF. Volumes and number of trees are calculated by applying CFS-FIDS cruise data to the provided area figures.



Map 4

Mountain Pine Beetle

Areas of recently killed lodgepole pine as determined by aerial surveys, 1983

and south was being tempered by logging. The number of small pockets of red trees continues to increase north of Nilkitkwa Lake, at Tsezakwa Creek and at Smithers Landing. Similarly the number and size of infestations are modestly increasing in the Telkwa River area, in the Trout Creek area and in the Bulkley River Valley between Reiseter and Sharpe creeks.

In the Kispiox TSA the area with beetle-killed trees decreased slightly. Localized host depletion within the older portions of the infestation in the Kispiox, Suskwa, and Skeena river drainages is beginning to reflect in the smaller area figures.

In the Kalum TSA the beetle activity increased within and adjacent to previously infested areas along the Cranberry-Nass rivers, south of Vandyke. However, some of the large increase in area is due to more general mapping techniques.

Cruise strips were run along the advancing edge of infestations at six locations to determine the degree of current attack. The average current attack was reduced from 1982 by 7% (35 to 28%).

Major increases of current attack were most notable in the numerous small pockets of beetle activity in the Babine-Fulton lakes area. Numbers of current attacks equalled the number of all previously killed trees. Several climatically favourable years have allowed populations to increase dramatically in the area.

Broods in all areas examined continued to display overlapping life cycles. Early fall attacks were common, however they usually resulted in small broods. The same trees are often reattacked the following spring and summer. Due to the initial attack frequently occurring the previous fall, red trees commonly contained late instar larvae and adults.

Initial parent galleries with or without eggs constituted 72% of the 1983 attacks on trees which had not been previously attacked (green trees). The remaining green attacked trees contained by the fall, primarily early instar larvae. In 58% of the trees which were red in the fall, progeny had developed to the adult stage, and will be ready to fly during the first warm period next spring.

TABLE 10. Status of lodgepole pine in stands infested by mountain pine beetle. Prince Rupert Forest Region, 1983.

Location	Percentage of stems attacked					Healthy
	1983	1983 partial	1983 pitchout	1982	Prior to 1982	
Fulton L.	23	8	2	12	12	43
Harold Price Cr.	36	3	0	38	5	18
Telkwa	31	1	2	27	18	21
Kispiox	36	4	3	22	7	28
Kitwanga/Hazelton	17	-	4	6	3	70
Cranberry Jct.	25	-	13	3	2	57

N.B. The 1983 attacks are those attacks which are on trees still green during fall surveys. Trees initially attacked during the fall of 1982 and reattacked during 1983 are included under the 1982 attack column.

Root collar weevil, Hylobius sp.

Root collar weevils continued to cause young tree mortality. Overall damage was generally less than 5%. However, tree mortality increased along the edges of plantations adjacent to mature pine stands in unburned or poorly burned portions of the plantation, and in mechanically prepared sites (Table 11).

TABLE 11. Percent of trees killed by root collar weevil, Prince Rupert Forest Region, 1983.

Location	Adjacent to mature stands		Centre of plantation	
	Burned	Not Burned	Burned	Not Burned
McBride Lk.	8	8	0	3
Palling	-	7	-	4

All trees within a 1000 by 5 meter strip were tallied in each category at each location. This does not include trees that were attacked but only partially girdled. The greatest damage occurred within 6 m of the edge and decreased further into the plantation. The attacks annually move further towards the plantation centre. The spread has been followed in a 13 year old plantation near McBride Lake since 1981, when ten currently attacked trees were marked. Re-examination in the fall of 1983 indicated that an average of two 1983 attacks had occurred within a 10 meter radius of each previously marked tree.

Pine engraver beetle, Ips pini, and Lodgepole pine beetle, Dendroctonus murrayanae

West of Kitwanga, 25 young lodgepole pine were killed over 2 ha due to population buildup in windfall along the edge of the stand. In

the Francois Lake-Nadina main area scattered small groups of two to five lodgepole pine were killed. Tree mortality has been present during the past three years but at a static to declining level, mortality usually continues for no more than one or two years.

Populations of this pest can build up very rapidly in slash. Large numbers of beetles will kill adjacent trees on poor sites or stressed trees.

Ambrosia beetle, Trypodendron lineatum

Ambrosia beetles normally found in felled timber and log decks were found in 20 mature lodgepole pine over 1 ha at 15 km of the Skeena Crossing road. As no other causal agents were observed it was assumed that this usually secondary pest was the principal cause of this mortality. Timely removal of logs is needed to ensure that populations have no chance of increasing to levels where they attack living trees. The population and corresponding tree mortality could increase in this area next year.

Comandra blister rust, Cronartium comandrae

The rust canker of lodgepole pine caused an average of 9% tree mortality in seven young plantations where rust was present. Mortality is rapid after infection. In a 12 year old plantation near Division Lake, 10 plots were established in 1981. The incidence of infection in the area increased by 12% during the two-year period (from 47 to 59%). Of the 40 trees with a stem infection in 1981, 45% were dead by the fall of 1983. In addition, 11 trees which had no external signs of infection were dead by 1983 due to C. comandrae. This is a severely infected plantation, but it illustrates the damage potential of the disease when host and climatic conditions are favourable.

Western gall rust, Endocronartium harknessii

Of 15 young pine stands examined 8 had major stem cankers present on an average of 14% of the trees. The effect of this rust on a young spaced stand near Ootsa Lake was documented annually since 1981. Infected trees with at least one major stem gall had a smaller average dbh of 5%, shorter average height of 4% and less volume (14%) than non-infected trees. In addition, 2% of the trees had been killed due to breakage at the point of infection. Spacing programs can be a factor influencing incidence of infection. When severely infected trees are not removed during spacing the infection will spread, since this rust favours healthy, fast growing trees.

Two pathogens, Fusarium eateritium and Nectria fuckeliana were isolated from galls gathered at Diana Lake Park. These uncommon hyperparasites are capable of reducing aeciospore production in western gall rust.

Lodgepole needle miner, Coleotechnites sp.

Light defoliation of current years needles of lodgepole pine continued, between Km 24-25 along the Topley Landing Highway, for the fourth consecutive year. An average of 40% of the terminal and upper whorl foliage was defoliated. Trace needle mining was also present in 10-15 year old plantations near McBride Lake.

In a recently spaced young stand along the Topley Landing Highway terminal mortality had occurred on 25% of the trees remaining. Tree quality will be greatly reduced as multiple leaders develop and fungal invasions occur.

Coleotechnites sp. have caused extensive tree mortality in the northwestern United States. However, in Canada only occasional tree mortality has been recorded in the Canadian Rockies. Temperature appears to be the major limiting factor of infestation severity and longevity. Severe larval mortality occurs when winter lows of -40 C persist for several days.

Pine sawfly, Neodiprion sp.

Extensive defoliation of shore pine occurred over 5 ha at Nadu Creek on Graham Island in the Queen Charlottes. Damage was most noticeable on 5-15 year old pine which suffered 80% defoliation, older trees exhibited only light defoliation. In 1976, over 92 000 ha of shore pine were defoliated by this pest. The Queen Charlotte Islands lack any large stands of shore pine, consequently this sawfly is not of economic importantance. Mortality is not expected to result from this year's defoliation.

Atropellis canker, Atropellis piniphila

Stem cankers on lodgepole pine caused by this fungus are common in most pine stands in the Region. In two spaced stands north of Burns Lake, 9 and 18% of the trees had major stem infections. The latter stand was 'cat' spaced, which doesn't allow for specific tree selection and removal of diseased trees. The rapid spread of this fungus is encouraged within dense fire origin stands. Spacing could reduce spread of the disease, but infected residuals will be of little value for sawlogs.

Foliage Diseases

Several needle diseases discolored lodgepole pine needles in stands between Forestdale and the eastern regional boundary. Lophodermella concolor was present through most of these stands. Several patches of up to 300 ha were moderately infected near Hicks Hill. Infection destroyed 75% of the 1982 foliage on 60% of the trees. Other foliar diseases present were Scirrhi pini and Lophodermium pinastri.

The former is the most virulent and has the greatest damage potential, since it infects all foliage ages. L. pinastri is primarily a secondary fungus. Further infection is dependent upon climatic conditions during spore release. Spore release periods during mid summer for L. concolor and through much of the spring and summer for S. pini, were favourable for an increased severity of infection for 1984.

Pinewood nematode, Burcephelenchus lignicolus

A total of 9 samples from chlorotic lodgepole pine trees were submitted for determination of nematode presence. All samples proved to be negative. This nematode which causes tree mortality in Japan and Europe and has recently been identified in Manitoba and in the United States. Transfer between trees has been associated with woodborers such as Monochamus sp.

HEMLOCK PESTS

Hemlock sawfly, Neodiprion sp.

Populations increased significantly in the Luno Creek to Kispiox River area near Hazelton and at Yakoun Lake and Alliford Bay on the Queen Charlotte Islands. In the Luno Creek to Kispiox River area the number of larvae in three tree beatings averaged 377, up from the 219 average in 1982. The major increase occurred in the Luno Creek (1003 from 280) and Dennison Creek (635 from 255) areas. Defoliation was restricted to the old needles on understory and on lower branches of overstory trees. Very high numbers of larvae ($\pm$1000 larvae) are required to cause extensive defoliation. Parasites normally prevents long term epidemics.

Light defoliation was evident at Yakoun Lake on Graham Island and at Alliford Bay on Moresby Island. Damage was limited to 5% of the branch tips. Three tree beating samples at several locations on the islands contained 150 - 250 larvae. The numbers indicate a possible infestation developing next year, which could result in hemlock mortality such as occurred in 1931.

Porcupine Damage

The BCMF in Prince Rupert consider this rodent to be the major pest in the District. Second growth 30 year old western hemlock in Khutzeymateen Inlet northwest of Prince Rupert were severely damaged with an estimated 880 ha of mortality. Portland Canal and Bitter Creek areas account for an additional 520 ha of tree mortality. In previous years, porcupines on the coastal regions of Prince Rupert have restricted their feeding to western hemlock and shore pine. Reports this year of immature spruce being killed by porcupines has resulted in

a much closer examination of this pest, as spruce is the desirable species for planting in this area. BCMF and the Provincial Fish & Wildlife are working together to establish a control program. The importation of a natural predator seems to hold the greatest promise.

Sawyer beetle, Monochamus oregonensis

Extensive damage was caused by this pest at Luno Creek east of Hazelton. Western hemlock, lodgepole pine, alpine fir and white spruce had been felled and bucked over a 10 ha area and then left for over a year. Balsam was the most heavily attacked of all the species. Wood that was cut in the winter of 1983 was attacked in the summer by beetles emerging from logs cut in 1981. The damage was so extensive that the wood could only be used for pulp.

Logs should be removed from the cut block as soon after cutting as possible to ensure that they are not attacked. Trees cut after June may be attacked immediately.

Ips beetle and small populations of balsam bark beetle are also evident throughout this area in windblown alpine fir at the edges of the cut block.

Ambrosia beetle, Trypodendron lineatum

This beetle has extensively damaged felled and bucked western hemlock and red cedar at three locations on the Queen Charlotte Islands. The timber on two recently logged sites on Graham Island was heavily infested with ambrosia beetle. Each site covered approximately 10 ha; one on the northwest side of the lake and the other on the southeast. Company foresters indicated that the beetle flight was large this year and claimed that a majority of their felled and bucked was infested.

At Deena Creek, hemlock logs left on the ground for over a year were heavily infested with the beetle. In all cases these logs were to be stored in the ocean to prevent the emergence of beetles. Next year's population trend depends largely on the treatment of infested logs during the summer.

BALSAM PESTS

Balsam bark beetle, Dryocoetes confusus

Scattered fringe alpine fir were killed by the beetle for 2 km along the edge of a clear cut at 3 Km on the Kinskuch River Road. The beetles are not expected to cause any significant mortality or volume loss. As alpine fir is a minor component of the stand. Farther north

the alpine fir component increases and extensive damage could result if the beetle becomes established here.

Populations were also detected in windblown alpine fir at the edges of a cutblock at Luno Creek. Although standing timber was not yet attacked, populations could build up in the windthrow and attack standing trees.

Due to very limited aerial surveys, no area figures are available for 1983.

Blackheaded budworm, Acleris gloverana

The incidence of blackheaded budworm larvae in beating samples declined to 51% positive from 65% in 1983. The number of insects per collection decreased to 6 larvae from 23 in 1982. Populations persisted at low levels in the Morice River drainage (19 larvae per positive collection; 78% positive) and at Byman Creek (65 larvae). Both areas were lightly defoliated over 150 ha in 1982, but no defoliation was evident in 1983.

Needle Diseases

Foliar rusts of alpine fir were common along the southern end of Babine Lake. Light infection by Pucciniastrum epilobii was present in most stands. Infection of understory reached 95% in the Pinkut Creek, Helene Lake, and Granisle areas. At the latter location Melampsora abieti-capraeium reached severe intensity on 70% of the trees. Both rusts infected the current year's foliage resulting in 90% ± loss of 1983 foliage. Infection of alpine fir by basidiospores from the respective alternate hosts (fireweed and willow) was favoured by damp weather shortly after bud burst.

DOUGLAS-FIR PESTS

A budworm, Choristoneura orae

A 1982 Douglas-fir plantation trial covering 6 ha at Chist Creek was lightly defoliated by spruce budworm. Budworm infested 30% of the three-year old seedlings with the majority of the defoliation to the terminal buds. Douglas-fir is not the principal host of C. orae, which was identified as the budworm species in this area. Damage is expected to continue next year, based on the lack of diseased insects and the general increase in populations throughout the area.

Foliage Pests

An average of 20% (up to 70%) of the current year's foliage was lightly to moderately infected by the needle disease Melampsora medusae

in a Douglas-fir plantation north of Houston. This disease will also severely damage young pine and spruce when infection sources are plentiful and climatic conditions are favourable for infection. The 1983 foliage was also affected by Cooley spruce gall aphid, Adelges cooleyii, feeding. The two pests combined damaged 90% of the current foliage on 10% of the trees. Both pests require an alternate host to complete their life cycle, M. medusae on trembling aspen and A. cooleyii on spruce.

Douglas-fir beetle, Dendroctonus pseudotsugae

Scattered individual mature Douglas-fir trees were attacked by Douglas-fir beetles in the Pinkut Creek area. Only five prior collections have been recorded in the Babine Lake area; the most recent being in 1969. This beetle favours windfall and stressed mature trees, but attacks healthy trees as populations increase.

CEDAR PESTS

Cedar bark beetle, Phloeosinus punctatus

This beetle has killed 20 western red cedar from 10 to 100 years old over a 1 ha location 1 km south of Yakoun River. The trees were growing on a poor site making them more susceptible to attack by Phloeosinus spp. The Queen Charlotte Islands have numerous poor sites supporting cedar stands so the possibility of more extensive damage exists. This beetle was responsible for mortality of a small pocket of cedar last year at Phantom Creek.

DECIDUOUS TREE PESTS

Forest tent caterpillar, Malacosoma disstria

In the interior portion of the Region, forest tent caterpillar populations increased in 1983, the first significant defoliation in the Bulkley Valley since the 1961-65 infestation. In the Kispiox Valley south to Hazelton, and near Moricetown, patches of two to ten hectares were moderately to severely defoliated in 1983. Egg mass counts in both areas indicate a rapidly increasing population for 1984. At Moricetown the new to old egg mass ratio was 45 to 1, while at Kispiox the ratio was 4 to 1. There was no evidence of a natural control agent.

Western tent caterpillar, Malacosoma californicum pluviale

The white tents of this pest were prevalent throughout the western portion of the Region. A previously unrecorded infestation was located at Dahl Creek, northwest of Kitimat. Up to 100% defoliation has occurred on red alder over 50 ha, between 7 Km-10 Km of the Dahl Creek mainline.

A three-year old infestation at Meziadin Lake has spread north to Cousins Creek and west into the town of Stewart. Parasites and/or a virus controlled the infestation at Meziadin Lake. Dead and dying larvae were evident on 80% of the tents. Further to the south at Hanna Main no such controls were in effect, as 100% of the roadside willow is 10 - 100% defoliated with tents spreading to the alder and smaller conifers. Black cottonwood was 100% defoliated over 10 ha at Cousins Creek. Population trends are difficult to predict as over 40 different parasites attack this defoliator, some attacking the eggs, some the larvae and others the cocoons.

Poplar and willow borer, Cryptorhynchus lapathi

The willow borer caused extensive mortality of willow over a large area of the West Prince Rupert District. Numerous complaints were received from residents in Terrace and Kitimat who had weevil attacked willow in their yards. The damage was most evident along roadways and old cutblocks from Kitimat north to Cranberry Junction and west to Prince Rupert. Of little economic importance, the weevil can be controlled by cutting and burning of attacked trees or application of a recommended insecticide.

Poplar shoot blight, Venturia sp.

Trembling aspen was defoliated for the seventh consecutive year over widespread areas in the eastern portion of the Region. In 1983, mainly light infection was recorded from Trout Creek southeast to Francois and Ootsa lakes. Moderate infection occurred in localized areas along the Trout Creek, Telkwa Hi Road, Goathorn Creek, Hungry Hill, Topley Landing, Francois and Ootsa lakes. Moderate infection seldom occurs in the same clonal groups in successive years.

Alder sawfly, Hemichroa crocea

This sawfly skeletonized 15% of the leaves on alders over 2 ha at Yakoun Lake. Damage will be more severe later in the fall as this pest has two generations per year. Very little tree mortality has resulted from alder defoliation.

Birch leaf miner, Lyonetia spp.

This leaf miner destroyed 40% of the needles on 70% of the white birch over 100 ha at Echo Lake on the Stewart-Cassiar Highway. No mortality is expected but populations should remain high enough for continued defoliation in 1984.

EMPLOYMENT BRIDGING ASSISTANCE PROGRAM (EBAP)

Seven EBAP sites were examined in the Region to assess pest problems. Problems encountered were generally minor in nature. Some situations, however, provided favourable conditions for potential increase of specific pest problems. Brushing in young Sitka spruce stands encouraged spruce weevil. Physical scarring of leave trees encouraged decay and some diseased trees were left following spacing.

Pest Problems in EBAP Sites

Location	Tree Sp.	Type of Work	Remarks
Chist Cr.	sS	restocking	spruce budworm lightly defoliated 3-4 yr. seedlings
Lakelse Hot Springs	wH, wC	reduce fire hazard & cut firewood	physical scarring of trees
Kitimat R.	sS	spacing and brush control	opening Sitka spruce stand will favour spruce weevil
Kitsumkalum L.	lP	spacing	large amounts of lodgepole pine slash severely attacked by Ips pini creating potential threat to leave trees
Kalum Rd.	wH	spacing	opening of mistletoed stands encouraged more rapid development and spread
Suskwa R.	lP, wH, wS	spacing	fire scarred trees; low levels of Poria subacida present
Natlin Creek	sS	brushing	spruce weevil at low levels, Armillaria mellea root rot in association with Hylobius sp. causing tree mortality

NOT SUFFICIENTLY RESTOCKED (NSR)

Not sufficiently restocked areas were examined at 15 sites in the Region for potential problems that would be encountered during re-establishment to productive forest stands. The major problem was deciduous brush which has over-run many open sites. Control in the western areas of the region would be essential before restocking these sites. Further problems exist in the form of root rots (Polyporus tomentosus in spruce sites) which persist in the stumps for up to 40 years. Identification of these spots within the sites is essential if susceptible species are to be planted. Alternatively, sites permitting, resistant tree species could be planted. In the most severely infected areas retention of the nonsusceptible deciduous growth may be the best long term choice in order to eliminate the disease problem.

In the 11 interior sites, brush is much less of a problem and in most areas no control action is necessary. Burning while destroying brush encourages other pest problems, e.g. black army cutworm. However, other pests may be more prevalent, such as stalactiform rust in areas where the alternate host, Indian paint brush, has become firmly established.

Pest problems in NSR sites

Problem	Locations
Brush competition	End Lake, Humphrys Creek, Kleanza Creek Kispiox River (3 areas)
Browse damage	Kleanza Creek
Root rots Armillaria mellea Polyporus tomentosus	Kispiox River
No major problems	Gramophone Creek, Morice River, Parrott Lake, Goosely Lake, McKillegan Lake, Maxan Lake, Pinkut Lake.

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