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Forest Pest Conditions in the Pacific and Yukon Region

A Mid-Season Summary

C.S. Wood and G.A. Van Sickle

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Canadian Forestry Service
Forest Insect and Disease Survey
Pacific Forestry Centre
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SUMMARY

The status of currently active major forest pests up to late July are highlighted. A more complete report including maps of infestations will be completed later in 1988 following completion of aerial and late summer and fall ground surveys.

Following drier than normal summers and mild winters, the most noticeable **CLIMATE IMPACT** has been premature mortality of mainly immature conifers on the southeastern coastal area of Vancouver Island, the Gulf Islands, the Sunshine Coast and dry sites along roads and highways in the southern interior some in association with road salting.

MOUNTAIN PINE BEETLE populations in perennially infested mature lodgepole pine stands in five forest regions overwintered successfully and threatened large areas of susceptible pine. Populations in the Cariboo Forest Region remain at their lowest levels since 1972, apart from a localized infestation over 500 ha near remote Chilko Lake. **PINE ENGRAVER BEETLE** populations were common in high numbers in parts of the Nelson Region but declined in the Cariboo Region, and **WESTERN PINE BEETLE** populations increased in ponderosa pine in both regions. Numbers of **PINE NEEDLE SHEATHMINER** declined in the Kamloops, Nelson and Vancouver regions where populations had infested and prematurely defoliated lodgepole pine for up to four consecutive years. Infection of 1-year-old needles of lodgepole, white and ponderosa pines in the southern half of British Columbia by **NEEDLE DISEASES** increased due to wet weather this spring.

New flush of Douglas-fir in parts of the Kamloops, Cariboo, Nelson and Vancouver forest regions were again defoliated by **WESTERN SPRUCE BUDWORM**, but generally less severely and extensively than in 1987, except near Pemberton. **DOUGLAS-FIR TUSSOCK MOTH** populations remain low following increased numbers of male adults caught in pheromone-baited sticky traps in the north Okanagan in 1987. **DOUGLAS-FIR BEETLE** attacks were again active, killing pockets of mature Douglas-fir in the Fraser River drainage in the Cariboo and Vancouver regions. Infection of Douglas-fir by **ARMILLARIA ROOT DISEASE** continues to be common in parts of the eastern area of the Nelson Region.

SPRUCE BEETLE populations have declined for the seventh consecutive year but populations occur in isolated pockets in parts of the Nelson and Prince Rupert regions. New growth of young Sitka spruce in the western part of the Prince Rupert Region were damaged by **BUD INSECTS** for the second consecutive year.

Current year's needles of alpine fir and spruce were defoliated by **EASTERN SPRUCE BUDWORM** in the Fort Nelson and Liard River areas in northeastern British Columbia, some for the fourth consecutive year. Mature **2-YEAR-CYCLE BUDWORM** were active in new buds in parts of the Cariboo, Nelson and Prince George regions but defoliation was light. There has been no further expansion of the **BALSAM WOOLLY APHID** infestation recorded in 1987 on West Thurlow Island. This was significantly north of the established quarantine and infestation zones which are currently under review.

Defoliation of western hemlock by **WESTERN BLACKHEADED BUDWORM** and **HEMLOCK SAWFLY** in coastal areas of the Queen Charlotte Islands is forecast to continue, but less severely and less extensively than in 1987. **WESTERN HEMLOCK LOOPER** populations on the west side of Jervis Inlet in the Vancouver Region will be assessed later in the season.

LARCH CASEBEARER populations are generally endemic in western larch in the Nelson and Kamloops regions with isolated pockets of moderate defoliation, similar to 1987. Very light damage to western larch by **LARCH BUDMOTH** at Johnson Creek in the Nelson Region indicates continuing populations; low endemic populations occur elsewhere in West Kootenays. Discoloration of larch foliage by **NEEDLE DISEASES** was less conspicuous and extensive than in the previous two years.

Active **BLACK ARMY CUTWORM** populations caused variable degrees of defoliation to conifer seedlings and ground cover in parts of the Cariboo, Kamloops, Nelson, Prince George and Prince Rupert regions.

Recently planted conifer seedlings damaged by **VOLES** were numerous in the western part of the Prince Rupert Region; **HARES** were also common. **RODENTS** severely damaged immature spaced lodgepole pine in the Cariboo Region.

FOREST TENT CATERPILLAR defoliated deciduous trees and shrubs in parts of the Cariboo, Kamloops, Nelson and Prince George regions. **WESTERN TENT CATERPILLAR** is common in the Okanagan Valley and East and West Kootenay but declined to endemic levels in southwestern British Columbia following seven consecutive years of activity. Localized **GYPSY MOTH** populations at Colwood and Parksville on Vancouver Island, and near Kelowna, were treated to prevent spread, part of the cooperative interagency quarantine-related program. Poplars over about 150 ha east of Chilliwack were severely defoliated by **SATIN MOTH**. **WESTERN WINTER MOTH** defoliated understory maples in the Skagit River and Fraser Canyon areas and in the North Thompson River Valley in the Kamloops Region, some for the second consecutive year. **LEAF MINERS** severely discolored birch in the northern part of the Nelson Region, in some areas for the fourteenth consecutive year. Infection of Pacific dogwood by **LEAF BLIGHT** increased in southwestern B.C.

More detailed reports and forecasts will be available later when surveys are concluded and data analyzed, including aerial surveys of defoliators, bark beetles and other pests, pests of young stands, cone and seed orchard pests, pinewood nematode vector survey and evaluation of European pine shoot moth pheromones, pheromone-baited trap catches, defoliator egg surveys, and acid rain plot assessments.

PINE PESTS

Mountain pine beetle
Dendroctonus ponderosae

Sufficiently high numbers of mountain pine beetle broods were present in previously infested mature lodgepole pine stands in all six regions, to result in tree mortality similar in area and volume killed in 1987, the lowest level in 7 years.

Continuing populations are forecast at 42 locations in 6 forest regions based on the ratio of progeny to parent beetles ('R' value). The regional 'R' values ranged from 2 to 7.5 with most (75%) greater than 4.1 which indicates generally increasing populations. In the western part of the Prince Rupert Region and near Pemberton in the Vancouver Region static and declining populations, respectively, should result in reduced numbers of 1988-attacked lodgepole pine.

The highest average regional 'R' value was in the Kamloops Forest Region at 7.5 (range 0-37) in 9 active infestations mostly in the Okanagan TSA east of Kelowna. West of the Okanagan Valley, population assessments by CFS bark beetle specialists indicate a similar trend. In the Lillooet TSA, beetle broods in spot infestations west of the Fraser River are expected to decline for the third consecutive year.

Generally increasing populations are forecast in most beetle-infested stands in the Nelson Region, where the average 'R' value of 6.9 (range 0-13.6) in 17 areas was similar to 1987. Most of the increases are forecast in the Boundary and Cranbrook TSAs, and generally static populations in the Invermere TSA. Engraver and ambrosia beetles are again common in active infestations where recent logging slash has accumulated.

In nine active infestations in the western part of the Prince Rupert Region values averaged 3.7 (range 0.5-6.3), similar to 1987, indicating generally static populations. At Coyote Creek near Sideslip Lake and Cranberry Junction areas 'R' factors were slightly higher than average (5.7) indicating increasing populations. Host depletion in the Skeena River Valley is extensive; in Terrace area winter 'cut and burn' operations were implemented. In the eastern part of the Prince Rupert Region, 'R' values declined to an average of 5.3 down from 7.9 in 1987, but still indicating increasing populations. Highest levels were in the Morice and Bulkley TSAs at Tochcha Lake, Trout Creek and on the Telkwa Road; 10.5, 8.4 and 5.0, respectively.

Populations in the Middle River area in the Fort St. James TSA in the Prince George Region are forecast to increase slightly with a factor of 4.2. Assessment of other currently active infestations in the TSA was limited due to poor access conditions at the time.

Declining availability of mature pine stand types at Birkenhead Lake and Tenas Creek east of Pemberton in the Vancouver Region contributes to declining beetle populations in the area where the average 'R' factor was 2.0.

Pine mortality in the Cariboo Region remains at the lowest level since 1972. A mountain pine beetle infestation over about 500 ha near Chilko Lake is the only significant beetle activity in the region. The number of lodgepole pine infested by engraver beetles in the western part of the region declined significantly.

Western pine beetle, D. brevicomis populations killed an increased number of mature ponderosa pine in widely scattered pockets in the Boundary TSA in the Nelson Forest Region and in the Lillooet TSA in the Kamloops Region.

Mature lodgepole pine in established and developing mountain pine beetle outbreaks attacked this year will be examined in September to determine the beetle's potential in 1989.

A pine needle sheathminer Zelleria hainbachi

Sheathminer populations in lodgepole pine stands in parts of the Kamloops, Nelson and Vancouver regions declined generally following 2-3 successive years of moderate to severe discoloration.

Two to 5% of the branches of lodgepole pine in three seed orchards in the north Okanagan Valley in the Kamloops Region were infested. Elsewhere in the region foliage discoloration of single and small groups of lodgepole pine occurred along roadsides in the Pritchard, Mt. Lolo and Mt. Todd areas. Defoliation did not occur where populations in 1987 killed new shoots of immature pine over at least 500 ha near Salmon Arm, near Chase, from Birch Island to McMurphy, and near Gold Bridge.

Populations declined slightly overall in the Nelson Region. At Gibbs Creek in the West Kootenay, however, current foliage of lodgepole pine was moderately defoliated over about 200 ha, and roadside pine for 12 km along Highway 3 near Greenwood were lightly defoliated. Between 10-20% of the foliage on leaders of 10% of the young lodgepole pine over 200 ha at Driftwood Creek near Spillimacheen was destroyed. There was no evidence, however, of sheathminer activity in young pine stands between Cranbrook and Yahk this year, following two successive years of defoliation.

Defoliation of pine regeneration in the Vancouver Region was light near Squamish, but declined to less than 10% of the new shoots on about a third of the trees on the east side of Lillooet Lake, near Pemberton and Keefers. One and 10% of the shoots on 20% and 80% of the pine near Harrison Lake and Boston Bar, respectively, were infested. None was visible on Vancouver Island.

Pine needle diseases
Dothistroma pini
Elytroderma deformans
Lophodermella concolor

Infection of year-old needles of lodgepole, ponderosa and white pines by native needle diseases was common for the second consecutive year in parts of the Nelson, Kamloops and Prince George regions and Yukon Territory, and increased in the Cariboo Region.

Severe (70-95%) infection of 1-year-old and older needles of lodgepole pine by Lophodermella needle disease was common in the southern part of the Cranbrook district in the Nelson Region, similar to conditions in 1987. Discolored 1-year-old needles infected by the needle disease were common also in lodgepole pine stands in the Kamloops Forest Region from near Manning Park to Gold Bridge, including the Okanagan Valley drainages. Infection averaged 45% of the older needles on about 40% of the trees in pockets up to 20 ha. At Summit Lake on the Alaska Highway in northern British Columbia, up to 5% of the needles on 20% of the lodgepole pine were infected. In the southern Yukon near Whitehorse, Tarfu Lake and the Atlin road, light infection (5%) of immature lodgepole pine, including a provenance trial, occurred.

Discoloration and brooming by Elytroderma needle disease was common in ponderosa pine stands in the Kamloops and Cariboo regions. Infections ranged from light to severe in patches, and over areas of several hundred hectares from Monte Lake to Gold Bridge, in the North Thompson River Valley, from Kelowna to Osoyoos and west of Princeton. Infection of lodgepole and ponderosa pine stands was widespread in the Cariboo Region. Discoloration up to 45% (average 35%), mostly of the lower crowns of most trees, occurred in 0.5-100-ha areas west of Williams Lake and in the 100 Mile House, Williams Lake and Clinton areas.

Infection of 1-year-old needles by Dothistroma needle disease on immature white pine in a long-term CFS-FIDS damage assessment plot at Summit Lake near New Denver declined. Consecutive years of infection have resulted in premature loss of all the needles in the lower crown and 5% in the upper crown. Increased infection of young western white pine by Dothistroma needle disease occurred between Shelter Bay and Revelstoke in the West Kootenay where 5-70% (average 30%) of the trees were infected, mostly in lower crowns on 2-year-old foliage. Infected white pine was less common south of Shelter Bay to Nakusp and in the Slocan Valley.

Pinewood nematode
Bursaphelenchus xylophilus

The nematode has been found in small numbers in British Columbia; however, it is not a conspicuous or damaging forest pest. To date, the 'm' or 'r' form has been extracted from three species of previously damaged or predisposed conifers or chip piles at 12 locations in 5 regions and in only 1 adult woodborer. Additional woodborers are being collected for examination this year, the sixth year of detection surveys for the nematode in B.C.

European pine shoot moth
Rhyacionia buoliana

Quarantine-related detection surveys of native and ornamental pines for the pine shoot moth throughout British Columbia found little change in its status. Only 4% of the current shoots of pine at Delta and East Vancouver have been infested. None has been found at Peace Arch, nor in native ponderosa pine at Keenleyside Dam in the West Kootenay. Pheromones from CFS, USDA, and industry are being evaluated in cooperative trials near Victoria, in the Fraser Valley and in the Okanagan Valley. Surveys for parasitoid determinations have been expanded and results will be available later this year.

Pine sawflies
Neodiprion spp.

Defoliation of about 20% of the needles on ponderosa pine by increased numbers of sawflies was common in older stands between Kamloops and Louis Creek. A similar increase occurred in Kalamalka Seed Orchard near Vernon, where 3-10 larvae/branch lightly defoliated most lodgepole pine over about 4 ha.

Pine blister rusts
Cronartium comandrae
C. coleosporioides

Stem infections on suppressed naturally regenerated lodgepole pine by Comandra blister rust, C. comandrae was prevalent in the Morice and Lakes TSAs in the Prince Rupert Region, but less common in the Bulkley and Kispiox TSAs. Rodent feeding around the edges of the infections was common. Stem cankers of stalactiform blister rust, C. coleosporioides, were up to 3 m long on about half of the intermediate lodgepole pine over 10 ha south of Hanceville in the Cariboo Region. About 2% of the pine were killed by infection and rodent girdling of the canker, which also was common on living trees, and attacks by pine engraver beetle, Ips pini.

DOUGLAS-FIR PESTS

Western spruce budworm
Choristoneura occidentalis

The area and intensity of defoliation by the budworm of Douglas-fir forests in the southern interior in 1988 is expected to be less than the 834 000 ha affected in 1987.

Surveys of 48 Douglas-fir stands in four forest regions in late May-early June determined that early-instar larvae infested an average of 25% of the buds, down slightly from 33% in 1987. Twenty buds on each of 5 trees were examined per location.

Most defoliation will occur in the Kamloops Region. Moderate defoliation (16-30% of the buds infested) is forecast at 44% of the sites, severe at 28%, and light at the remainder. Most severe sites are scattered throughout the Okanagan, at Botanie Valley near Lytton, and at Paul Lake near Kamloops. Light and moderate defoliation will be scattered throughout the region in previously defoliated stands with most west of Kamloops to Oregon Jack Creek and south of Cache Creek. Moderate defoliation will occur elsewhere, including the North Thompson River drainage south of Barriere.

Defoliation for the second consecutive year in the Cariboo Region is forecast to be light, but less extensive and mostly in the eastern part of the region and on Big Bar Mountain west of Clinton.

In the western part of the Nelson Region, defoliation of Douglas-fir is again expected to be light and moderate in the Boundary TSA from east of Anarchist Mountain to Bridesville and Rock Creek, including the Johnstone Creek area.

Douglas-fir stands near D'Arcy in the Vancouver Region are expected to be severely defoliated, as in 1987 when increased populations defoliated most new flush over 2850 ha in 13 areas in the Gates, Haylmore and Blackwater Creek drainages. Populations remain at endemic levels in the Fraser Canyon area.

Operational sprays by the B.C. Forest Service applied Bacillus thuringiensis over 2000 ha of budworm-infested Douglas-fir stands in the Kamloops Forest Region in the Lillooet, Kamloops, Clearwater, Salmon Arm and Armstrong districts and in the Rock Creek District of the Nelson Forest Region.

Results of the rearing for parasitism, adult trapping, egg mass counts and overwintering larval assessments to forecast population trends, and more detailed information on the extent and intensity of defoliation by the budworm from aerial surveys, will be reported later. Data from 12 plots established in three regions in 1987 were again collected as part of a long-term study to develop more reliable and accurate forecasting for budworm. Additional data are necessary, however, before numbers of larvae, adults, egg masses and defoliation can be correlated with population changes and damage.

Douglas-fir tussock moth
Ogyia pseudotsugata

Populations are forecast to increase this year based upon the increased number of male adults (387) trapped in 45 traps at 12 sites in 2 regions in 1987. The number of larvae in standard FIDS beating collections, however, remain low. Six pheromone-baited sticky traps, to monitor male moth populations, are located at each of 19 selected sites in the Kamloops and Nelson regions with a history of tussock moth infestations. Additional traps have been located near Kamloops and Kelowna to monitor the spread of male adult tussock moths, and enhance detection.

Douglas-fir beetle
Dendroctonus pseudotsugae

For the second consecutive year, widely scattered pockets of up to 15 mature Douglas-fir trees killed by Douglas-fir beetle occurred in the Fraser River drainage in the Cariboo and Vancouver regions and in the East Kootenay in the Nelson Region.

In the Cariboo Region most beetle-killed trees, in groups of 5-15, were along the west side of the Fraser River near Marguerite. Newly attacked trees were common near slash piles of Douglas-fir near Comer near Williams Lake. Small groups of 1-3 mature Douglas-fir killed by the beetle in the Fraser Canyon occurred between North Bend and Nahatlatch Lake; they were probably weakened by maturity and root disease in this area which has a long history of scattered beetle-related tree mortality. Groups of 2-15 standing beetle-killed Douglas-fir in Gold Creek in the Cranbrook TSA were associated with root disease and subsequently blown down and infested.

Armillaria root disease
Armillaria ostoyae

Armillaria root disease infected and killed mature Douglas-fir in mixed stands in several areas in the Rocky Mountain Trench in the Nelson Forest Region. At Cariboo Creek on Bush Arm, 10-15% of the mature trees over several hundred hectares have been recently killed; 25-30% mortality is common in small patches. At Sanca and Kidd creeks near Creston, 5-15% of the Douglas-fir were killed in pockets with larger centers around old stumps. In an undisturbed mixed stand in the Kootenay River Valley east of Canal Flats, 6% of the mature (100-year-old) Douglas-fir and western larch were infected and killed by the disease. There was no evidence of disease-infected trees in a 65-year-old selectively logged stand in the nearby Palliser River Valley.

SPRUCE PESTS

Spruce beetle
Dendroctonus rufipennis

Following five consecutive years of decline, spruce beetle populations generally remain at endemic levels in all regions. Most of the beetles remain in scattered windthrow, right-of-way, log decks and butts of standing trees and in overmature trees in remote areas. Timely salvage, sanitation and host depletion, however, should maintain present populations and tree mortality at minimal levels. Control programs along the Haines Road in the northern part of the Prince Rupert Region where trees have been predisposed by the effects of road construction since 1983, have effectively reduced beetle populations. Beetle broods, however, were present in low numbers in fresh windthrow.

Spruce bud insects
Zeiraphera canadensis
Pineus sp.

For a third consecutive year, new growth of Sitka spruce in the western part of the Prince Rupert Region was damaged. Spruce bud moths, particularly Z. canadensis, lightly damaged new shoots of most (average 74%) of the 7-15-year-old spruce in 15 plantations in the Kitimat, Copper, and Skeena river drainages, similar to 1987. A spruce gall adelgid, Pineus sp., lightly infested new shoots on 12-68% of the young Sitka spruce in eight plantations, levels similar to the two previous years of recorded damage.

TRUE FIR PESTS

Budworms
Choristoneura spp.

Defoliation of alpine fir and spruce forests in three regions by eastern spruce budworm and 2-year-cycle budworms which covered 59 400 ha and 59 750 ha, respectively, in 1987, is forecast to continue but at slightly reduced intensity and area in 1988.

Defoliation of current foliage of alpine fir and white spruce by eastern spruce budworm, C. fumiferana, in the northeastern part of the Prince George Region is generally lighter and less widespread than in 1987. Larvae were more numerous at Kleedo Creek than in 1987, and defoliation of new growth of understory trees at Liard River was severe, but elsewhere, populations and defoliation were down from 1987. Three 50-ha mature stands in the Fort Nelson District were selected by B.C. Forest Service for aerial applications of B.t. in a test to minimize defoliation.

Bud counts in May in the Prince George, Cariboo and Nelson regions indicated generally moderate defoliation of 1988 alpine fir-spruce shoots by mature larvae of two-year-cycle budworm, C. biennis. East and southeast of Prince George at ten locations, including Stoney and Ahbau lakes, an average of 10% of the buds (range 1-20%) were infested, with the highest at Centennial and Slim creeks and in the upper Willow River valley. Similarly, light to moderate defoliation, based on an average of 15% of the buds infested, was forecast at five previously infested stands in the northeastern part of the Cariboo Region including the Willow, Swift and McKay river drainages, near Barkerville and east of Horsefly Lake.

In the Nelson Forest Region alpine fir-spruce buds infested by two-year-cycle budworm were numerous, particularly in the West Kootenay at Barnes Creek (52%), Plant (28%) and Airy (18%) creeks, indicating moderate to severe defoliation of new growth by mature 'off-cycle' larvae in 1989. In the East Kootenay 5-31% (average 14%) of the new buds were infested in higher-elevation alpine fir-spruce stands at Bugaboo Creek and west of Kimberley at Dewar, Baker and Redding creeks. This is similar to 1987 when 60 pockets were infested over more than 9 000 ha. Increased populations infested 29-100% (average 55%) of the new buds at Vowell, Bobby Burns, and

McMurdo creeks.

Data on larval and adult populations and defoliation are being monitored in eight long-term study areas established in three forest regions to develop more reliable and accurate forecasting of budworm populations. Further data are necessary before numbers can be correlated with population changes and damage.

Balsam woolly adelgid
Adelges piceae

The status of quarantine regulation zones remain under consideration after the discovery in 1987 of adelgid populations on West Thurlow Island substantially beyond the 1976 regulation and infestation zones. Additional surveys within and outside the zones in southwestern British Columbia, and along the international border in the Nelson Region, have not found any significant occurrence of the adelgid in 1988. Nearby in northern Idaho, adelgids are quite common in frost pockets with high numbers of stem bark attacks but little gouting on mature alpine fir. Parasite recovery surveys continue and results will be reported later.

HEMLOCK PESTS

**Western blackheaded budworm
and Hemlock sawfly**
Acleris gloverana and Neodiprion tsugae

Defoliation of western hemlock by blackheaded budworm in the Queen Charlotte Islands is forecast to decline in 1988, following three consecutive years of defoliation, but sawfly populations could continue. Blackheaded budworm infestations which developed in 1987 near Holberg on Vancouver Island and in the Kamloops Region are expected to continue. Populations on alpine fir and spruce in the eastern part of the Prince Rupert Region, common since 1982, are continuing to infest new shoots in 1988. More complete information will be available following ground and aerial surveys in late summer.

LARCH PESTS

Larch casebearer
Coleophora laricella

Casebearer populations in western larch stands in the Nelson and Kamloops regions are generally endemic for the second consecutive year, as predicted. However, small pockets of moderately defoliated larch occurred in previously infested stands mostly in the West Kootenay near Castlegar, Thrums, Crescent Valley, Duncan Lake, Nakusp to Arrow Park, and near Rossland; at Boswell and Rykerts in the Creston area and between Cranbrook and Kimberley in the East Kootenay; and east of Vernon in the Kamloops

Region. Elsewhere in stands where casebearer activity occurred previously, including 21 of 26 long-term study sites between Kooacanusa Lake and Anarchist Mountain, defoliation was trace to light often only in small patches and mostly on understory and fringe trees. Defoliation was not present at the other five sites.

Releases of introduced adult parasites and male adult population distribution monitoring programs were discontinued this year. The effects of long-term defoliation by the casebearer in immature and mature western larch is being evaluated in the West Kootenay in stands near Thrums and Rossland.

Larch budmoth
Zeiraphera improbana

Numbers of bud moth larvae increased very slightly in Johnstone Creek Provincial Park in the West Kootenay and very lightly defoliated western larch in a small area of mixed conifers. Elsewhere in the Nelson and Kamloops regions where defoliation occurred from 1983 to 1985, very low numbers of larvae, but no feeding damage, were evident near Castlegar. None was recovered at Hanna and Murphy creeks in the West Kootenay.

Larch needle blight
Hypodermella laricis

Discoloration of western larch by the needle blight was generally less conspicuous and extensive throughout the host range than in the previous two years.

In the Kamloops Region lightly infected trees in widely scattered pockets over 5-10 hectares occurred on the east side of the Okanagan Valley, similar to 1987. Generally light infection of stands in the Nelson Region occurred in patches in the White, Kootenay and Palliser river drainages.

MULTIPLE HOST PESTS

Black army cutworm
Actebia fennica

Conifer seedlings and herbaceous ground cover were defoliated by high numbers of black army cutworm larvae in recently burned and planted sites in parts of the Cariboo, Kamloops, Nelson, Prince George and Prince Rupert regions.

In the Cariboo Region, 60-100% of the Douglas-fir seedlings and most herbaceous ground cover in three 1986 burns near Black Jack Lake west of Likely, were severely defoliated. Defoliation was attributed to increased populations of black army cutworm; however, other cutworms may have been present.

Black army cutworm larvae were present in the Kamloops Region but only in very low numbers in the Clearwater District. Very light feeding damage to herbaceous ground cover was recorded in one of eight sites burned in 1986; spruce and pine seedlings were not damaged.

Conifer seedlings and herbaceous ground cover were defoliated in several recently planted sites in the Nelson Forest Region including the Gibby Fire but not in the Ram Creek area east of Canal Flats where high populations and severe defoliation occurred in 1987. Elsewhere in the East Kootenay, 88% of the seedlings in the 1986 'Fun' Fire on Bush Arm were totally stripped; larvae averaged 15/1000 cm². Similar numbers (13/1000 cm²) in CP 35 on Blackwater Ridge, near Donald, defoliated aspen and willow regeneration but damage to conifer seedlings was minimal. High numbers of late-instar larvae also occurred at Hunter Creek east of Golden. Near Red Rock Harbor east of Mica Dam in the West Kootenay, 45% and 55% of the 1987 planted Engelmann spruce in a 107-ha, and a nearby 26-ha 1986 burn, were stripped. This is the first cutworm infestation recorded in this area. All ground cover over half the area was totally consumed and pockets of complete defoliation were scattered throughout the remainder.

Increased populations in 1986 burns in the Prince George Region defoliated seedlings and ground cover. At East Twin Creek near McBride, white spruce and Douglas-fir seedlings and all the ground cover over 30 ha were severely defoliated. At Caine Creek north of Prince George, white spruce planted this year were not affected by increased numbers of cutworm which lightly and moderately defoliated the ground cover.

In the Prince Rupert Region cutworm were more numerous than in 1987, particularly in the western part of the district; however, damage was restricted mostly to herbaceous ground cover. Of 31 sites surveyed in the eastern part of the region, seedlings were lightly damaged over about 1 ha at Corral Main and herbaceous ground cover, mainly fireweed, was defoliated at three others. Low numbers (4-18/1000 cm²) of larvae at three burns in the western part of the Prince Rupert Region in the Bell-Irving River drainage lightly defoliated abundant fireweed but seedlings were not damaged. Historically, black army cutworm populations have not been a significant pest of seedlings in this area.

A contract to develop a system to forecast population fluctuations based on numbers of male adults in pheromone-baited non-sticky traps and subsequent defoliation and degree of damage to seedlings and vegetation, is in its second of three years. Baited sticky traps for detection purposes are being placed in 1987 burns in most recent cutworm-active areas. Data on trapping and parasitism will be reported later in the year.

Animal damage

Damage to recently planted conifer seedlings by high numbers of meadow voles, *Microtus* sp., increased significantly in the western part of the Prince Rupert Region. Damage was not evident, however, in the eastern part of the region where seedling mortality was widespread in 1987.

Feeding on lodgepole pine and Sitka spruce seedlings planted in 1987 in the Bell-Irving River Valley ranged from 3-56% (average 14%) at eight sites, but there was no evidence of seedling mortality. Feeding on bark of 1-2-year-old lodgepole pine and 10-15-year-old Sitka spruce, suspected to be caused by hares, Lepus sp., was also common in the western part of the Prince Rupert Region. Partial debarking of the upper stems, occasionally laterals, of 8 and 25% of pine seedlings occurred at two of four sites on the Kalum Road. Partial debarking of lower branches of 92% of the spruce on Branch 77 Road, 67% at Nalbeelah Creek and 20% at Kalum Lake was very light and patchy and little mortality is expected.

Half the recently spaced immature lodgepole pine in 1-2-ha pockets throughout a 50-ha site on the Palmer Lake Road in the Cariboo Region were completely girdled at the base by rodents, seriously affecting stand density. Numerous whitebark pine in the Heckman Pass area west of Anahim Lake were killed by girdling of the stems at about 1 m above ground level. Rodent feeding was common also on blister rust-infected lodgepole pine south of Hanceville.

Climatic injury

The increased number of scattered dead and dying conifers across British Columbia, particularly in drier parts of the south coast in the Vancouver Region, was mostly attributed to drought conditions in 1985-1987. Mortality of mainly immature western red cedar and grand fir and some western hemlock was most common and patchy on the Saanich Peninsula, the Gulf Islands and the Sunshine Coast, particularly on rocky sites and stand fringes. Secondary bark beetle attacks by Scolytus ventralis were common in the affected grand fir and Phloeosinus sequoiae in western red cedar.

Conifer mortality in interior regions was common but not exclusively associated with roadsides where winter salting may have been a contributing factor. Recently dead lodgepole pine and Douglas-fir were numerous in the Cariboo Region, particularly along Highway 97 between Clinton and Williams Lake. Higher than normal numbers of recently dead Douglas-fir and ponderosa pine occurred in groups of 5-10 along roadsides in the Kamloops Region, in the Kamloops, Lillooet and Okanagan TSAs. In the West Kootenay, 20-40% of the young lodgepole pine in pockets of 5-20 ha at McKinney and Trapping creeks were dead or severely affected by drought. Between McBride and Valemout in the Prince George Region about 40% of the roadside lodgepole pine saplings were lightly discolored which was attributed to drought and salting.

DECIDUOUS AND ORNAMENTAL TREE PESTS

Tent caterpillars Malacosoma spp.

Forest tent caterpillar, M. disstria, defoliated deciduous trees and shrubs in parts of the Prince George, Nelson, Kamloops, Vancouver and Cariboo regions, some for the fourth consecutive year. Western tent

caterpillar, M. californicum pluviale, colonies were numerous but defoliation was minimal in the Okanagan Valley and East and West Kootenays, and remained at endemic levels in the Vancouver Region following population decline in 1987.

Forest tent caterpillar

As predicted in 1987, forest tent caterpillar populations around Prince George moderately defoliated trembling aspen in the Salmon River Valley and near Chief, Nass and Nukko lakes. In the Peace River area, defoliation was variable in patches from Pouce Coupe to Fort St. John.

In the Nelson Region, defoliation of trembling aspen, cottonwood and birch is more widespread in the East Kootenay than in 1987 but less evident in the West Kootenay. Generally light to moderate defoliation with pockets of severe in the south is widespread throughout the Rocky Mountain Trench from Wardner to Donald and in the Kitchener and Creston areas. The population decline in the West Kootenay is attributable in part to parasitism.

Populations declined in the Kamloops Region to endemic levels near Monte Lake, Falkland and Barriere where poplar, maple and birch were defoliated in 1987.

In the Bella Coola area of the Vancouver Region severe defoliation of deciduous forest types and ornamental trees occurred near Hagensborg. Light to severe defoliation occurred in pockets elsewhere in the valley where the defoliation was first recorded in this area in 1987.

Colonies were common for the first time in recent years on willow and poplar in the McKay and Horsefly river valleys in the Cariboo Region, but defoliation was minimal.

Western tent caterpillar

In southwestern British Columbia, populations which collapsed due to nuclear polyhedrosis virus infection in 1987 are at their lowest levels following 7 consecutive years of defoliation.

For the second consecutive year, colonies in the Okanagan Valley in the Kamloops Region lightly and moderately defoliated small pockets of deciduous trees and shrubs and occasionally poplar near Lumby, Lavington and Vernon. Near Paul Lake northeast of Kamloops, widely distributed colonies lightly defoliated willows and other shrubs.

Colonies were common on aspen, birch and shrubs near Invermere and Steamboat Mountain in the East Kootenay and near New Denver, Gibbs and Johnson creeks in the West Kootenay, but defoliation was minimal.

Gypsy Moth
Lymantria dispar

Intensified monitoring and periodic control programs since 1978 have prevented the establishment of gypsy moth populations and defoliation of hardwood hosts in British Columbia.

Following catches of adult male gypsy moths and detection of new egg masses at Kelowna, Colwood and Parksville in 1987, ground and aerial applications of B.t. were completed by Agriculture Canada, Plant Health, in May and June. Results of the applications and the ongoing cooperative pheromone trapping program will be available later in the year.

Satin Moth
Leucoma salicis

Last reported in the Vancouver Forest Region in 1975, increased satin moth populations severely defoliated poplar over about 150 ha southeast of Chilliwack on Mt. Thurston and at Harrison Hot Springs. Late-instar larvae near Chilliwack were severely infected by virus or disease. Localized infestations lasting one or two years have occurred periodically in the Fraser Valley since the 1920's.

Winter Moth
Operophtera brumata

For the fourth consecutive year, winter moth populations were at very low levels. Elsewhere in previously infested stands on southern Vancouver Island and Saltspring Island, there was no significant defoliation of deciduous hosts attributable to the winter moth.

Western Winter Moth
Erannis vancouverensis

Increased western winter moth populations defoliated scattered pockets of mixed deciduous forest in parts of the Kamloops Region, some for the third consecutive year, and for the second consecutive year in the Vancouver Region.

Scattered pockets of white birch, maple and poplar in the Kamloops Region between Little Fort and Vavenby, in the Clearwater River Valley, east of Chase and near Skimikin, Tappen and Shuswap Lake Provincial Park were lightly to severely defoliated.

Defoliation of vine and broadleaf maples and willow was more widespread in the southeastern part of the Vancouver Region than in 1987. Light to severe defoliation occurred in widely scattered pockets from Harrison Lake to the Skagit River Valley and in the Fraser Canyon near Alexandria and North Bend.

Infestations of two to three years duration have been recorded in coastal and interior deciduous forests periodically since 1949.

A birch leaf skeletonizer
Lyonetia saliciella

In some areas of the northern part of the East Kootenay of the Nelson Forest Region, discoloration of patches of white birch by the skeletonizer occurred for the fourteenth consecutive year. Discoloration was severe between Golden and Revelstoke and moderate in drainages in the Purcell Mountains west of the Rocky Mountain Trench. Light to moderate discoloration of birch in the Kaslo and Duncan Lake areas is an increase from the previous years of little or no foliar damage.

Large aspen tortrix
Choristoneura conflictana

Trembling aspen along the Alaska Highway near Takhini River Crossing in the Yukon Territory were severely defoliated by increased tortrix populations over 800 ha and less severely over 200 ha. Defoliation of aspen has occurred periodically since 1958 in the Yukon, usually of 2-6 years duration.

Dogwood leaf blotch (Anthracnose)
Gloeosporium sp.

Infection of dogwood trees was more severe and widespread in the Lower Mainland area of the Vancouver Region than in 1987, attributable to a wetter spring. Severe infection of most trees at Mt. Seymour Provincial Park has resulted in premature loss of foliage, particularly in the lower crowns. On the Sunshine Coast, up to 90% foliar loss and dieback of up to 60% of the branches is common. Less severe infections are common throughout the Fraser Valley and in the Fraser Canyon north to Alexandria.