1998 ANNUAL REPORT

FOREST Health

IN ALBERTA

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Alberta Land and Forest Service
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NOTE:

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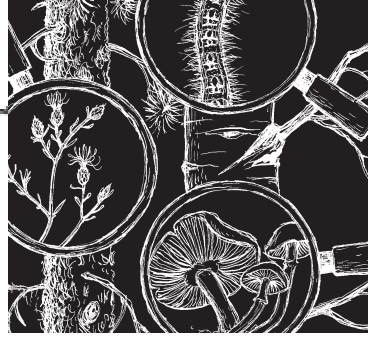

ACKNOWLEDGEMENTS

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Steve Simser, GIS Technologist of the Forest Protection Division helped with preparing the maps for this publication. Karen Plante of Communications Division, Alberta Environmental Protection provided the design and layout of this report.

SUMMARY

During 1998, there was a resurgence of spruce budworm infestations in Alberta. The spruce budworm-defoliated area in the province increased from an estimated 50 056 ha in 1997 to 114 668 ha in 1998, excluding the area north of Fort Chipewyan. The severity of spruce budworm defoliation increased in some previously sprayed areas and most of the unsprayed areas infested by the spruce budworm in northern Alberta, as well. In addition, few pockets of new spruce budworm infestations were also found.

The results of spruce budworm moth surveys, carried out by using pheromone-baited traps, showed a high risk of new spruce budworm outbreaks in the Upper Hay, MacKenzie, Athabasca and Waterways forest areas in northern Alberta. The Foothills Forest Area in the Northern East Slopes Region will have a moderate risk of a two-year cycle spruce budworm outbreak in 1999. The other forest areas will have a low risk of spruce budworm outbreaks in 1999. The results of the second instar budworm surveys predict moderate or severe spruce budworm defoliation in most (65%) of the plots located in currently defoliated stands in the Upper Hay and MacKenzie forest areas, Northwest Boreal Region. Similarly, the results of the second instar spruce budworm surveys predict moderate or severe spruce budworm defoliation in most (63%) of the plots located in currently defoliated stands in the Athabasca and Waterways forest areas, Northeast Boreal Region. These increases in severity and extent of spruce budworm defoliation may be attributed to the warm, dry weather pattern experienced in the province in 1998.

No mountain pine beetle-killed trees were observed within the Green Area during the annual aerial survey carried out in southwestern Alberta. However, mountain pine beetle-killed lodgepole pines were observed in Banff National Park; lodgepole pines suspected to be mountain pine beetle-killed were also observed in Waterton National Park and in the adjoining Blood Indian Reserve in southern Alberta.

Pheromone-baited lodgepole pines in the Foothills Forest Area and Wilmore Wilderness Park of the Northern East Slopes Region had relatively high number of beetle hits; these trees were cut and burned. The number of mountain pine beetle hits on pheromone-baited lodgepole pines increased, compared to 1997, in the Southern East Slopes Region.

During 1998, neither new spruce beetle infestations were detected nor pheromone traps were set up to detect the spruce beetles within the Green Area monitored by LFS.

Larch sawfly defoliated large tracts of larch in the Upper Hay Forest Area of the Northwest Boreal Region.

Outbreaks of the pine false webworm, a potential pest of lodgepole pine in the Green Area, were abundant and widespread in Edmonton.

Among the aspen defoliators, forest tent caterpillar-defoliated area in 1998 in the Northwest Boreal Region increased compared to the defoliated area in 1997. There was no aspen leaf roller defoliation in the Northwest Boreal Region. The large aspen tortrix defoliated aspen stands over an extensive area in the Northwest Boreal Region. Satin moth infestations increased dramatically in and around Edmonton. The sprearmarked black moth continued to defoliate white birch stands in the Upper Hay Forest Area. Four gypsy moths were collected during a provincewide ground survey carried out by using pheromone-baited traps.

In 1998, incidence of forest diseases was less common than in 1997. Dutch elm disease has not been detected in the province although one of its vector species has been repeatedly trapped in several urban areas of Alberta.

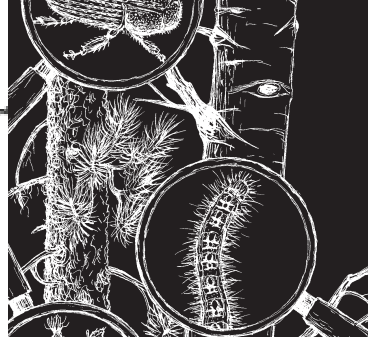
The Forest Health Branch formulated policies and guidelines on management of noxious, and restricted weeds in the Green Area. Regional weed management programs in 1998 included making

inventories of noxious, and restricted weeds; increasing awareness of weeds; and, weed control by using either chemical or cultural methods.

A biological insecticide, Foray 48B®, was aerially sprayed over 8801 ha of budworm-infested forest stands in the Upper Hay Forest Area. This spraying resulted in marginal control of budworm perhaps due to extremely high prespray population levels.

Integrated Pest Management (IPM) groups were functioning in all four forest regions. These groups were involved in planning integrated pest management programs, as well as in managing noxious, and restricted weeds.

The Forest Health Branch produced a "Spruce Budworm Management Guide" and an accompanying video on aerial spray operations in Alberta. A video entitled "Pests of Juvenile Conifer Stands" was also produced. Posters on important forest insects and diseases in Alberta were produced and distributed during 1998. Forest Health Branch is planning to produce a poster on noxious, and restricted weeds in Alberta. The divisional website was updated with forest health information. This Branch continued to provide training on forest health-related matters.

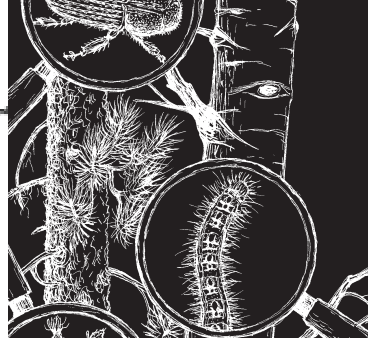


INTRODUCTION

The Forest Health Branch of Alberta Land and Forest Service (LFS) is responsible for addressing forest health concerns within the Green Area of the province. The four forest regions carry out the operational forest health programs. These include carrying out annual forest health surveys and managing forest pests.

During 1998, there was a noticeable increase in the occurrence of major forest pests in Alberta. The area affected by the spruce budworm outbreaks increased to two and half times the area affected in 1997, in northern Alberta. Mountain pine beetle activity in the Northern East Slopes Region also increased, as predicted in 1997. The forest tent caterpillar and large aspen tortrix defoliated large tracts of aspen in the Northwest Boreal Region. These increased pest activities are due, at least in part, to a mild winter, a dry spring and a hot, dry summer experienced in Alberta in 1998. However, there were no spruce beetle infestations in the province in 1998.

This report summarizes the forest pest conditions in Alberta in 1998 and predictions for 1999, based on the results of forest health surveys carried out. For the first time, this report includes details of noxious, and restricted weed management in the Green Area. The details of the operational pest management programs are also given. In addition, other programs aimed at increasing awareness on forest pests through training, and production of audio-visual material are also discussed.



PEST CONDITIONS IN 1998 and Predictions for 1999

SPRUCE BUDWORM

Choristoneura fumiferana (Clemens)

In 1998, spruce budworm defoliation increased in many areas in the Northeast Boreal and Northwest Boreal regions, as predicted in 1997. Spruce budworm populations reached record levels (as high as 140 budworms per 45 cm branch tip) in the northern part of the Northwest Boreal Region (NWBR). The severity of defoliation was likely exacerbated by the weather conditions favourable to the spruce budworm — relatively mild winter, dry spring and a dry, warm summer — experienced in 1998.

Results of the Aerial Surveys on Defoliation

During aerial surveys carried out in July 1998 in the NWBR, either moderate or severe budworm defoliation (over 35%) was recorded over an estimated 82 265 ha; this is nearly two and a half times as big as the moderately or severely budworm-defoliated area observed in this region in 1997. Although there was no budworm defoliation in the area sprayed with a biological insecticide in 1997, there was either moderate or severe defoliation in some of the areas sprayed in the previous years. In addition, budworm defoliation was recorded in some previously unaffected areas.

In the Upper Hay Forest Area of the NWBR, budworm-defoliated area was estimated at 68 931 ha. Of this area, 6957 ha were moderately defoliated (35% - 70% defoliation) and 61 974 ha were severely defoliated (>70% defoliation). As predicted in 1997, spruce budworm defoliated previously sprayed areas along the Chinchaga River,

northwest of Zama City, along the East and West Sousa creeks, and north of the Paddle Prairie Metis Settlement. Budworm defoliation reappeared, after a lapse of few years, in areas along the South Shekeilie River, the Hay River near the British Columbia border, and southwest of High Level. Budworm defoliation was recorded, for the first time during this outbreak, in the Cameron Hills near the Northwest Territories border, in a small area in the upper reaches of the Steen River and in a small area along the Vardie River (Figure 1).

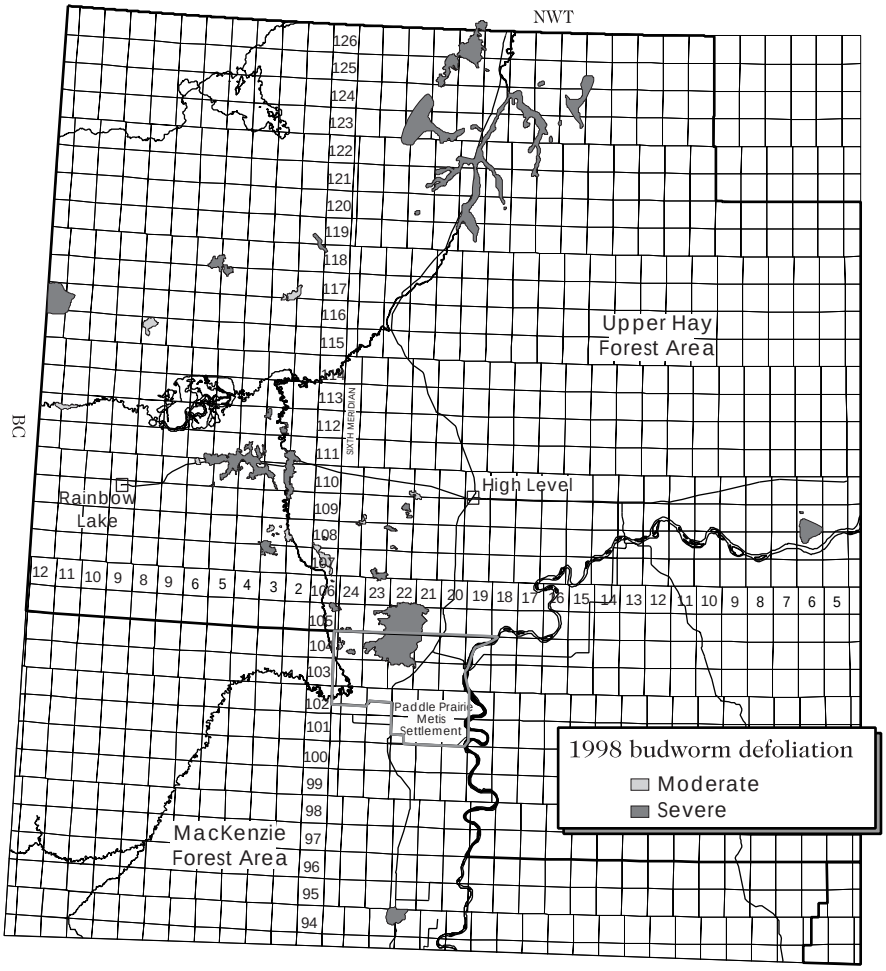
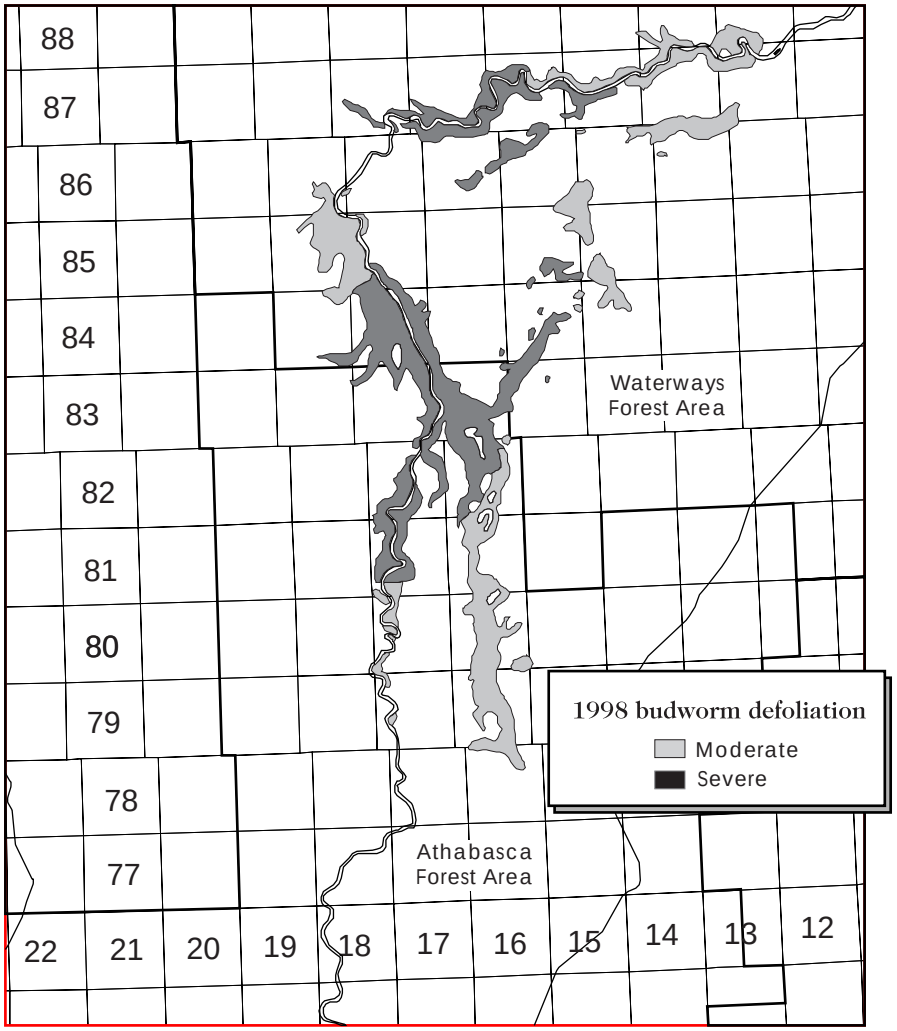


Figure 1 *Spruce budworm-defoliated areas in the Northwest Boreal Region in Alberta, 1998.*

In the Mackenzie Forest Area of the NWBR, spruce budworm defoliation increased in severity and extent compared to 1997, as predicted. In this Forest Area, budworm defoliation was observed over an estimated 13 334 ha. Of this area, 174 ha were moderately defoliated and 13 160 ha were severely defoliated. Most of the defoliated area (85%) was in the Paddle Prairie Metis Settlement. Spruce budworm defoliation observed in 1997 in the Hawk Hills area along highway 35 and on the north side of the Peace River near Dunvegan Historical Park, continued unabated in 1998 (Figure 1).

In the Northeast Boreal Region (NEBR), the spruce budworm defoliated predominantly white spruce stands along the Athabasca and House rivers. This defoliation extended from Athabasca Forest Area in the south to Waterways Forest Area in the north. The defoliated area along the Athabasca River extended from Pelican Rapids in the south to the Linock River confluence in the north; this defoliation further extended east from the Buffalo Creek to Little Cascade Rapids. Spruce budworm defoliated area along the House River extended from Township 78 to confluence with the Athabasca River. This defoliation extended northeast along a tributary of the House River towards Algar Lake and north of Grande Fire Lookout. Further north, spruce budworm defoliated areas along the Algar and Horse rivers. The extent of this defoliation, excluding the area north of Fort Chipewyan, was estimated at 32 403 ha. This is nearly double the defoliated area observed in 1997. Of this area, 14 469 ha were moderately defoliated and 17 935 ha were severely defoliated (Fig. 2).



Aerial surveys were conducted through the cooperative efforts of CFS and LFS.

Figure 2 *Spruce budworm-defoliated areas in the southern section of the Northeast Boreal Region in Alberta, 1998.*

Most of the budworm defoliation north of Fort Chipewyan in the Waterways Forest Area occurred along the Peace River west of the Peace/Slave River confluence. In addition, the spruce budworm defoliated some stands further north along the Slave River. The gross area with spruce budworm defoliation in this infestation is estimated to be 4 900 ha; out of this, 2 500 ha had moderate defoliation and 2 400 ha had severe defoliation (Figure 3).

The spruce budworm defoliation in Wood Buffalo National Park was surveyed in 1998 by personnel from the Forest Health Network, Northern Forestry Centre, Canadian Forest Service. The gross area of defoliation was estimated to be 123 800 ha, out of this 101 400 ha had moderate defoliation and 22 400 ha had severe defoliation.

Aerial surveys were conducted through the cooperative efforts of CFS and LFS.

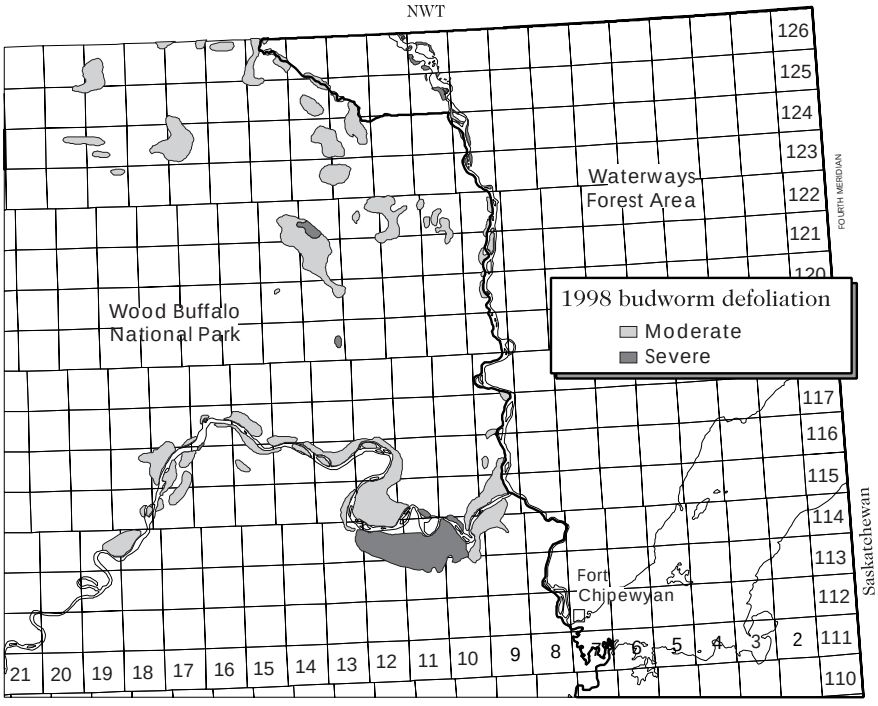


Figure 3 *Spruce budworm-defoliated areas in the northern section of the Northeast Boreal Region and Wood Buffalo National Park in Alberta, 1998.*

Moth Surveys with Pheromone Traps

In 1998, spruce budworm male moth populations were surveyed provincewide to predict any impending outbreaks in high-risk forest stands. Multi-pher I® traps (le Groupe Biocontrole, Ste-Foy, Quebec) baited with the female sex pheromone, Biolure® (Consep Membranes Inc., Bend, Oregon), were used to trap male budworm moths. The trapping procedure is described in the "Spruce Budworm Management Guide" (Ranasinghe and Kominek 1998).

Altogether, 137 survey plots were established across the province (Fig. 4). In nine plots, the average moth catch per trap exceeded 2000 moths. These nine plots are expected to have a high risk of spruce budworm outbreaks in 1999. Six of these plots were located in the Upper Hay Forest Area, two in the Mackenzie Forest Area (near Hawk Hills and at Dunvegan) and the other plot was located in the Athabasca Forest Area.

In 50 other survey plots, the average moth catch per trap varied between 500-2000 moths. These plots are expected to have a moderate risk of budworm outbreaks in 1999. Twenty-eight of these plots were in the Upper Hay Forest Area, NWBR with most occurring in the Steen River and Indian Cabin areas. Some plots with a moderate risk of an outbreak in 1999 were located along the Wabasca River, an area that has had a spruce budworm outbreak in the late 1960s; this area has to be closely monitored in 1999. Three other plots with a moderate risk of an outbreak were in the MacKenzie Forest Area and another was in the East Peace Forest Area in the NWBR. In the Northeast Boreal Region, 10 plots in the Waterways Forest Area and two plots in the Athabasca Forest Area had trap counts indicative of a moderate risk of spruce budworm outbreaks in 1999. In the Northern East Slopes Region, six plots in the Foothills Forest Area had trap counts indicative of a moderate risk of outbreaks. These appear to be the two-year-cycle budworm, *C. biennis,* because the trap counts alternate between low and high numbers in consecutive years.

Seventy-two plots had average catches between 1 to 500 moths per trap resulting in a low risk of an outbreak occurring in these plots in 1999. These include all the plots in the following forest areas: all the forest areas in the Southern East Slopes Region; Marten Hills Forest Area; Woodlands Forest Area; Yellowhead Forest Area; Lakeshore Forest Area; Smoky River Forest Area; and Wapiti River Forest Area (Fig. 4). In six other plots, traps were either missing or were damaged by wind or bears.

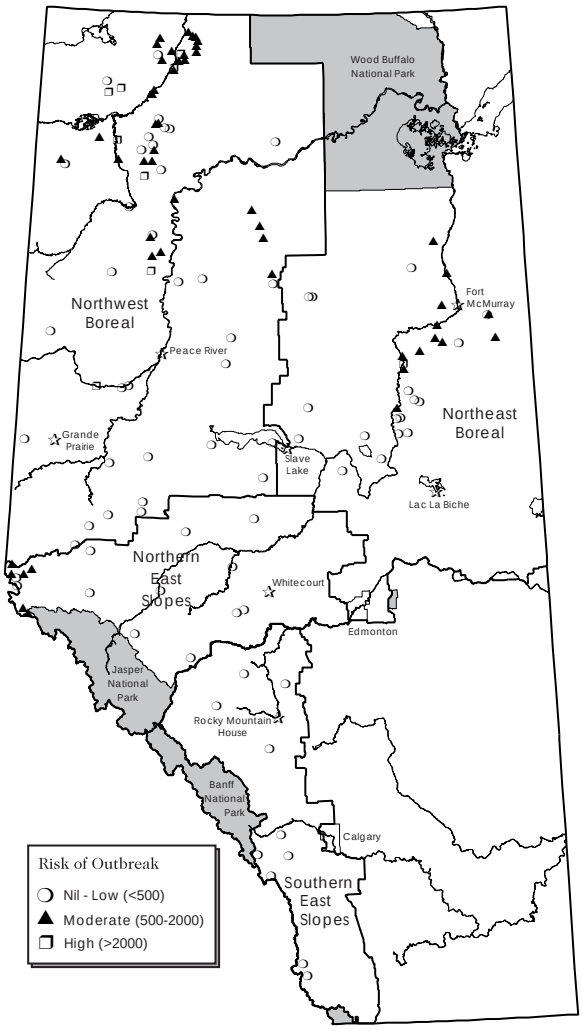


Figure 4 *Spruce budworm moth catches in pheromone-baited traps in Alberta, 1998.*

In summary, the Upper Hay and MacKenzie forest areas in the NWBR, and Athabasca and Waterways forest areas in the NEBR will have a high risk of new spruce budworm outbreaks in 1999. The Foothills Forest Area in the Northern East Slopes Region will have a moderate risk of a two-year-cycle budworm outbreak in 1999. The other forest areas will have a low risk of budworm outbreaks in 1999.

Second Instar (L_2) Surveys

Second instar spruce budworm (L_2) surveys were carried out in areas that were defoliated by the spruce budworm during the 1998 outbreak and in the vicinity of these areas, to predict the level of defoliation expected in 1999.

In the Northwest Boreal Region, 176 plots were established. The results of this survey are shown in Fig. 5. In this region, 169 plots were located in the Upper Hay Forest Area; of these, four were located in the area sprayed with a biological insecticide and the other plots were located in unsprayed areas. The results of the L_2 survey predict severe defoliation in 1999 in 64 (39%) plots in this Forest Area. Almost all of the areas defoliated by spruce budworm in 1998 in this Forest Area are expected to have severe defoliation in 1999. These include the following: Paddle Prairie; areas along the Chinchaga River; the East Sousa, and West Sousa creeks; the South Shekelie River; the Hay River; the Dizzy, and James creeks; the Yates River, and Cameron Hills. In addition, large tracts of white spruce located northwest of Zama City, and between Adair and Amber fire lookouts are also expected to be severely defoliated in 1999. However, the currently defoliated area in John D'or Prairie and areas along the Steen River aerially sprayed in 1998 to control the spruce budworm, are expected to have only light to moderate defoliation in 1999. In this Forest Area, moderate defoliation is expected in 1999 in 44 (26%) of the plots, mainly located in the fringe areas of current defoliation. Light defoliation is expected in another 59 (35%) of the plots scattered around the current defoliation; in the remaining two plots (1%), no defoliation is expected in 1999. Seven plots were located in the

MacKenzie Forest Area. Two plots located in the currently defoliated stands at Hawk Hills had high counts. These plots are expected to have severe defoliation in 1999. Four of the five plots located in the Paddle Prairie Métis Settlement are expected to be severely defoliated in 1999; the other plot is expected to have light defoliation. Overall, most of the affected area in the Paddle Prairie Métis Settlement area is expected to have severe defoliation in 1999 (Fig. 5). In 1999, spruce budworm defoliation in the NWBR is expected to be severe and extensive. This sudden increase of spruce budworm defoliation may be attributed to conditions conducive to budworm outbreaks — mild winter; dry, spring; and a dry, warm summer — experienced in 1998, after two consecutive wet years that promoted foliage growth.

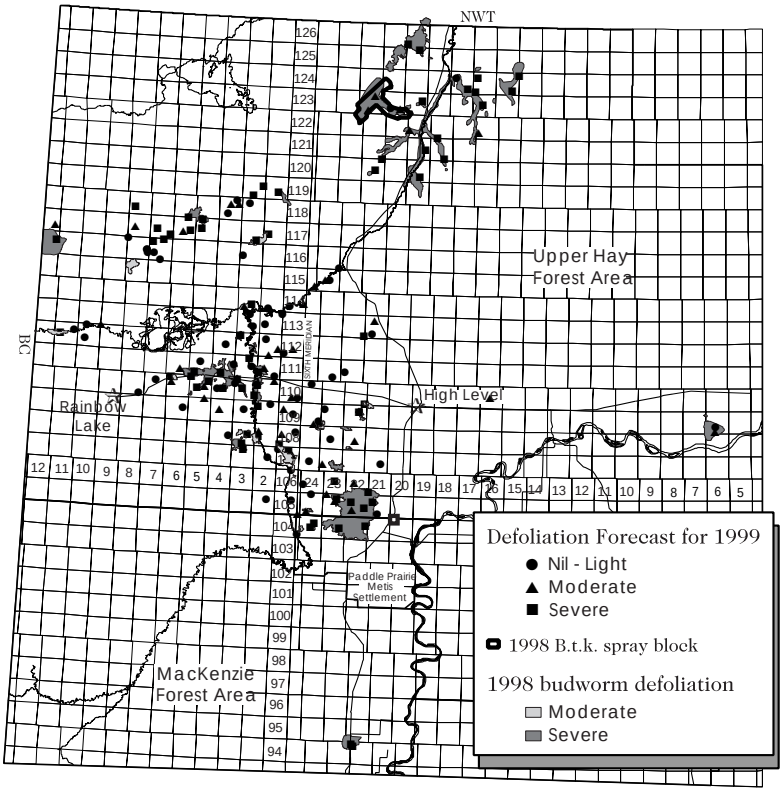


Figure 5 *Spruce budworm defoliation forecast for 1999 based on second instar (L_2) larval counts, Northwest Boreal Region, Alberta.*

In the Northeast Boreal Region, 16 L_2 plots were established in the southern section of the area defoliated by the spruce budworm in 1998. The results of the L_2 survey are shown in Fig. 6. Seven plots were located in the Athabasca Forest Area. One plot located south of Indian Cemetery is expected to have severe defoliation in 1999. One plot located south of Pelican Rapids, and one plot located north of Stoney Rapids along the Athabasca River, and another plot located halfway between Indian Cemetery and Droplet Creek along the House River are expected to have moderate defoliation in 1999. The remaining three plots, located towards the southern end of the current defoliation, are expected to have light defoliation in 1999. Thus, the spruce budworm defoliation in 1999 is expected to be light along the House River south of the Dropoff Creek and along the Athabasca River south of Stoney Rapids. Defoliation is expected to be moderate or severe between Indian Cemetery and Dropoff Creek along the House River and north of Stoney Rapids along the Athabasca River. In the Waterways Forest Area, severe defoliation is expected in a plot located near Grand Rapids and another plot located near Brute Rapids along the Athabasca River. In this Forest Area, moderate budworm defoliation is expected in a plot located in the currently defoliated area along a tributary to the House River northeast of Indian Cemetery and another plot located in the area northeast of Grande Fire Lookout. Spruce budworm defoliation is expected to be moderate in a plot located at south of the Lonock River and the Athabasca River confluence, south of the Buffalo Creek, and another plot located along the Algar River near Boiler Rapids. Budworm defoliation in 1999 is expected to be light in three plots located west of Little Cascade Rapids along the Athabasca River (Fig. 6). Overall, spruce budworm defoliation in the NEBR is expected to increase in severity and extent in 1999.

Aerial surveys were conducted through the cooperative efforts of CFS and LFS.

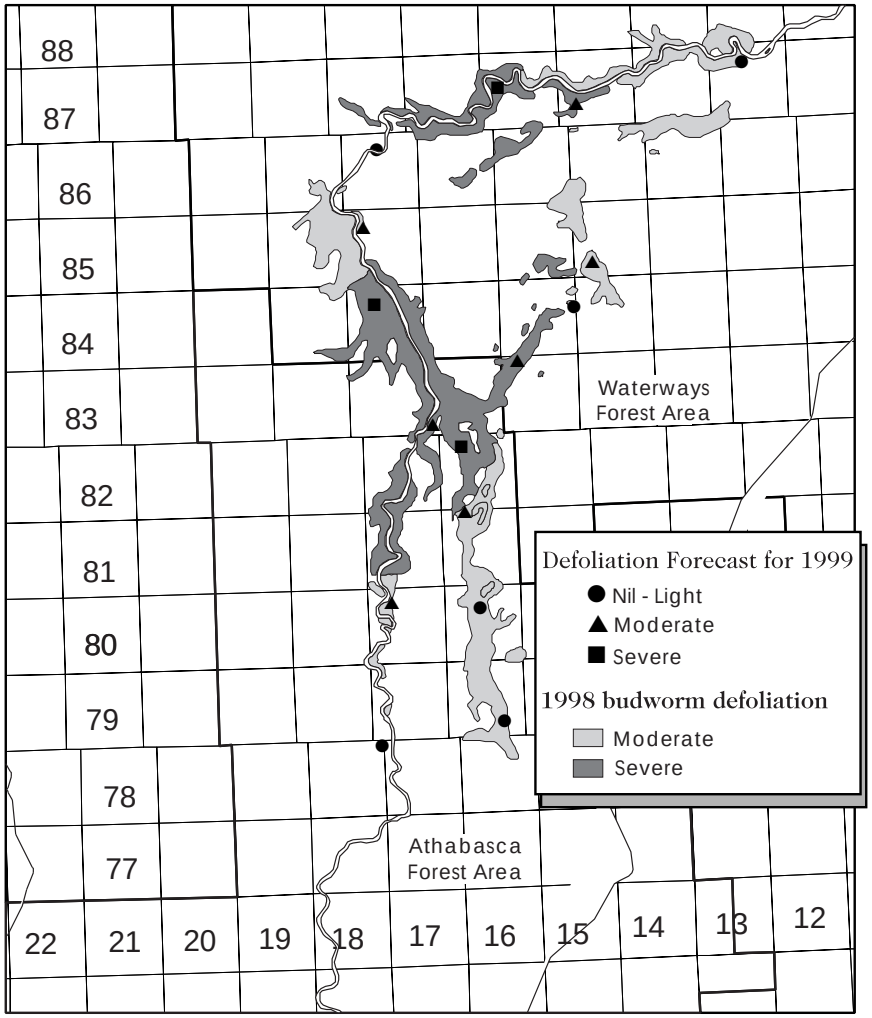


Figure 6 *Spruce budworm defoliation forecast for 1999 based on second instar (L_2) larval counts, Northeast Boreal Region, Alberta.*

MOUNTAIN PINE BEETLE

Dendroctonus ponderosae Hopkins

Aerial Surveys

No mountain pine beetle-killed trees were observed within the Green Area during an aerial survey carried out in August, jointly by LFS, Canadian Forest Service (CFS) and Parks Canada. The area surveyed included mainly the river valleys in the foothills bordering B.C., in southwestern Alberta.

Nearly a dozen small patches of mountain pine beetle-killed trees were observed in Banff National Park (Fig. 7). Ground-truthing confirmed some of these tree kills were caused by the mountain pine beetle. In addition, a large tract of mountain pine beetle-killed pines was detected along the Holmes River in B.C. about five km southwest of Wilmore Wilderness Park. This infestation is a major concern because of its proximity to the mature pine stands in Wilmore Wilderness Park. Further south, trees suspected to be killed by the mountain pine beetle were detected, during an aerial survey in Waterton National Park and in the adjoining Blood Indian Reserve. More mountain pine beetle-killed stands were found towards McBride in B.C.

Forest Health Branch has requested the authorities of Banff National Park to take action regarding the mountain pine beetle infestation. A meeting of personnel from LFS, B.C. Ministry of Forests, National Parks, and Zeidler (McBride), which is responsible for harvesting the affected area along the Holmes River, is scheduled to be held in January 1999 to discuss about options for mountain pine beetle control in Holmes River Valley infestation.

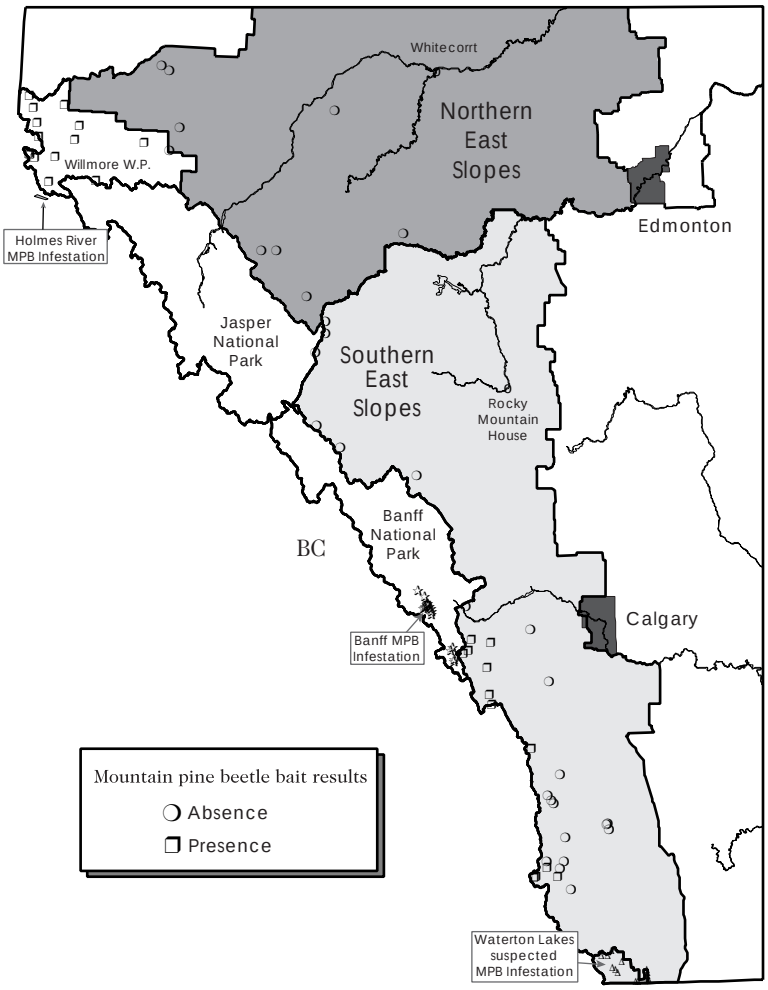


Figure 7 *Mountain pine beetle hits in plots with pheromone-baited trees, and mountain pine beetle infestations in Alberta, 1998.*

Mountain Pine Beetle Surveys with Pheromone Baits

In southwestern Alberta, pheromone baits were used to monitor mountain pine beetle activity in high-risk, lodgepole pine (*Pinus contorta* Dougl. var. *latifolia* Engelm.) stands. A two-component mountain pine beetle aggregation pheromone (Phero Tech Inc., B.C.) was used as a bait. The procedure for deploying these pheromone baits is described in "Mountain Pine Beetle Pheromone Monitoring Sampling Manual 1998" (Kominek 1998).

In the Northern East Slopes Region, 23 plots with pheromone-baited trees were established (Fig 7). In the Foothills Forest Area, 14 out of 18 plots had trees with beetle hits ranging from 2 to 100 per tree. Forty-two beetle-infested trees at 13 of these sites were either debarked or cut and burned during October 1998; Thirty-two of these trees were baited and the other 10 trees were adjacent to the baited trees. This increase in beetle activity is partly due to the heavy snowfall which insulated beetle-attacked trees, and perhaps due to a large beetle infestation along the Holmes River Valley about five km away in B.C. In the Yellowhead Forest Area, there were no mountain pine beetle attacks in the five pheromone-baited plots.

In the Southern East Slopes Region, 33 plots with pheromone-baited trees were established (Fig. 7). In the Crowsnest Forest Area, 5 out of 18 plots had beetle attacks ranging from 2 - 30 hits per tree. This is a slight increase in beetle hits in this Area, compared to 1998. In the Bow Forest Area, 7 out of 9 plots had trees with beetle hits. The number of hits ranged from 2 - 32 hits per tree. Although this is a substantial increase compared to 1997, the number of hits are within the historical range for this area. One noticeable difference in 1998 was an increase in length of the beetle galleries; it increased from 6-12 cm in previous years to 30-50 cm in 1998. None of the six plots established in the Clearwater Forest Area had any beetle hits. This Area has not had any beetle hits since monitoring began in 1992. The risk of a mountain pine beetle infestation

in this region in 1999 appears to be increasing, especially in view of the beetle infestation in Waterton National Park and its vicinity. All the trees with mountain pine beetle hits will either be debarked or cut and burned before the spring of 1999. Those plots with the mountain pine beetle hits will be closely monitored in 1999.

SPRUCE BEETLE

Dendroctonus rufipennis (Kirby)

Aerial Surveys

During 1998, neither spruce beetle infestations were detected nor pheromone-baited traps were deployed to monitor spruce beetle activity within the Green Area monitored by LFS.

LARCH SAWFLY

Pristiphora erichsonii (Hartig)

Larch sawfly defoliated large tracts of tamarack (*Larix laricina* [Du Roi] K. Koch) in the Upper Hay Forest Area, Northwest Boreal Region. This defoliation was observed in areas extending from south of the Steen River to the Northwest Territories border, and from Highway 35 west to Cameron Hills. There was also a significant larch sawfly defoliation on Bootis Hill, from the South Shekelie River to Petitot Fire Lookout.

PINE FALSE WEBWORM

Acantholyda erythrocephala (Linnaeus)

Outbreaks of this pest were abundant and widespread in Edmonton in 1998. These outbreaks caused heavy defoliation of lodgepole pines in the city (Saunders, 1998). This pest was detected in Edmonton in 1989 (Eamond and Cerezke, 1990). Since then outbreaks of this sawfly have become common in Edmonton.

This is an exotic, web-spinning sawfly species first reported in Canada in 1961 (Eidt and McPhee, 1963). It has become more common in recent years in Ontario where up to 90% defoliation of red pine plantations has been reported (Moody, 1990).

Lyons (1995) described the biology of this insect species in Ontario. The larvae feed on the basal part of the needles. Larval silk, frass (pellets of excrement by larvae), caste larval skins, and uneaten part of the cut needles form webs that enclose the larvae; hence the name webworm.

Although this pest has not been reported from the Green Area, it is a potential pest of lodgepole pine in the province.

FOREST TENT CATERPILLAR

Malacosoma disstria Hübner

Aerial Surveys

In the Northwest Boreal Region, forest tent caterpillar defoliation within the forested area was aerially surveyed between June 15 and 17, 1998. The gross area with forest tent caterpillar defoliation was estimated to be 104 103 ha. (Fig.8). Within the affected area, severely defoliated stands

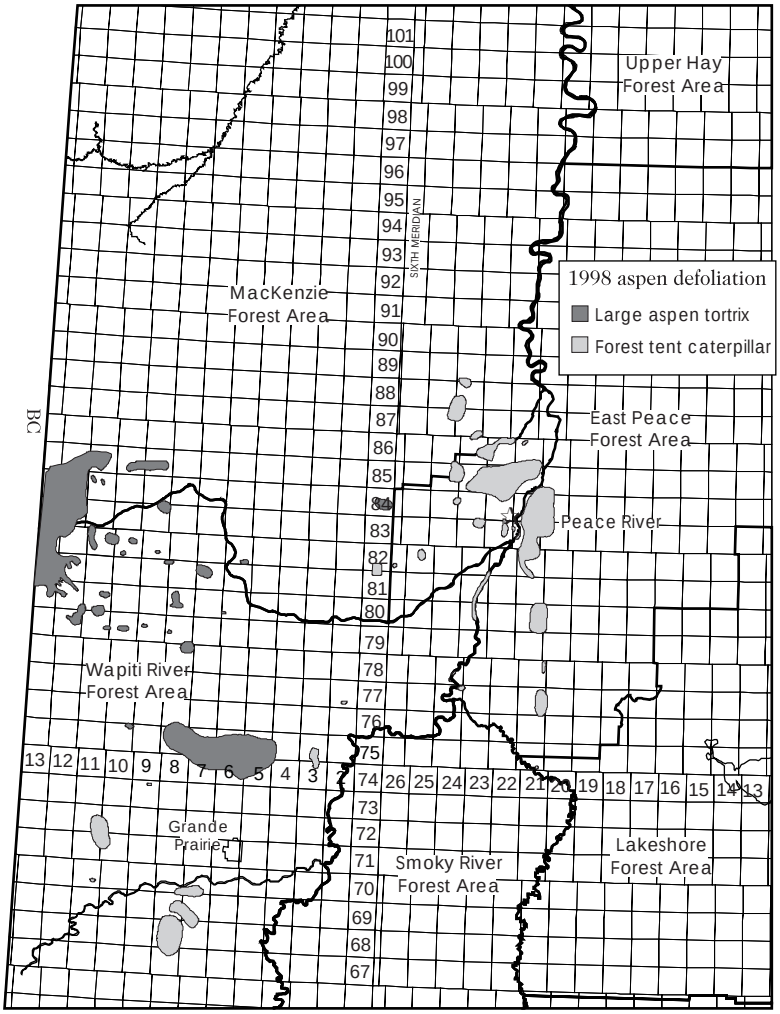


Figure 8 *Forest tent caterpillar, and large aspen tortrix defoliation in the Northwest Boreal Region in Alberta, 1998.*

were observed over 97 652 ha; moderately defoliated stands were observed over 5905 ha; and lightly defoliated stands were observed over 546 ha. In the East Peace Forest Area, the forest tent caterpillar defoliated aspen stands along Highway 43 south of Donnelly; along Highway 2 south of Nampa, south of Peace River, north of Leddy, and north of Dixonville; along Highway 986 east of Leddy with another infestation south of this highway and west of Highway 686. In the Wapiti Forest Area, the forest tent caterpillar defoliated aspen stands along Highway 2 north of Sexsmith, along Highway 666 near Grovedale, and south of Highway 671. The extent of forest tent caterpillar defoliation in 1998 is significantly higher compared to 1997.

In the Northeast Boreal Region, there was no aerially visible forest tent caterpillar defoliation in 1998.

Predictions for 1999

Predictions on forest tent caterpillar defoliation for 1999 are unavailable because no egg band surveys were carried out in 1998.

ASPEN LEAF ROLLER

Pseudexentera oregonana (Walsingham)

There was no aspen leaf roller defoliation in the NWBR in 1998. Ground-truthing carried out in 1998 showed that the area reported to be defoliated by the aspen leaf roller in 1997 was actually defoliated by the large aspen tortrix.

LARGE ASPEN TORTRIX

Choristoneura conflictana (Walker)

The large aspen tortrix defoliated aspen stands over an extensive area in the NWBR. This defoliation was inadvertently reported as aspen leaf roller damage in 1997. The gross area of defoliation was estimated to be 130 305 ha. Out of this area, lightly defoliated stands were observed over 10 188 ha; moderately defoliated stands were observed over 59 209 ha; and, severely defoliated stands were observed over 60 908 ha. This main defoliation was observed in the Mackenzie and Wapiti forest areas, north and south of the Peace River and along the Pouce Coupe River, east of the B.C. border. Other defoliated stands were found along Highway 64 near Cleardale in the Mackenzie Forest Area; north of Highway 49 west of Spirit River, along Highway 725, and north of this highway in the Wapiti Forest Area (Fig. 8).

SPEARMARKED BLACK MOTH

Rheumaptera hastata (Linnaeus)

Defoliated white birch stands, (*Betula papyrifera* Marsh.), where defoliation was attributed to the spearmarked black moth, were observed around Mount Watt and along Zama Ridge near Rainbow Lake in the Upper Hay Forest Area, NWBR. This is the third consecutive year of defoliation of white birch in this area. However, the damage in 1998 was neither as extensive nor as severe as it was in 1997.

GYPSY MOTH

Lymantria dispar (Linnaeus)

Use of Pheromones to Detect Gypsy Moths

Annually, Canadian Food Inspection Agency (CFIA) carries out a program to detect this pest in Alberta. This is done by setting up traps baited with gypsy moth pheromone, throughout the province. This program is carried out in collaboration with several agencies including LFS.

In 1998, CFIA set up 451 delta traps baited with Dispalure® pheromone, with the cooperation of several agencies. The Forest Health Branch of LFS coordinated setting up of 45 of these pheromone traps throughout the province. No gypsy moths were caught in 1998 in the traps set up under this program by LFS, in all four forest regions of the province.

However, traps set up in Banff National Park by Northern Forestry Centre, Canadian Forest Service, captured one male gypsy moth at the Bow Summit, and two male gypsy moths at Tunnel Mountain. Another trap, set up by CFIA, captured one male gypsy moth at Mountain View Campsite in Conrich, east of Calgary (H. Koga, pers. comm.).

SATIN MOTH

Leucoma salicis (Linnaeus)

In Edmonton, 145 new sites infested by the satin moth were recorded in 1998. This is a dramatic increase from the 33 infested sites recorded in 1997. Altogether, there were 255 active infestation sites in the city (Saunders, C., 1998).

The satin moth still has not been detected in the Green Area of the province. This pest, introduced relatively recently to Alberta, poses a serious threat to the deciduous forest. Up to now, the satin moth has been reported from Edmonton and surrounding communities where it seems to be firmly established.

Although it appears to be a matter of time before this pest moves to the Green Area, monitoring of this pest is hampered by the lack of a pheromone bait for trapping the moths. Light traps can be used to trap the satin moths but these traps also attract many other kinds of insects making their use an expensive and a cumbersome operation.

Normally the satin moth prefers hybrid poplar as a host. This year, the satin moth was feeding on aspen as well as willow in Edmonton. The spring emergence of overwintering satin moth larvae was staggered over five weeks. Thus, the emerging larvae can feed on the first as well as the second leaf flush of aspen, aggravating their detrimental effect. The staggered development of larvae makes it impossible to control this pest with a single application of a biological insecticide.

DISEASES

of Conifers

In general, the incidence of forest diseases in the province in 1998 was less prevalent than in 1997. The common diseases of conifers observed in 1998 were western gall rust (*Endocronartium harknessi*i [J. P. Moore] Y. Hirat.), and root rots (*Armillaria* spp. and *Inonotus tomentosus* [Fr.] Gilbn.).

DUTCH ELM DISEASE

Ophiostoma ulmi (Buis.) Nannf.

In 1998, the Society to Prevent Dutch Elm Disease (STOPDED) coordinated setting up of traps at 480 locations within the province to trap the beetle vectors of Dutch Elm Disease (DED). This year, the smaller European elm bark beetle (SEEBB), *Scolytus multistriatus* (Marsham) — one of the vector species of DED — was trapped in Calgary; Edmonton; St. Albert; and, for the first time, in Medicine Hat. This beetle was trapped at 23 locations in Calgary; at six locations in Edmonton; one location in St. Albert; and several locations in Medicine Hat. In previous years, SEEBB has been trapped in Vauxhall and High River in southern Alberta, as well.

To date, there are no confirmed reports of DED occurring in Alberta. The STOPDED is also compiling a data base of all the elms in the province (Janet Feddes-Calpas, pers. comm.).

There are no native elms growing naturally in Alberta. Thus, Dutch Elm Disease (DED) is not a concern in the Green Area. However, many elms planted as shade trees in the province, especially in the urban areas, will be affected seriously if there is a DED outbreak.

OTHER DISEASES

of Broadleaf Trees

In 1998, twig blights (*Venturia* spp.) of aspen and poplar were widespread in the Northwest Boreal Region. Other reported diseases of broadleaf trees occurring in 1998 were: hypoxylon canker (*Hypoxylon mammatum* (Wahl.) J.H. Miller (= *H. purinatum* (Klotzsch) Cooke), and decay fungi.

OTHER DAMAGING *Agents*

Red belt was prevalent along the eastern slopes of the Rockies during 1998.

In many parts of the NWBR, many species of trees along the highways had red foliage in 1998. The tree species commonly affected by this condition were aspen poplar, *Populus tremuloides*; balsam poplar, *P. balsamifera*; black spruce, *Picea mariana*; white spruce, *P. glauca*; and willow, *Salix* spp. This damage was observed along Highway 35 between Peace River and High Level, and along Highway 2 from Valleyview to Peace River, and from Peace River to Cleardale. The most likely cause of this red foliage is salt toxicity, caused by the salt used on highways getting accumulated in adjacent low-lying areas.

WEEDS

In 1998, the Forest Health Branch formulated the provincial policies and guidelines on restricted and noxious weed management jurisdiction (FPD 16.0) and weed management in Green Area (FPD 16.1).

In the Northern East Slopes Region (NESR), the weed management program composed of:

- formation of a weed awareness group;
- taking an inventory of weeds within the region; and,
- weed control.

Weed Awareness Group: The weed awareness group formed in this region included representatives of Management Districts (Big Lakes,

Brazeau, Greenview, Woodlands and Yellowhead), LFS, and Alberta Agriculture, Food and Rural Development (AAFRD). Throughout the year, information concerning weed infestations, and weed control was shared among the members of this group. A weed awareness report form was printed and distributed as part of the awareness program. A pamphlet depicting the ten most important weeds in the region was printed and made available to the interested parties.

Weed Inventory: In the summer, a seasonal weed inventory person was assigned to each forest area within the NESR. These persons were responsible for taking weed inventory for the entire forest area. The priority sites were LFS sites (ranger stations, yards, fire lookout sites, genetic sites), cutblocks, and grazing dispositions. Inventories of weeds in the provincial parks and recreational areas were taken, as well. The targeted weed species were: Canada thistle, *Cirsium arvense* (L.) Scop.; scentless chamomile, *Matricaria maritima* L. var. agretis (Knaf.) Wilmot; ox-eye daisy, *Chrysanthemum leucanthemum* L.; tansy, *Tanacetum vulgare* L.; and tall buttercup, *Ranunculus acris* L. In addition, the presence of yellow toadflax, *Linaria vulgaris* Mill., and knapweed, *Centauria* sp. were noted. In the Woodlands Forest Area, 51% of the sites had Canada thistle; scentless chamomile was found at 31% of the sites; and tansy was found at 15% of the sites. In the Yellowhead Forest Area, Canada thistle was found at 49% of the sites, and scentles chamomile was found at 25% of the sites. In the Foothills Forest Area, tall buttercup was found at 32% of the sites; Canada thistle was found at 13% of the sites; and, ox-eye daisy was found at 12% of the sites. Small patches of yellow toadflax, and knapweed were also found in this forest area.

Weed Control: One spray project was carried out to control scentless chamomile, Canada thistle, and tansy in Carson Pegasus Provincial Park in the Woodlands Forest Area. LFS (58%) and Rigel Oil and Gas Ltd (42%) jointly funded this project.

In the Southern East Slopes Region (SESR), the weed management program composed of:

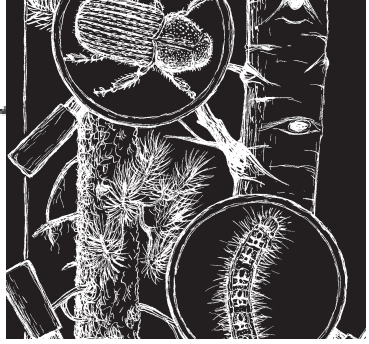
- weed inventory, and
- weed control.

Weed Inventory: Noxious, and restricted weed inventories were taken in: the Porcupine Hills of Crowsnest Forest Area; north of Bow River in the Bow Forest Area; and, previously treated areas in five townships and along hundreds of km of trails in the Clearwater Forest Area.

Weed Control: Weeds were either hand-pulled or sprayed with herbicides to control them. Herbicides were sprayed to control noxious, and restricted weeds in the following areas: along Highway 3, the Crowsnest Corridor, Porcupine Hills, and north of Highway 533 in the Crowsnest Forest Area (202 ha); south of the Bow River, at Sibbald Flats, and around West Bragg Creek in the Bow Forest Area (256 ha); around Stevens Creek in Sundre, Chambers Creek Snowmobile Trail, Baker Road, Swan Lake, Meadows Cabin, Dray Creek, Blackstone-Wapiabi, Nordegg Townsite, and Faraway in the Clearwater Forest Area (48.5 ha); and around Brazeau Tower in the Brazeau Forest Area (9.2 ha). In some other areas, weeds were hand-pulled, especially in sensitive areas. This was done at a small site in the Crowsnest Forest Area, and on a 7.6 ha block in the Brazeau Forest Area.

In the NWBR, the forest areas are negotiating weed management agreements with their local Municipal Districts (MD). The MacKenzie and East Peace forest areas have initiated making inventories of noxious ,and restricted weeds in their jurisdictions. The Smoky River Forest Area, in collaboration with the MD of Greenview, picked up weeds along the Simonette River.

There was no weed management program in the NEBR in 1998.



PEST MANAGEMENT
Operations

In 1998, a formulation of the biological insecticide, *Bacillus thuringiensis* sub sp. *kurstaki* (Btk) — Foray 48B® (Abbott Laboratories, Chicago, IL, USA) — was aerially sprayed to manage the spruce budworm outbreak in the Upper Hay Forest Area, Northwest Boreal Region. The details of this spray program are found in the report, "1998 Northwest Boreal Region Spruce Budworm Management Program" by Mike Maximchuk, Forest Health Officer, Northwest Boreal Region.

The main objective of this spraying was to keep the trees alive by reducing the epidemic budworm populations to endemic levels so as to limit future defoliation in the sprayed stands to less than 35%. The forest stands were selected for aerial spraying based on the results of the second instar (L_2) surveys carried out in 1997. If left unsprayed, these stands were expected to be moderately or severely defoliated (over 35% defoliation) by the spruce budworm in 1998.

The development of the spruce budworm, and spruce buds (phenological observations) were monitored in relation to daily accumulation of heat units (degree-days), beginning on May 13. The degree-days were calculated by using daily minimum and maximum temperatures with a threshold of 6° C. The weather data recorded at the High Level Airport were used for these calculations. This monitoring was done to predict when the peaks of spray-targeted stages of the spruce budworm (peak of fifth instar), and spruce buds (buds with needles flaring and caps off) would occur.

In 1998, the degree-days accumulated at a faster rate than in any other year dating back to 1990. Consequently, development of the spruce budworm, and spruce buds progressed at a higher rate than in any of the

previous eight years. The white spruce buds were spray ready on May 26. The spruce budworm larvae reached the spray-targeted stage, i.e., peak of fifth instar, on May 27, the earliest they have been spray ready during this outbreak.

A prespray sampling was carried out between May 23 - 24 when most budworms were in second to fifth instars. The results of this sampling showed extremely high budworm counts in the plots that were earmarked for spraying. There were as much as 140 budworms per branch tip (14 141 budworm larvae per 10 m^2 of foliage) collected during prespray sampling. These are the highest prespray budworm counts ever recorded during the current outbreak that began in 1987.

An estimated 8801 ha (Fig. 9) were sprayed with 27 154 L of an undiluted, water-based formulation of a biological insecticide (Foray 48B®, Abbott Laboratories, Ltd.). Of the sprayed area, 5395 ha were sprayed twice with a minimum five-day interval between the two sprayings, and 3406 ha were sprayed once.

Undiluted Foray 48B was sprayed at a volume of 2.0 L/ha (25.4 billion international units per ha) by using one Ayers Thrush S2R spray aircraft equipped with six Micronair AU4000® atomiser nozzles (Micronair Ltd., England) and a Satloc Forestar® Differential Global Positioning System (Satloc Inc., USA). A fixed-wing aircraft (Cessna 172) was used to monitor the spray operations. The aerial spraying was carried out between May 27 and June 5. The technical details of aerial spraying are given in Appendix II.

An independent laboratory analysis of two Foray 48B samples (carried out by Jean Cabana, Microbiology Laboratories, Quebec Ministry of Natural Resources) showed that both samples exceeded the potency guaranteed by the supplier. The results of a bioassay showed that the levels of microcontaminants in the samples were acceptable and met the standards.

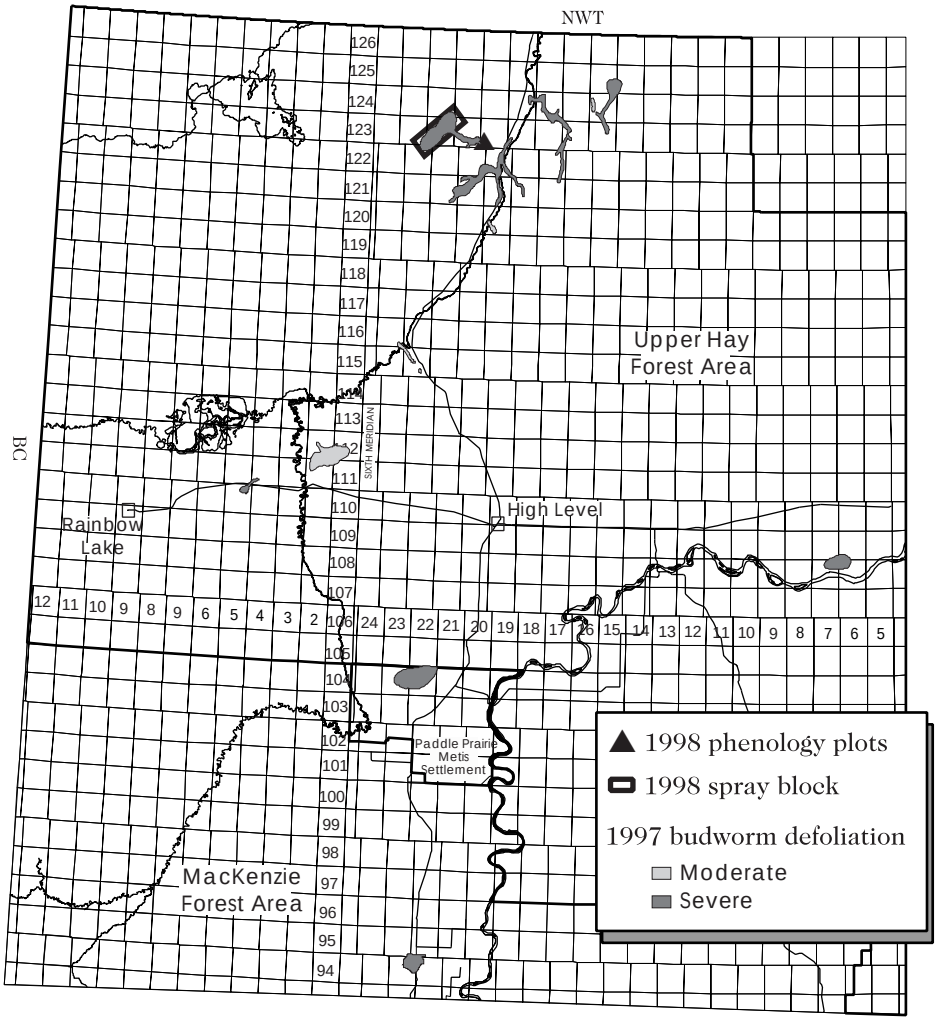


Figure 9 *Phenology plots and spray blocks in 1998, in relation to 1997 spruce budworm defoliation in the Upper Hay Forest Area, Northwest Boreal Region in Alberta.*

In the fall, an L_2 survey was carried out to determine the effectiveness of aerial spraying in reducing the budworm populations. The results of this survey showed that budworm populations were reduced from an epidemic to an endemic level, i.e., light defoliation is expected in 1999, in 1 out of 4 sprayed plots; budworm populations in the other three sprayed plots still remained at a level that is expected to cause moderate defoliation (35% - 70%) in 1999. This lack of desired control of budworm populations in these three sprayed plots may be attributed to the high population levels of the preceding generation of budworms recorded during the prespray surveys. When the prespray counts are extreme, as high as 140 budworms per 45 cm branch tip, even a 90% budworm mortality resulting from spraying would still leave enough residual population to produce sufficient number of larvae capable of causing moderate defoliation in the following year.

OTHER Programs

INTEGRATED

Pest Management Groups

Integrated Pest Management (IPM) groups have been established in all four forest regions (Northwest Boreal, Northeast Boreal, Northern East Slopes, and Southern East Slopes) to foster collaboration between LFS and forest industry in managing forest health issues.

The IPM group in the Northwest Boreal Region continued working towards the development of an integrated pest management system. It hired a contractor, to collect information on the permanent sample plot systems used by the participating agencies, to design appropriate tools to monitor and sample important pests, and to assess aerial detection methods. Manuals will be prepared on the aerial, and ground assessment of pest conditions, and on the analysis of data collected from the plots. Currently, six forest companies and LFS are involved in this project. The cost of this three-year program will be borne equally by these companies and LFS.

The IPM group in the Southern East Slopes Region had a guest speaker to discuss about a weed management program for the region. They shared the pest survey data, especially the monitoring of pests by using pheromone baits. This group plans to hold a workshop in the spring to discuss management of dwarf mistletoe in the region and the use of pheromone baits to monitor pests.

TRAINING AND
Increased Awareness

The Forest Health Branch, in association with the Strategic Management and Education Branch, has produced a video entitled "Pests of Juvenile Conifer Stands." A comprehensive "Spruce Budworm Management Guide" was produced for internal use by LFS personnel. This manual, comprising of two parts, deals with spruce budworm biology, sampling and management. A video on aerial spraying to manage spruce budworm was also produced. This video is available for distribution to the LFS staff together with the "Spruce Budworm Management Guide."

Website

The external and internal websites for Forest Health were completed in 1998. This was part of the Forest Protection Web Site developed by the Divisional Internet Working Group. The forest health web sites include sections on quarantine pests of interest, forest health conditions in the province, and new publications. The website addresses are as follows:

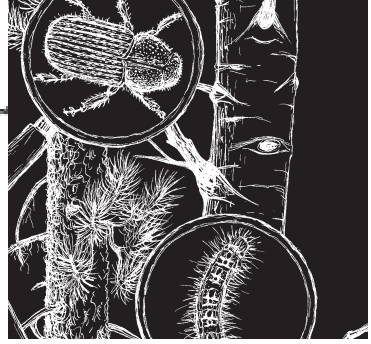
Internal Site: http://edmgwb1g/forprot/index.html
External Site: http://www.gov.ab.ca./env/forests/fpd/

For both sites, click on "Forest Health."

Training

The Forest Health Branch personnel took part in several training programs to increase awareness on forest insects and diseases. These included workshops on pest identification, pre-harvest silvicultural prescription, initial attack crew leader training, and courses on forest pests.

Depending on the regional needs, Forest Health Branch personnel trained the Forest Health Officers and forest area staff in some or all of the following data entry business areas: spruce budworm pheromone lure, L_2, and prespray/postspray surveys; gypsy moth pheromone lure survey; mountain pine beetle bait survey; pesticide supply and analysis contracts; aircraft flight reports (A0-02); and spruce budworm spray projects.



APPENDIX I

INFORMATION ON USE OF *Pheromones in Alberta, 1998*

Gypsy moth

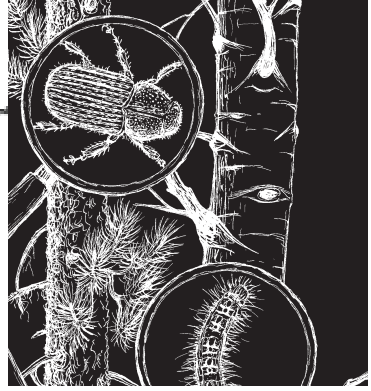
Chemical component(s):	(+)cis-7, 8-epoxy-2-methyloctadecane (Disparlure ®)
Lure type:	laminate strip
Trap:	Delta sticky trap
Pheromone source:	Trécé Inc., Salinas, California (purchased and distributed by the Canadian Food Inspection Agency)

Mountain pine beetle

Chemical component(s):	trans-verbenol, exo-brevicomin
Lure type:	pre-packed tree-bait
Trap:	not applicable
Pheromone source:	Phero Tech Inc., Delta, British Columbia

Spruce budworm

Chemical component(s):	95% E-11-tetradecenal, 5% Z-11-tetradecenal
Lure type:	Biolure
Trap:	Multi-Pher I
Pheromone source:	Consep Inc. (purchased and distributed by Dr. Chris Sanders, Natural Resources Canada, Ontario)



APPENDIX II

TECHNICAL DETAILS ON AERIAL SPRAYING

For Spruce Budworm Control in Alberta, 1998

Insecticides

▼ ***Foray 48B®***

Active ingredient: *Bacillus thuringiensis* sub sp. *kurstaki*
Formulation: water-based
Additions: none
Dilutions: none
PCPA NO. 21464
Micro-contaminants: nil

Aircraft

▼ ***Ayers Thrush S2R (Spray)***
with Satloc® Forestar GPS guidance system

▼ ***Cessna 172 (pointer)***

Spraying

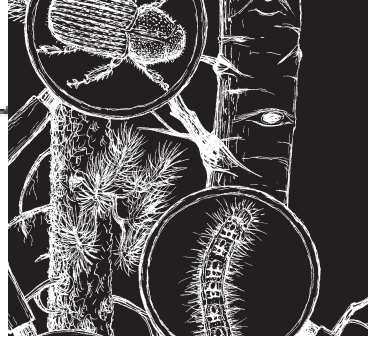
Nozzle system: Micronair AU4000® with flowmeter
Nozzles per aircraft: six
Blade angle: 33°
VRU setting: 11
Spray speed: 190 km/h
Swath width: 70 m
Atomiser rotation speed: 7000 rpm

Rate of spraying:	2.0 L/ha
Flow rate:	8.43 litres per nozzle per minute
Volume mean diameter:	95 - 110 microns
Period of spraying:	May 27 - June 5, 1998

Area sprayed: *Foray 48B*:	Sprayed once:	3406 ha
	Sprayed twice:	5395 ha
	Total:	8801 ha

Spray weather parameters

Temperature	5-30 °C
Relative humidity	over 30%
Wind	under 15 km/h
Precipitation	none within six hours



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