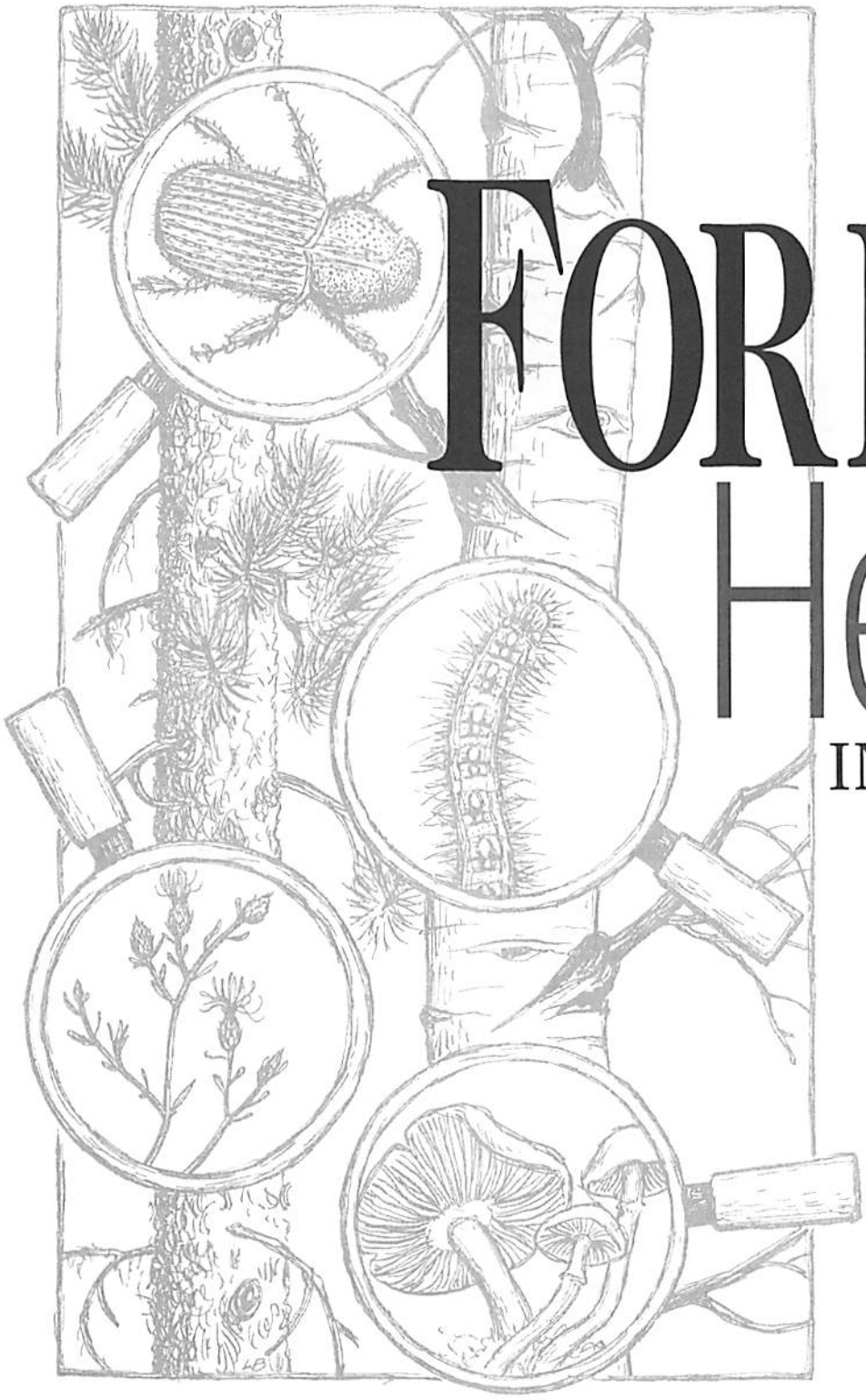
1999 ANNUAL REPORT



FOREST Health IN ALBERTA

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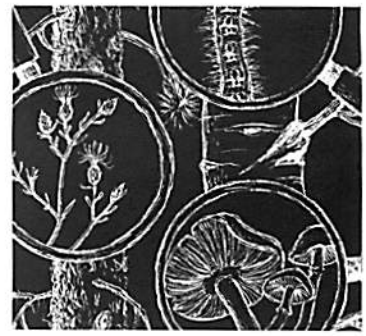

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NOTE:

The mention of certain products does not necessarily imply their endorsements, nor does the exclusion of other products necessarily imply their disapproval by Alberta Environment.

ACKNOWLEDGEMENTS

Sunil Ranasinghe, Forest Entomologist of the Land and Forest Service, compiled this report. It is based on the annual reports submitted by the Regional Forest Health Officers, Erica Lee (Northern East Slopes Region), Daniel Lux (Parkland, Bow and Prairie Region), Mike Maximchuk (Northwest Boreal Region), and Sarah Schwartz (Northeast Boreal Region). Mike Undershultz of the Forest Health Branch provided the details about the provincial noxious and restricted weed program.

Roger Brett, a forest health technician at the Northern Forestry Centre, Canadian Forest Service, helped with the aerial surveys of forest defoliator damage in the Northeast Boreal Region. Janet Feddes-Calpas of Alberta Agriculture, Food and Rural Development, provided a Dutch elm disease update for this report. Hiro Koga, a program officer at the Canadian Food Inspection Agency, provided the information on 1999 gypsy moth survey within Alberta. Christopher Saunders, an entomologist with Community Services, The City of Edmonton, provided information on the satin moth, birch leafminers and pine false webworm within the city.

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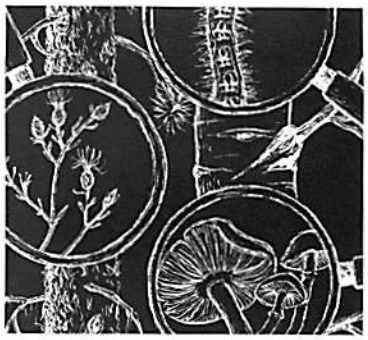
Most of the field survey data reported here were collected, under the direction of Regional Forest Health Officers, by the forest protection technicians in forest areas and summer crews.

Chris Van Tighem, Environmental Forest Education Coordinator of the Environmental Education Branch, coordinated the production of the two videos under the Forest Health Video Series and the pamphlet on woodborers.

Steve Simser, GIS technologist of the Forest Protection Division, and Mike Undershultz prepared the maps included in this report.

Ron Bos of the Communications Division, Alberta Environment, edited this report.



SUMMARY

This annual report provides details about forest insect pests, diseases and weeds that occurred in Alberta in 1999. Reported here are the results of the aerial and ground surveys; forest pest management programs; noxious and restricted weed management programs; training and increased awareness on forest health issues; and field trials carried out in the province in 1999.

The spruce budworm defoliated an estimated 191 657 ha in northern Alberta in 1999. This is a 67% increase in the defoliated area, compared to the defoliated area in 1998. The results of predictive surveys carried out in 1999 forecast an overall decrease in the severity and extent of budworm defoliation in currently infested areas in 2000. The risk of any new budworm outbreaks occurring in 2000 is nil to low in southern Alberta; however, the risk of new budworm outbreaks occurring is high in some areas in northern Alberta.

Although no mountain pine beetle infestations were detected in the "Green Area" of the province, several active or suspected beetle infestations were reported from Banff National Park, Jasper National Park and Willmore Wilderness Park. The lodgepole pine stands in southwestern Alberta are at a high risk of getting infested by the mountain pine beetle because of several infestations occurring in BC, close to Alberta – BC border.

The area defoliated by the forest tent caterpillar increased significantly in 1999. The large aspen tortrix and Bruce spanworm continued to defoliate deciduous stands in western Alberta. In 1999, a black army cutworm outbreak was reported from Alberta for the first time. No gypsy moths were detected during an annual province-wide survey of this pest carried out in 1999.

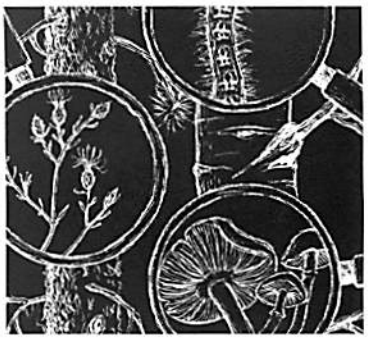
The first confirmed case of Dutch elm disease was reported from Alberta in 1998. Pheromone-baited traps continue to collect the smaller European elm bark beetle from several urban locations in the province. A computerized inventory of elms growing in Alberta has been compiled by the Society to Prevent Dutch Elm Disease in Alberta.

The noxious and restricted weed management program carried out several weed control programs in central and southern Alberta. Inventories of weed infestations in the Green Area of the province are being made.

An estimated 83 256 ha were sprayed with Thuricide 48LV® or Mimic 240LV® to control the spruce budworm outbreaks in the province. In the Northwest Boreal Region, unusually cold late spring weather hampered the spray operations; however, these conditions are expected to reduce the budworm populations in 2000. The budworm populations in most of the sprayed areas are expected to be at endemic levels in 2000.

The Forest Health Branch produced two videos and one pamphlet on major forest pests in Alberta. It also published an aerial survey manual and three issues of the "Bugs and Disease Newsletter." The forest health staff conducted several programs to train the forest service and industry personnel on forest health-related topics.

Field trials on Bruce spanworm, black army cutworm and Armillaria root rot were initiated in 1999 by the forest health staff.



INTRODUCTION

This report contains details about the forest pest conditions in Alberta in 1999 and the forecasts on major forest pest conditions in Alberta in 2000. Reported as well, are the details of the noxious and restricted weeds that occur in the forested area (Green Area) of the province. The operational pest management programs carried out in Alberta in 1999 are described in this report. In addition, other forest health-related programs aimed at increasing awareness, technology development and transfer, and training are also described.

The Forest Health Branch is responsible for addressing forest health concerns within the Green Area of the province. This Green Area is administered by 17 forest areas (Note: before 1999, the forest areas were known as forest districts). These forest areas are organized into four forest regions: Northwest Boreal (NWB) Region, Northeast Boreal (NEB) Region, Northern East Slopes (NES) Region and Parkland, Bow, Prairie (PBP) Region (Figure 1).

In 1999, there was a general increase in forest insect pest populations in Alberta. This year, the spruce budworm defoliated area nearly doubled, compared to the budworm defoliated area in 1998. The mountain pine beetle infested few patches of pines in Willmore Wilderness Park, Jasper National Park, and in Banff National Park. The area defoliated by the major aspen defoliators also increased substantially in 1999. For the first time in Alberta, a black army cutworm infestation was reported in 1999 in the NEB Region. This pest defoliated seedlings planted in fire-killed cutblocks. On the contrary, there was no noticeable increase in the major forest diseases in the province.

These pest conditions are due, at least in part, to mild winter conditions followed by another dry spring and a hot summer that occurred in Alberta in 1999. However, unusually cold late spring conditions experienced in the NWB Region are expected to bring some relief in 2000 from the current spruce budworm outbreaks occurring in that area.

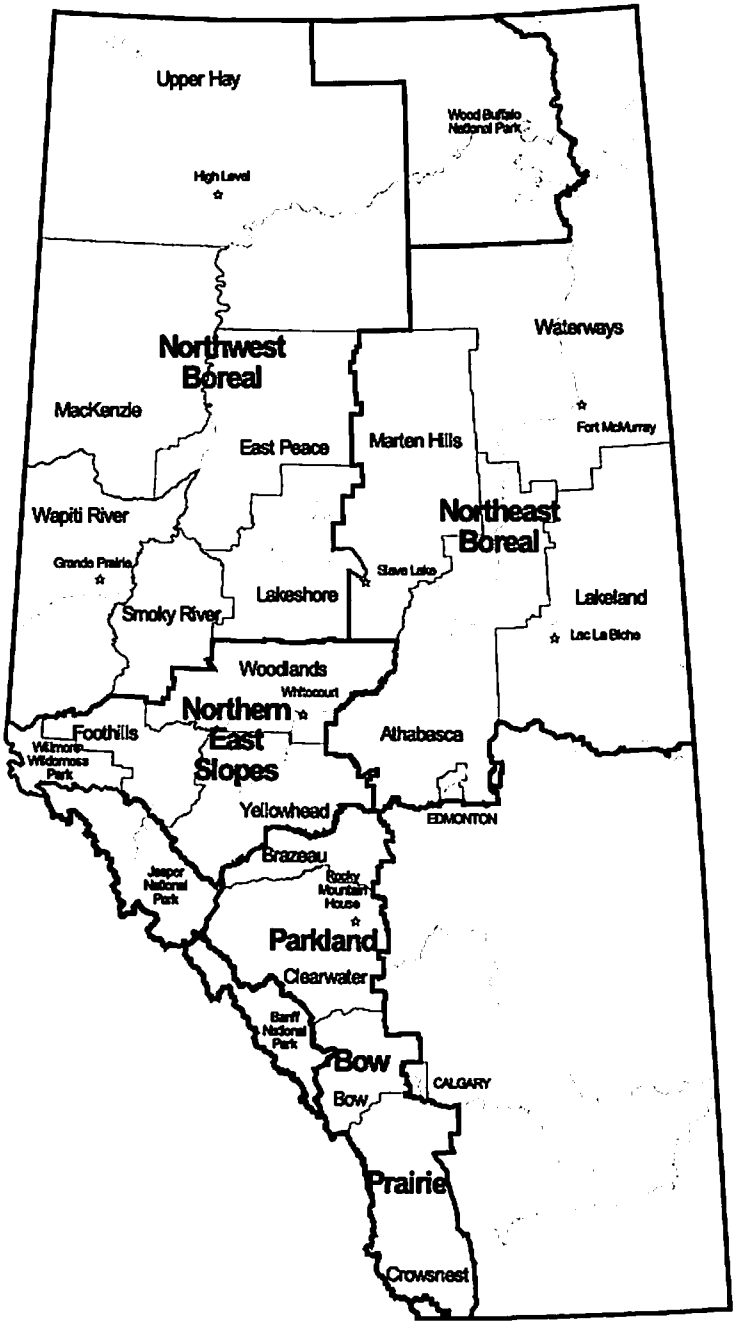
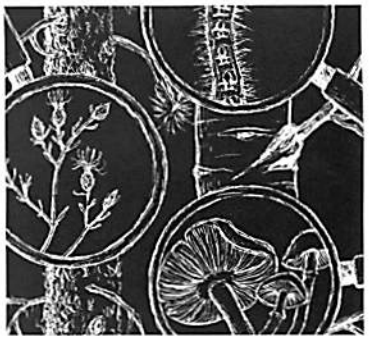


Figure 1. Forest areas and regional boundaries in Alberta, 1999.



PEST CONDITIONS IN 1999 AND PREDICTIONS FOR 2000

CONIFER PESTS

Spruce Budworm

Choristoneura fumiferana (Clemens)

As forecasted in 1998, the extent and severity of spruce budworm defoliation increased in 1999. This year, the spruce budworm defoliated area nearly doubled in size, compared to the area defoliated in 1998. Severity of budworm defoliation increased as well. However, unusually cool and wet weather experienced in late spring in parts of the NWB Region may reduce the extent and severity of budworm defoliation in 2000.

Aerial Surveys on Defoliation

Aerial surveys were carried out in July to map and estimate the extent of spruce budworm defoliated forest stands in the province. The procedure used for these surveys is described in the "Forest Health Aerial Survey Guide." The severity of defoliation was rated as moderate (36% to 70% defoliation) or severe (over 70% defoliation) because light budworm defoliation (i.e., less than 35% defoliation) usually is not visible from the air. The results of the aerial surveys are summarized in Table 1.

Table 1. Spruce budworm defoliated areas in Alberta, 1999

REGION	FOREST AREA	DEFOLIATED AREA (HA)			REMARKS
		Moderate	Severe	Total	
Northwest Boreal	Upper Hay	7395	99 468	106 863	Net Area
	MacKenzie	0	18 043	18 043	Net Area
Northeast Boreal	Athabasca & Waterways[a]	11 261	38 502	49 763	Net Area
	Waterways[b]	7119	9869	16 988	Gross Area
TOTAL		25 775	163 882	191 657	

[a] South of Lattitude 57.6 °N
[b] North of Lattitude 57.6 °N

Northwest Boreal (NWB) Region

Within the NWB Region, the extent and severity of budworm defoliation increased in 1999 as forecasted in 1998. Altogether, the spruce budworm defoliated 124 906 ha of host stands in this region. This is a 50% increase in the defoliated area compared to the defoliated area observed in 1998. Spruce budworm defoliation was severe in almost all (94%) of the affected area; it was moderate in 6% of the affected area.

The moderately defoliated area in 1999 included 128 ha along the Jackpot Creek that were sprayed in 1998. This unusual occurrence is perhaps due to extremely high pre-spray budworm populations (up to 8455 budworms per 10 m^2 of foliage) observed in this area in 1998. In spite of over a 90% population control due to spraying in 1998, the residual population in this stand was high enough to produce a progeny that moderately defoliated the stand in 1999.

In the Upper Hay Forest Area, spruce budworm defoliated 106 863 ha in 1999 compared to 68 931 ha defoliated in 1998. About 93% of this area was severely defoliated and the remainder was moderately defoliated (Table 1). New areas of spruce budworm defoliation were recorded south of the Basset Lake, along the Dizzy Creek and around the Swan Lake. The extent of defoliation increased along the Chinchaga River west of the Paddle Prairie Metis Settlement, along the Peace River south of John D'or Prairie, south of Meander River and along the Hay River from Lutose Creek to the Northwest Territories border. There was resurgence of budworm defoliation in areas sprayed in 1997 along the Negus Creek and the Amber River; similar resurgence was found in areas sprayed in 1996 along the Hay River northwest of Rainbow Lake and northeast of Zama City (Figure 2).

In the MacKenzie Forest Area, the spruce budworm defoliated 18 043 ha in 1999 compared to 13 334 ha defoliated in 1998. All of this area was severely defoliated (Table 1). Most of this defoliation (15 181 ha) was in the Paddle Prairie Metis Settlement. The other areas defoliated were near Hawk Hills (2260 ha) and near Dunvegan Historical Park (35 ha) north of the Peace River (Figure 2).

Northeast Boreal (NEB) Region

The spruce budworm defoliated 49 763 ha in the areas south of latitude 57.6° N in the NEB Region. This is a 54% increase in the defoliated area compared to the area defoliated in 1998. As forecasted in 1998, severity of budworm defoliation increased in this area in 1999. Severe budworm defoliation was observed on 57% of the affected area and moderate defoliation was observed on 43% of the area (Table 1).

The budworm defoliation in the southern part of the NEB Region was mainly found along the Athabasca and House rivers. Within the Athabasca Forest Area, the infestation along the Athabasca River spread from Pelican Rapids in the south to Indian Cemetery in the north. In this forest area, the infestation along the House River spread from township 78 in the south to the Athabasca – House River confluence in the north. Within the Waterways Forest Area, the infestation along the Athabasca River was from Indian Cemetery in the south to the confluence with the Linock River in the north and to Little Cascade Rapids in the east. In addition, spruce budworm defoliation extended along a tributary to the House River towards Algar Lake and north of Grande Fire Lookout. Further north, spruce budworm defoliated areas along the Horse and Algar rivers (Figure 3).

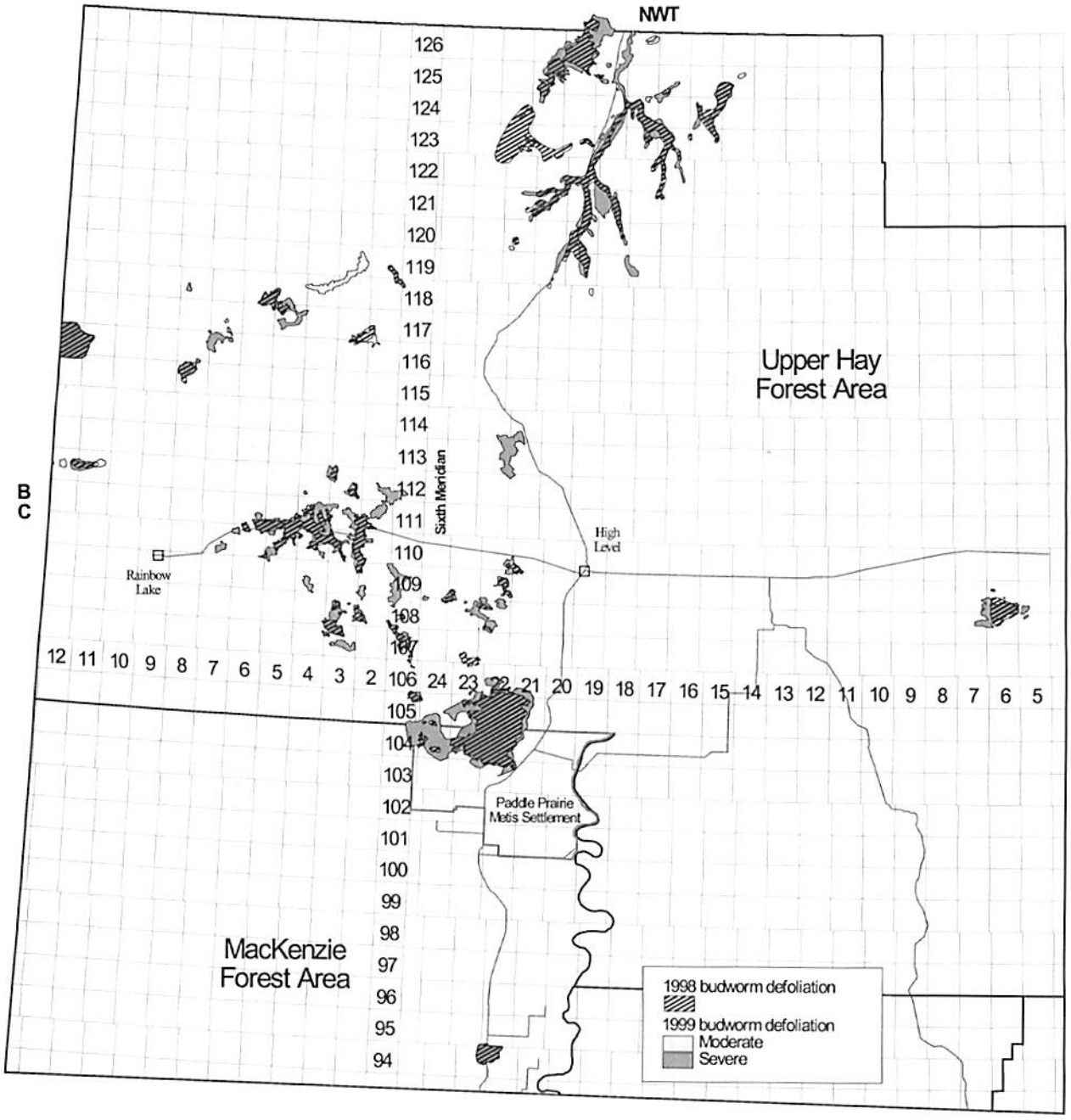


Figure 2. Spruce budworm defoliation in the Northwest Boreal Region of Alberta, 1999.

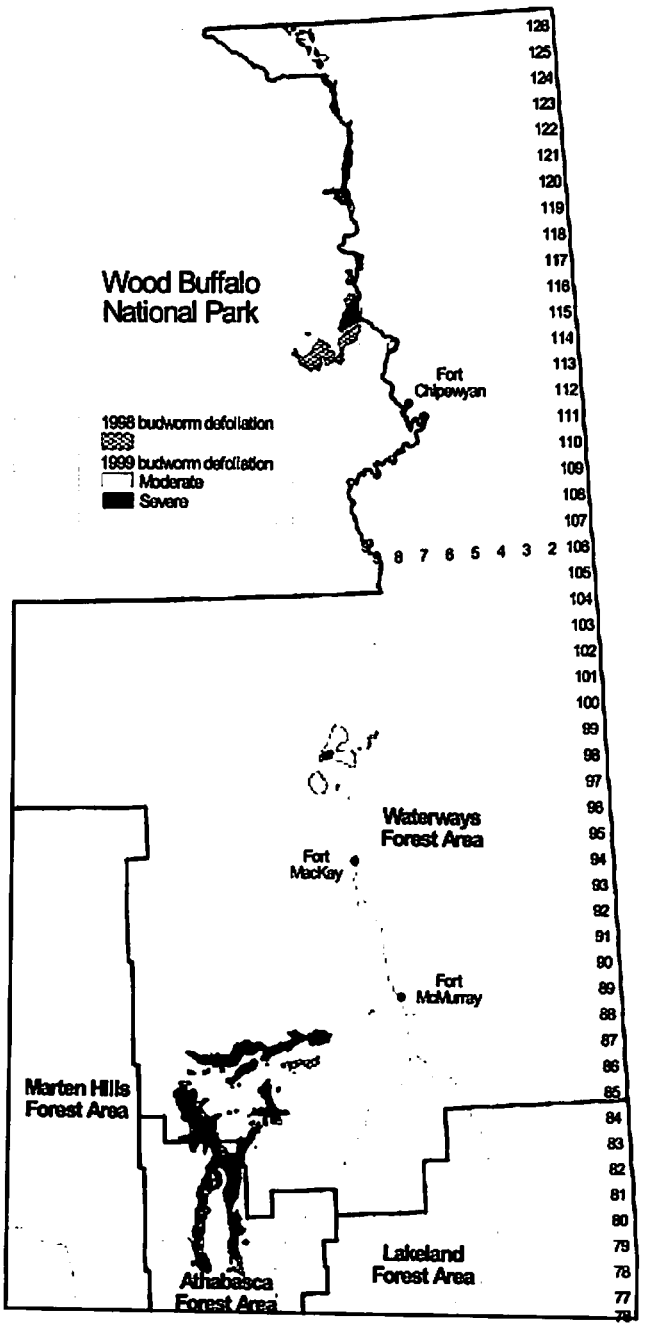


Figure 3. Spruce budworm defoliation in the Northeast Boreal Region of Alberta, 1999.

Two new budworm defoliated areas were detected near the Asphalt and Eymundson creeks north of Fort McKay in the Waterways Forest Area (Figure 3). This defoliated area was estimated to be 6994 ha. Almost all (98%) of this defoliation was moderate. Out of the total defoliated area, 3083 ha were in conifer-dominated stands and the remainder were in deciduous-dominated stands.

In the areas north of latitude 57.6° N in the NEB Region, the gross area of budworm defoliation, (i.e., area including non-host stands scattered within the budworm-defoliated area) was 16 988 ha. Out of this area, 7119 ha had severe defoliation and 9869 ha had moderate defoliation. This defoliation was observed north of Fort Chipewyan along the Peace River within Wood Buffalo National Park (WBNP) and the Slave River bordering WBNP (Figure 3).

Forecast for 2000 Based on Pheromone Trap Catches in 1999

The spruce budworm moth populations in several forest stands located across the Green Area were monitored to forecast severity of budworm defoliation in 2000. These stands are at a high risk of being defoliated by the spruce budworm in the near future. Multi-Pher I® traps baited with female sex pheromone lures were used to monitor the spruce budworm male moth populations. The monitoring procedure is described in the "Spruce Budworm Management Guide."

One hundred and seventy-five monitoring plots were established across the province as follows: PBP Region 12; NES Region 16; NEB Region 28; and NWB Region 119. In the NWB Region, forest companies helped in setting up 52 additional monitoring plots in the forest areas of East Peace (DMI-Brewster Lumber Division and Buchanan Lumber Ltd.), MacKenzie (Canfor - Hines Creek and Manning Diversified Forest Products Ltd.) and Upper Hay (DMI-High Level Lumber Division). The results of this survey are shown in Figure 4.

In the PBP Region, the plots were set up in the forest areas as follows: Brazeau 2; Clearwater 4; Bow 4; and Crowsnest 2. The risk of a budworm outbreak in this region in 2000 is low as indicated by the relatively low trap catches (range: 1 – 30 moths per trap).

In the NES Region, the spruce budworm moth catches ranged from 0 – 5 moths per trap in 10 traps set up in the Foothills Forest Area. However, this appears to be the two-year cycle budworm, *Choristoneura biennis* Free., because the trap catches have been alternating between high and low numbers in consecutive years. Higher trap catches are expected in 2000 in this forest area. In this region, moth catches per trap ranged from 9 – 59 (n = 3) in the Woodlands Forest Area and from 6 – 12 (n = 3) in the Yellowhead Forest Area. The risk of a budworm outbreak is low in this region in 2000.

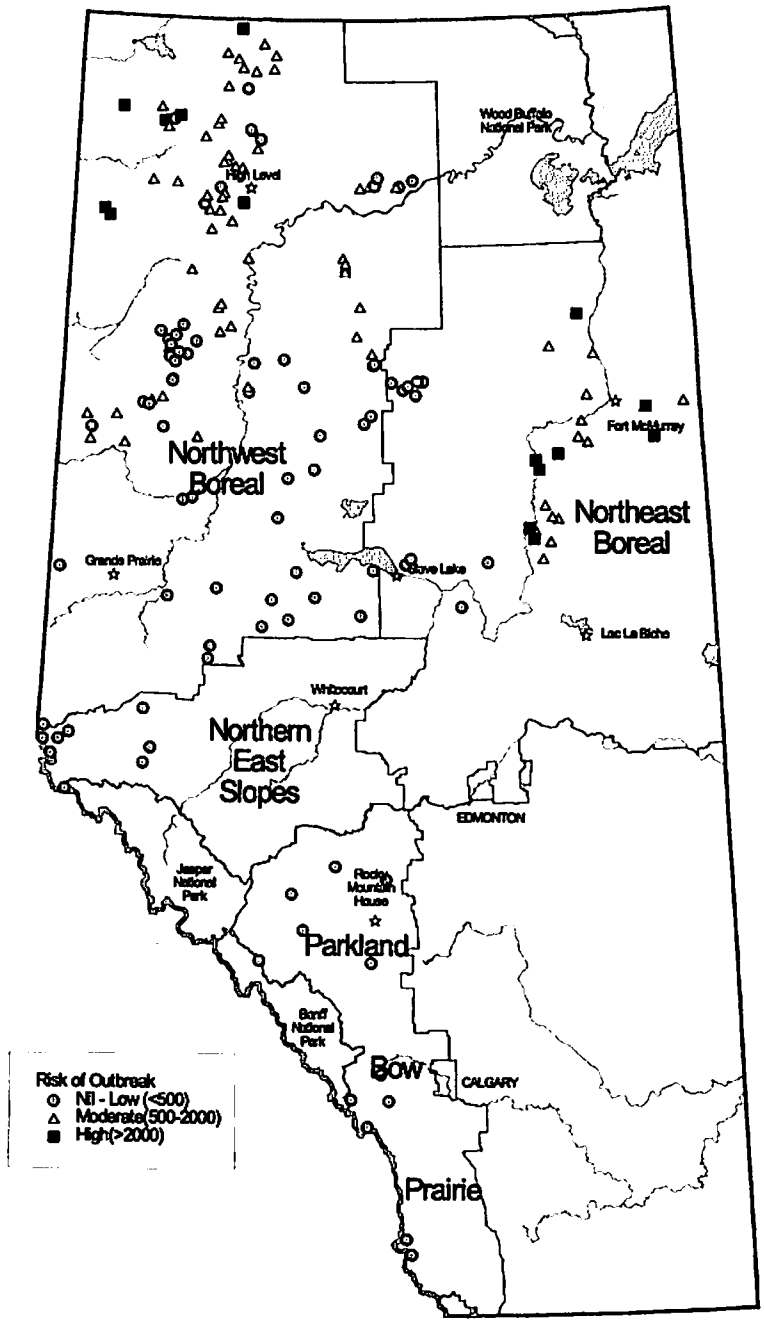


Figure 4. Spruce Budworm moth catches in pheromone-baited traps in Alberta, 1999.

In the NEB Region, 28 trap plots were established. The spruce budworm moth catches per trap ranged from 68 – 176 (n = 4) in the Marten Hills Forest Area of this region. The risk of a budworm outbreak occurring in 2000 is low in this forest area.

In the Athabasca Forest Area, 11 plots were set up. The pheromone trap catches indicated a low risk of spruce budworm outbreaks in two plots (27 – 191 moths per trap); a moderate risk in six plots (565 – 1627 moths per trap); and a high risk in three plots (2001 – 2360 moths per trap). Some plots with moderate to high risk of an outbreak were located south of the current outbreak in this forest area (Figure 4). These areas need to be monitored closely in 2000.

In the Waterways Forest Area, 5 out of 13 plots showed a high risk of an outbreak in 2000 (range: 2072 – 2340 moths per trap); the other eight plots had a moderate risk of an outbreak in 2000 (range: 573 – 1332 moths per trap). Three of the plots with a high risk of an outbreak were located in the vicinity of the current outbreak. However, one of the other two plots with high risk was located along the Clearwater River and the other was located along the Christina River, southeast of Fort McMurray (i.e., far away from the current defoliation). Previous spruce budworm outbreaks have been reported in these areas. The forest stands around these two plots have to be monitored closely for new spruce budworm outbreaks in 2000. Spruce budworm control action has to be contemplated in these areas if second-instar (L_2) counts in 2000 indicate moderate or severe defoliation in 2001 (Figure 4).

In the NWB Region, risk of a budworm outbreak occurring in 2000 is low in the forest areas of Lakeshore with eight plots (34 – 93 moths per trap); Smoky River with five plots (0 – 25 moths per trap); and Wapiti River with five plots (0 – 403 moths per trap).

In the East Peace Forest Area, the risk of a budworm outbreak occurring in 2000 is low although 6 out of 19 trap sites had moth counts indicative of a moderate risk (range: 130 – 565 moths per trap). In this area, two plots along the Wabasca River with a moderate risk of an outbreak should be monitored closely in 2000 because this area had an outbreak about 20 years ago.

The risk of a budworm outbreak occurring in 2000 is low to moderate in the MacKenzie Forest Area with 30 plots (0 – 1735 moths per trap). The moth catches in plots north of Manning, along the Chinchaga River near the Paddle Prairie Metis Settlement and at two new sites near Cleardale and Worseley, indicated a moderate risk of an outbreak in 2000. Out of these plots, those at the new sites have to be monitored closely in 2000.

In the Upper Hay Forest Area there were 58 trap sites. Seven sites had trap catches with a high risk of an outbreak in 2000 (2050 – 3546 moths per trap). Two of these sites were located south of Rainbow Lake, one south of High Level, and the remaining sites were near Zama City and in Cameron Hills. These sites have to be monitored closely in 2000. Thirty-nine sites in this forest area had trap catches with a moderate risk of an outbreak in 2000. Out of these, the sites along the Wabasca River and north of John D'or Prairie have to be watched for potential outbreaks in the near future. The remaining L_2 sites had trap catches indicative of a low risk of an outbreak in 2000 (Figure 4).

According to these survey results, no spruce budworm outbreaks are expected in the PBP Region in 2000. There is a low risk of a two-year cycle budworm outbreak occurring in the Foothills Forest Area in the NES Region in 2000. Risk of new budworm outbreaks has increased in the Waterways Forest Area in the NEB Region. Risk of new outbreaks continues to be high in the Upper Hay Forest Area of the NWB Region.

Forecast for 2000 Based on Second-Instar Larval Survey Results

Second-instar (L_2) surveys were carried out in forest stands that have been defoliated by the budworm during the current outbreak and in their vicinities. The results of these surveys were used to forecast the severity of defoliation expected in 2000. The survey procedures are described in the "Spruce Budworm Management Guide."

In the NWB Region, 214 L_2 plots were established; 66 plots were located in the stands sprayed with pesticides in 1999 for budworm control and the other 148 plots were located in unsprayed stands.

In the MacKenzie Forest Area, all eight plots were located in unsprayed stands. The larval counts in these plots forecast severe defoliation in two plots, moderate defoliation in two plots and light defoliation in four plots in 2000. In this forest area, severity of budworm defoliation is expected to remain high in the northwestern end of the Paddle Prairie Metis Settlement and in Hawk Hills.

In the Upper Hay Forest Area, 66 plots were located in the sprayed stands and another 139 plots were located in unsprayed stands. The larval counts in the unsprayed plots forecast severe defoliation in 28 (20%) plots, moderate defoliation in 39 (28%) plots and nil to light defoliation in 72 (52%) plots in 2000. In this forest area, the percent of plots with nil to light defoliation increased in 1999, compared to 1998. This increase may be attributable to unusually cold and wet conditions experienced in the infested area at the peak of budworm late instars. However, severe budworm defoliation is still expected in Cameron Hills west of Indian Cabins; along the Hay River, Little Rapids Creek, Dizzy Creek and Negus Creek; north of Zama City; along the South Shekelie River; east of the Chinchaga River; and south of the Meander River. Out of the 66 sprayed plots in this forest area, five are expected to have no defoliation and 53 are expected to have light defoliation in 2000. Seven of the remaining sprayed plots are forecasted to have moderate defoliation and the other sprayed-plot is expected to have severe defoliation in 2000.

The single plot located in the East Peace Forest Area is expected to have nil defoliation in 2000.

Overall, the results of the survey forecast a decrease in severity of budworm defoliation in the NWB Region in 2000, although severe budworm defoliation is expected in isolated pockets (Figure 5).

In the NEB Region, 19 L_2 plots were established. In the Athabasca Forest Area, 3 out of 9 L_2 plots were located in sprayed stands. The L_2 counts in these sprayed plots forecast light defoliation in 2000. Out of the six unsprayed plots, two are expected to have light defoliation and the other four plots are expected to have moderate defoliation in 2000. In the Waterways Forest Area, 3 out of 10 L_2 plots were located in sprayed stands. The L_2 counts in these three sprayed plots forecast light defoliation in 2000. Out of the seven unsprayed plots, defoliation is expected to be light in three plots, moderate in two plots and severe in two plots in 2000. Overall, there will be a drop in severity of current budworm defoliation in this region. Nil to light budworm defoliation is expected in the budworm-infested stands sprayed with Thuricide 48LV® in this region (Figure 6).

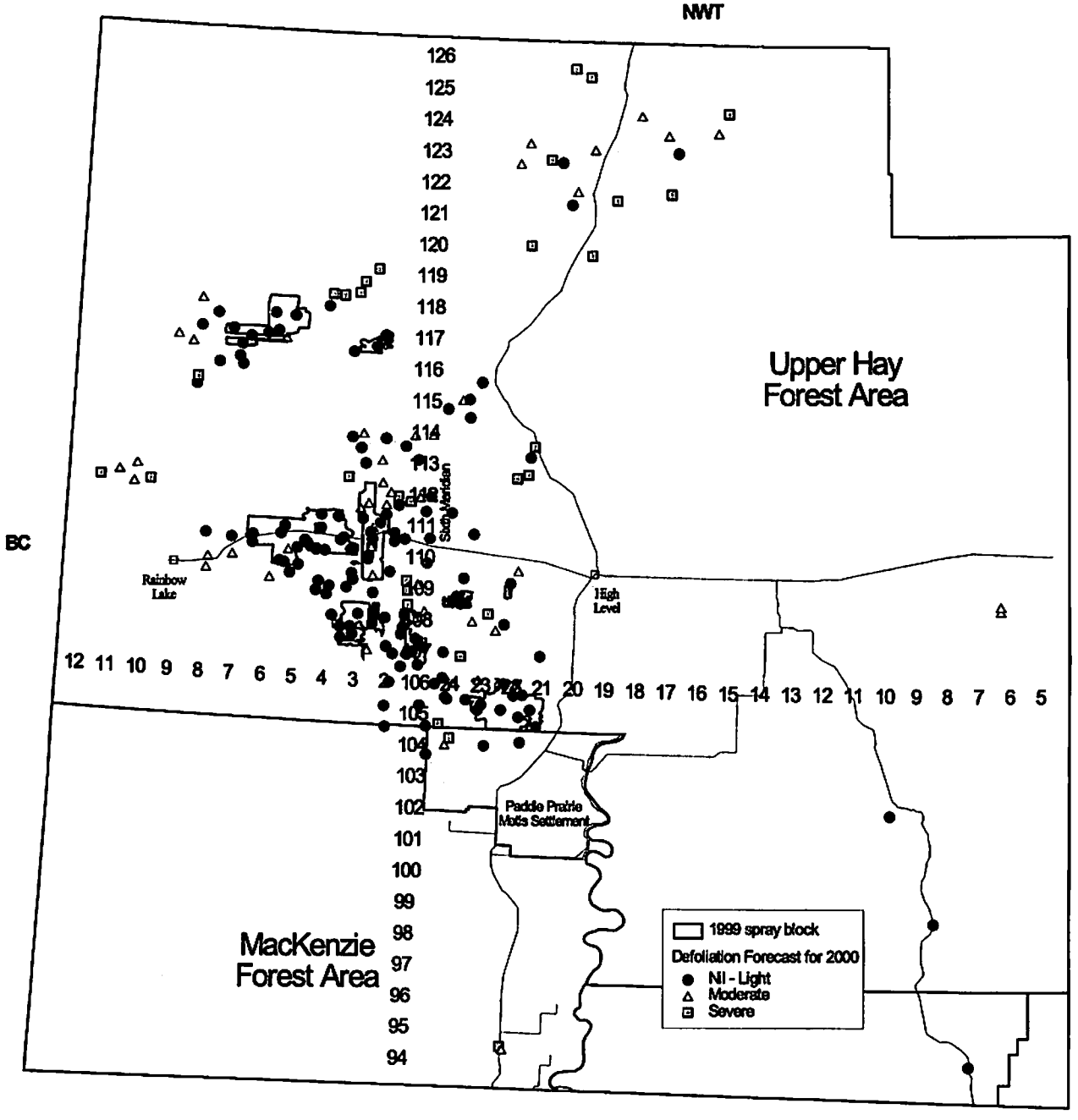


Figure 5. Spruce budworm defoliation forecast for 2000 based on 1999 second-instar larval counts, Northwest Boreal Region, Alberta.

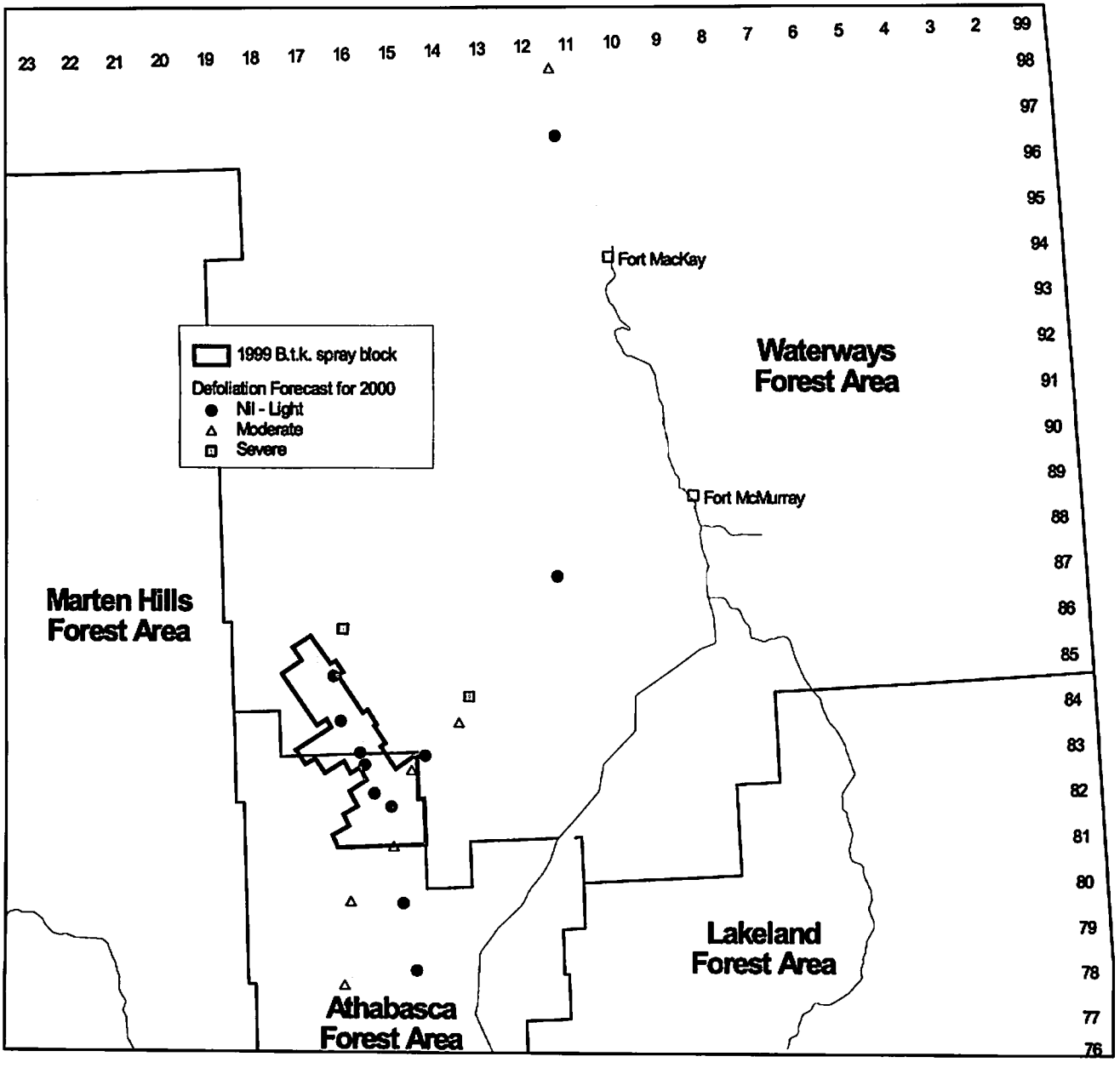


Figure 6. Spruce budworm defoliation forecast for 2000 based on 1999 second-instar larval counts, Notheast Boreal Region, Alberta.

Mountain Pine Beetle

Dendroctonus ponderosae Hopkins

Aerial Survey

In the spring and in the fall, the Green Area in southwestern Alberta was surveyed to detect mountain pine beetle (MPB) infestations. A rotary-wing aircraft (Bell 206 Long Ranger®) was used for these surveys carried out by the Regional Forest Health Officers in NES and PBP regions. The surveys mainly covered river valleys in the foothills bordering BC and in Banff and Jasper national parks.

In the PBP Region, no MPB infestations were detected within the Green Area. However, in Banff National Park, few small "red patches" symptomatic of MPB infestations were found along the Healy and Brewster creek drainages. Altogether, an estimated 75 trees are infested along the Brewster Creek. Active MPB infestations have been reported along Palliser and Cross rivers in BC close to Alberta-BC border. These infestations are located near Peter Lougheed Park in Alberta.

In the NES Region, five small patches of beetle-infested trees were reported in the Jackpine Pass in Willmore Wilderness Park (Figure 7). Trees with possible MPB attacks were observed down valley from Smokey Cabin and on Lake Twintree shore in Jasper National Park, close to the Willmore Wilderness Park border. Logging of the MPB infestation along the Holmes River in BC, about five km southwest of Willmore Wilderness Park, is expected to begin in 2000.

Survey with Pheromones

In southwestern Alberta, lodegpole pine stands with a high risk of becoming infested with MPB were monitored for beetle activity. A two-component aggregation pheromone bait was used. The procedure for deploying these pheromone baits is described in "Mountain Pine Beetle Pheromone Monitoring Sampling Manual 1998." Fifty-six plots were established to monitor MPB activity in southern Alberta in 1999. The results of this survey are summarized in Figure 7.

In the PBP Region, 2 out of 21 plots in the Crowsnest Forest Area had beetle-hits. The number of beetle-hits ranged from 1 to 3 per tree, a decrease compared to the number of beetle-hits per tree observed in 1998. None of these attacks was successful. In the Bow Forest Area, 4 out of 11 plots had beetle-hits. The number of beetle-hits per tree ranged from 3 to 24 per tree; this is similar to the level of attack observed in 1998. None of the six plots located in the Clearwater Forest Area had any beetle-hits. All the trees with successful beetle-hits in these forest areas will either be debarked or burned before the next spring.

In the NES Region, there were beetle-hits in 11 out of 16 plots located close to the BC border in Willmore Wilderness Park in the Foothills Forest Area. Twenty-eight beetle-attacked trees at these sites are scheduled to be cut and burned in the fall of 1999. There were no beetle-hits in the five plots located in the Yellowhead Forest Area of this region.

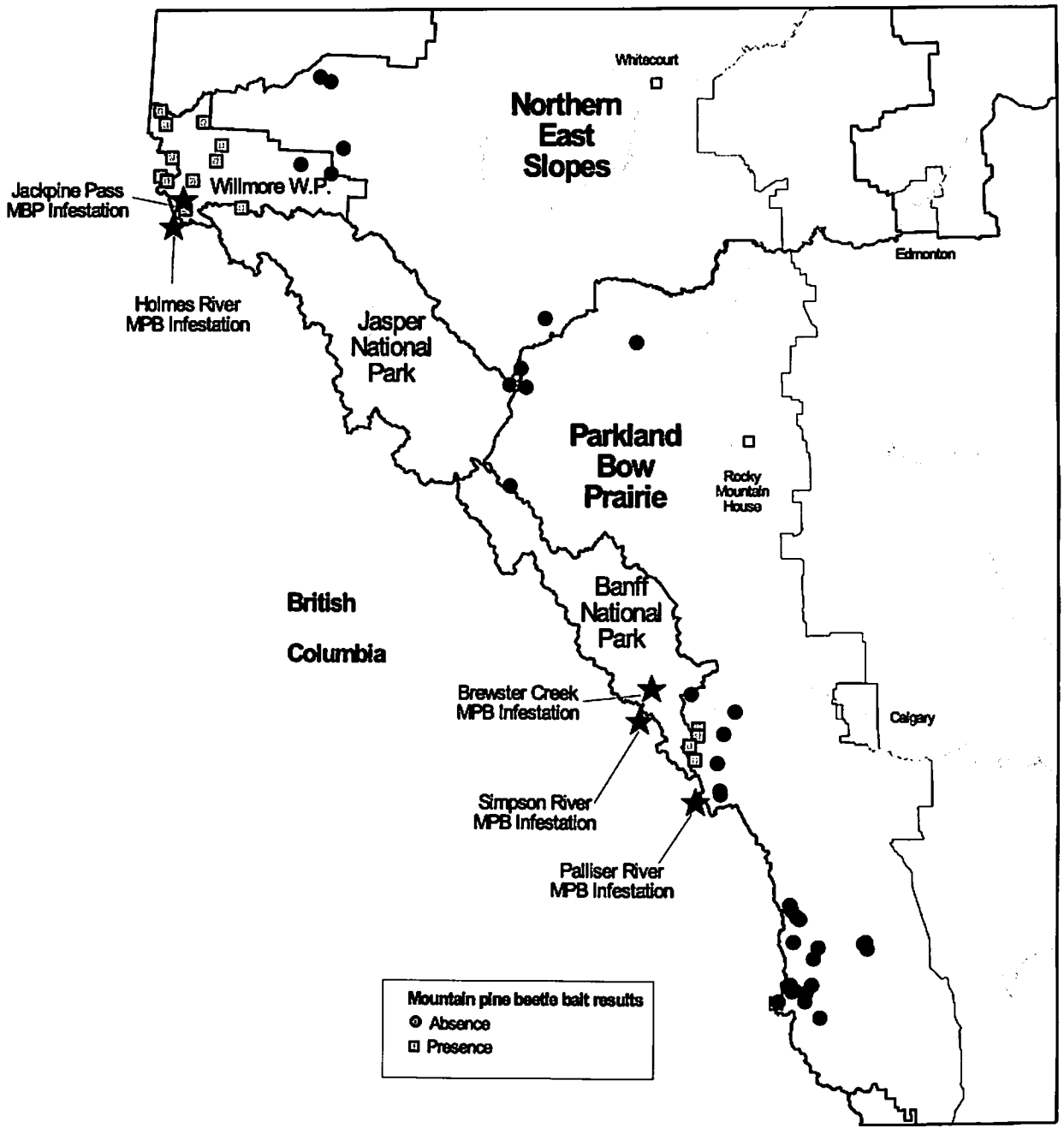


Figure 7. Mountain pine beetle infestations and beetle-hits in pheromone-baited plots in Alberta, 1999.

Larch Sawfly

Pristiphora erichsonii (Hartig)

The larch sawfly continued to defoliate tamarack *[Larix laricina* (Du Roi) K. Koch] in the Upper Hay Forest Area of the NWB Region. The area of defoliation was not estimated in 1999. This is the third consecutive year of larch sawfly defoliation observed in this area.

Pine False Webworm

Acantholyda erythrocephala (Linnaeus)

In 1999, pine false webworm populations in Edmonton declined, compared to 1998. This reduction is likely due to the return of normal cold winter conditions after the mild winters experienced in 1997 and 1998.

DECIDUOUS PESTS

Forest Tent Caterillar

Malacosoma disstria Hübner

The forest tent caterpillar defoliation in northwestern Alberta increased significantly in 1999, compared to 1998. In the NWB Region, the "gross" area with forest tent caterpillar defoliation was 584 260 ha in 1999, compared to 104 103 ha of defoliation recorded in 1998. Within this area, defoliation was severe over 489 700 ha, moderate over 93 431 ha, and light over 1129 ha. This tent caterpillar defoliation was observed around Peace River, Manning, Fairview, High Prairie and south of Grande Prairie (Figure 8). This defoliation affected some areas covered by the Forest Management Agreements (FMA) of Daishowa-Marubeni Industries (DMI), Tolko and Weyerhauser Canada.

In the NEB Region, the forest tent caterpillar remained endemic. The forest tent caterpillar defoliation in this region was confined to a small, lightly defoliated patch near Muriel Lake in the southeastern corner.

Satin Moth

Leucoma salicis (Linnaeus)

In Edmonton, 103 new satin moth infestations were detected in 1999. This is a slight decrease compared to 145 new infestations detected in the city in 1998. The satin moth primarily fed on ornamental poplar species. This pest, first detected in 1994 in Northwest Edmonton, is now believed to be firmly established in Edmonton and surrounding communities.

In 1999, the Pest Management Regulatory Agency approved minor use of Ambush® 500 EC (permethrin) for satin moth control. This year, personnel from the City of Edmonton initiated field trials on the use of Mimic® 240LV for satin moth control.

A braconid parasitoid *(Cotesia melanoscela)* has been observed in many satin moth larvae in Edmonton. However, this parasitoid does not attack late instars of satin moth and suffers from a high degree of hyperparasitism.

In 1999, the Land and Forest Service of Alberta Environment funded a research project by Dr. Gerhard Gries of Simon Fraser University to formulate satin moth pheromone for trapping purposes.

Large Aspen Tortrix

Choristoneura conflictana (Walker)

In 1999, the large aspen tortrix continued to defoliate aspen stands in central and northwestern Alberta, for the third consecutive year. In the NWB Region, the "gross" area defoliated by the large aspen tortrix and Bruce spanworm was estimated to be 775 497 ha (Figure 8). This area had mostly severe defoliation (542 909 ha), some moderate defoliation (192 880 ha) and little light defoliation (39 708 ha). Large aspen tortrix defoliation in the NWB Region was observed south of Lesser Slave Lake, near Valleyview, north and west of Grande Prairie, along the Peace River, north of Fairview, and east of Shell Hamburg. In addition, large aspen tortrix defoliated areas in the Upper Hay Forest Area. However, the defoliation in this forest area was not mapped. Light defoliation was reported near Adair Lookout Tower, southwest of High Level, and north and west of Zama Lake-Hay River area. Severe large aspen tortrix defoliation was reported from areas near Fort Vermillion and the confluence of the Chinchaga and Hay rivers (Figure 8). In the NES Region, the large aspen tortrix defoliated an estimated 4700 ha near Whitecourt (Figure 9).

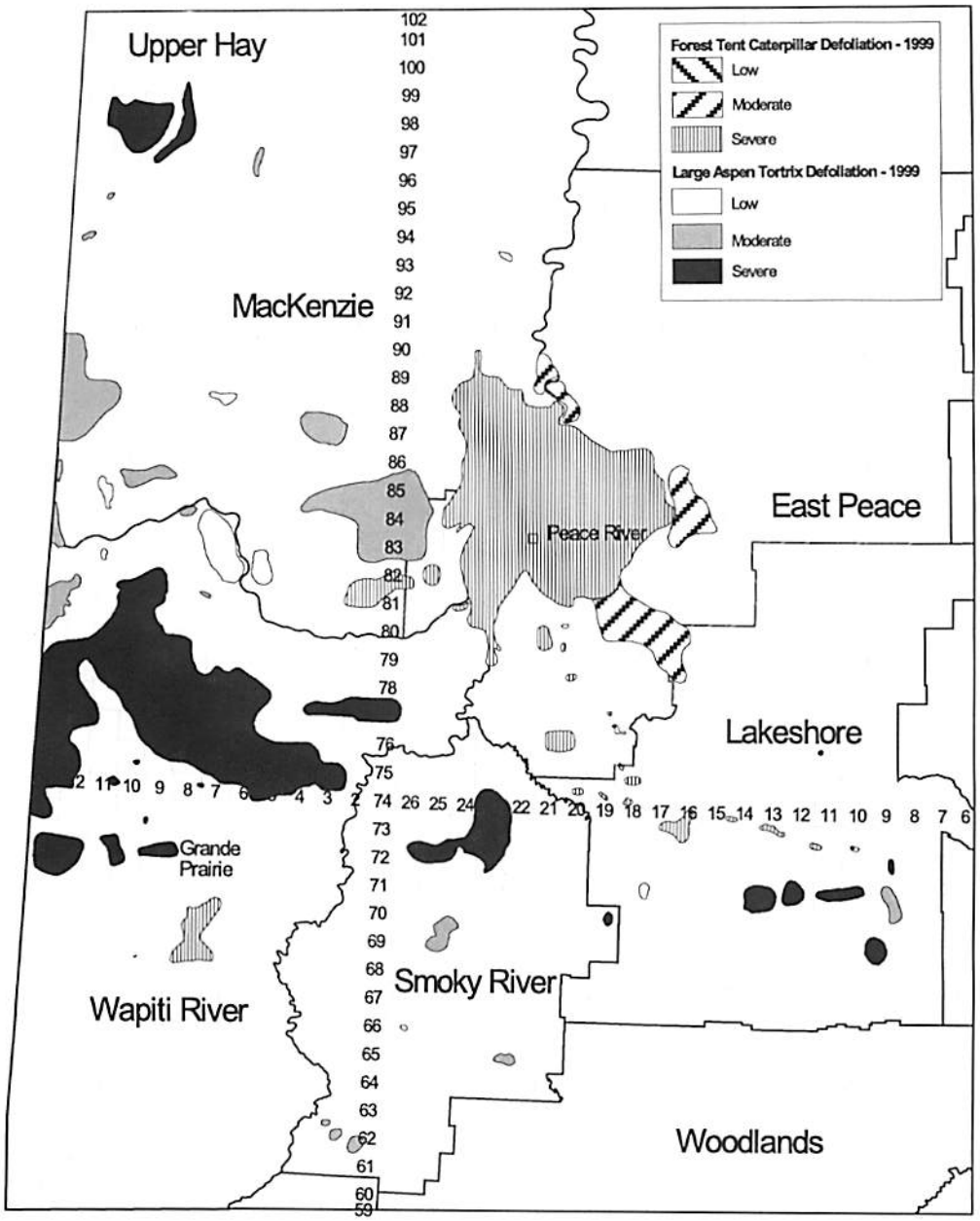


Figure 8. Areas defoliated by broadleaf-defoliators in the Northwest Boreal Region, Alberta, 1999.

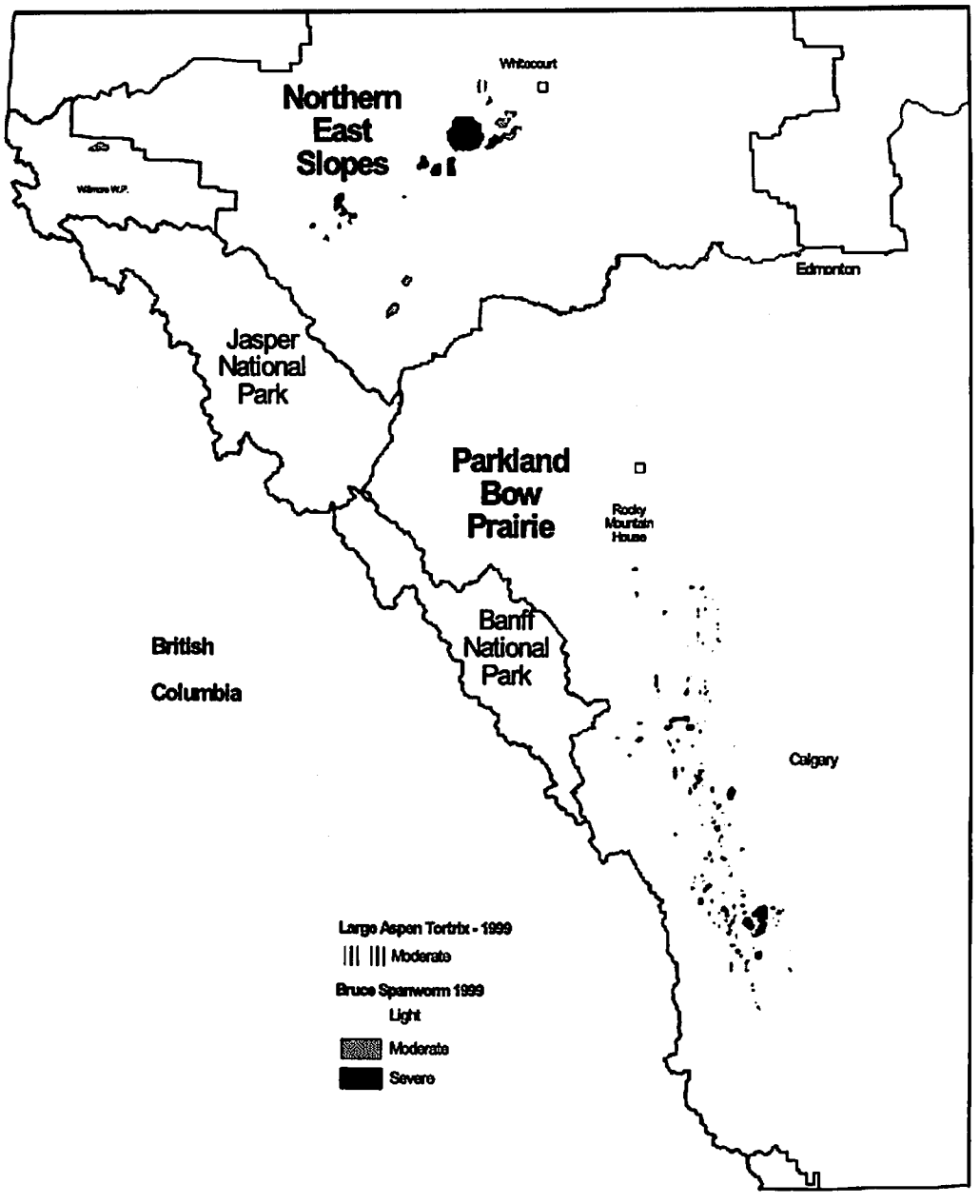


Figure 9. Areas defoliated by broadleaf-defoliators in the eastern slopes of Alberta, 1999.

Bruce Spanworm

Operophtera bruceata (Hulst.)

Bruce spanworm defoliation in western Alberta expanded during 1999. It was widespread in the NWB Region (see above). In this region, Bruce spanworm defoliation was observed near the Smoky Lookout Tower, east of Saddle Hills and north of Sexsmith. In the NES Region, either moderate or severe Bruce spanworm defoliation was recorded over 64 000 ha (Figure 9). In the PBP Region, Bruce spanworm defoliation was widespread, but was more pronounced in the Bow Forest Area (Figure 9). Bruce spanworm defoliation was light over an estimated 1745 ha and severe over an estimated 42 236 ha in the PBP Region.

Black Army Cutworm

Actebia fennica Tauscher

An outbreak of the black army cutworm was recorded for the first time in Alberta in the summer of 1999. This outbreak occurred in the NES Region following a large-scale fire that burned approximately 170 000 ha in May. The infestation was scattered throughout the burned area. However, the extent of black army cutworm-defoliated area was not estimated. The black army cutworm consumed the annual vegetation as well as conifer seedlings in many recently planted, fire-killed cutblocks. Seedlings planted in 1998 had light to severe defoliation whereas those planted in 1999 had light to moderate defoliation.

Gypsy moth

Lymantria dispar (Linnaeus)

The Land and Forest Service of Alberta Environment set up 47 Disparlure®-baited Delta traps as part of the annual gypsy moth survey conducted by the Canadian Food Inspection Agency. Altogether, 500 gypsy moth traps were set up across the province by various co-operating agencies. In 1999, no gypsy moths were trapped in Alberta.

Birch Leafminers

Profenusa thomsoni (Konow) &
Fenusa pusilla (Lepeletier)

The researchers of the City of Edmonton introduced an ichneumonid wasp *(Lathrolestes nigricollis)* a parasitoid of *F. pusilla,* to control this pest. This parasitoid spread rapidly providing effective biological control of this leafminer sp. Another introduced ichneumonid wasp *(L. luteolator),* is credited with controlling the amber-marked birch leafminer outbreak in the city.

Dutch Elm Disease (DED)

Ophiostoma ulmi (Buis.) *Nannf.*

The first reported case of DED in Alberta was confirmed from samples collected in 1998 from an elm tree in Wainwright. The pathogen was identified to be *Ophiostoma nova-ulmi* Brasier, the most virulent strain of the DED fungus. In 1999, thirty-five other suspected samples collected from different locations within the province were tested for the DED fungus; the test results were negative.

The smaller European elm bark beetle (SEEBB), *Scolytus multistriatus* (Marsham) — one of the vector species of DED — has been found in Alberta on a recurring basis. These beetles have been trapped every year from 1994 to 1999 in Calgary; from 1995 to 1999 in Edmonton; and from 1998 to 1999 in St. Albert near Edmonton and in Medicine Hat in southeastern Alberta. The number of SEEBB trapped in Edmonton and Calgary in 1999 was lower than the number trapped in 1998. Previously, SEEBB has been trapped in Vauxhall and High River in southern Alberta. The other vector of DED, the native elm bark beetle (*Hylurgopinus rufipes* Eichh.) has not been trapped to-date in Alberta.

In 1998, the Society to Prevent Dutch Elm Disease (STOPDED), a non-profit organization established to protect and preserve Alberta's elm trees from DED, commenced working on a site-specific elm inventory for the province. This inventory contains the geographical distribution, tree condition and value of elms in Alberta. This computerized elm tree inventory now contains data on 219 934 elms valued at $634 million growing in urban areas of Alberta.

Other Noteworthy Pests

The Warren root collar weevil (*Hylobius warreni* Wood) caused significant young stand mortality in the PBP Region. These weevils attacked mature pine trees as well in the Bow Forest Area within this region.

Red belt was prevalent along the eastern slopes in the NES Region.

Elytroderma needle cast *(Elytroderma deformans* (Weir) Darker) was widespread within the NES Region as well.

NOXIOUS AND RESTRICTED WEEDS

PROVINCIAL

In 1999, the provincial weed management program focussed on education and increased awareness, inventory surveying and control. Provincially, the Land and Forest Service Weed Working Group was formed to bring regional weed management staff together to enhance the weed management program. This move was necessary to co-ordinate provincial projects and establish provincial standards in view of the variety of weed species, stakeholders and management practices found among the forest regions.

REGIONAL

Northern East Slopes (NES) Region

In the NES Region, the weed management program composed of:

- Education and Awareness
- Inventory
- Control

Education and Awareness

The Northern East Slopes Weed Awareness Group composed of representatives from Municipal Districts (Big Lakes, Brazeau, Greenview, Woodlands and Yellowhead), LFS and Alberta Agriculture, Food and Rural Development held a weed awareness workshop in April. Sixty-five persons representing oil and gas companies, utility companies, forest industry, and Alberta Infrastructure attended this meeting. The feedback received from the attendees was positive due to the wide range of relevant topics covered at this workshop.

Inventory

A weed technician was hired for each of the three forest areas within the forest region for the 1999 field season. The technician was responsible for weed inventory within the respective forest area. The weed surveys in the Woodlands Forest Area identified Canada thistle *(Cirsium arvense* L.*)* and scentless chamomile *(Matricaria maritima* L.*)* as the most abundant weeds in the area. In the Yellowhead and Foothills forest areas, tall buttercup *(Ranunculus acris* L.*)* and ox-eye daisy *(Chrysanthemum leucanthemum* L.*)* were the most abundant species. The Land and Forest Service of Alberta Environment continued to work closely with the municipal districts and counties in the region on inventory initiatives.

Control

In 1999, nineteen Crown sites were sprayed with herbicides to control noxious weeds in the NES Region. At these sites a contractor sprayed approximately 25 ha with Lontrel®, a post-emergence, systemic herbicide that selectively controls broadleaf plants. Within the Woodlands Forest Area, the Whitecourt Mountain Genetic Site was the only site sprayed. The remaining 18 spray-sites were located within the Foothills Forest Area at William Switzer Provincial Park, Mason Creek Recreation Area, Berland Recreation Area, Wildhay River Group Camp Area, Rock Lake Recreation Area, Wildhorse Lake Recreation Area, Cache Percotte Forest, Simonette Lookout Tower and Mumm Creek Corral.

Parkland, Bow and Prairie (PBP) Region

In the PBP Region, the weed management program composed of:

- Inventory
- Control

Inventory

The extent of weed infestations in the PBP Region increased in 1999. This increase can be attributed to an improved inventory and covering of a wider area extending into the backcountry. Input from associated municipal districts, disposition holders and educated public has further expanded the current inventory.

In the Brazeau Forest Area 1386 km of trails were surveyed. In the Clearwater Forest Area approximately 103680 ha were surveyed. In the Bow Forest Area, Alberta Environment funded surveys completed by the Natural Resources Service (NRS) in Kananaskis Country and in the Green Area north of the Bow River to the Red Deer River. The Crowsnest Forest Area stands alone, as it has a reasonable inventory of all weed infestations in the area. In this forest area, 1086 ha within the Green Area are infested with restricted and noxious weeds. Tall buttercup (*Ranunculus acris* L.), ox-eye daisy (*Chrysanthemum leucanthemum* L.), scentless chamomile (*Matricaria maritima* L.), Canada thistle (*Cirsium arvense* L.) and blueweed (*Echium vulgare*) are among the most common weed species in the region.

Control

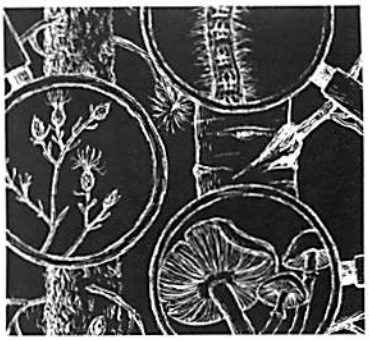
The spray contractors and Alberta Environment controlled weeds on unoccupied Crown land within the Green Area of the PBP Region. In the Clearwater Forest Area, Alberta Environment, disposition holders, grazing lease holders and the municipal districts co-operated to manage noxious weeds over 235 ha in multiple use areas. In the Bow Forest Area, the department funded the NRS to control weeds in the priority areas identified in their surveys. Several park areas adjacent to the Green Area were treated, including 22 ha of Canada thistle and leafy spurge. In the Crowsnest Forest Area, control efforts concentrated on new infestations, and a "contain and control" approach was taken where infestations are established. In this area, Alberta Environment, disposition holders, and municipal districts co-operated to proactively manage weeds at the landscape level. The only restricted weed found and controlled in the province this year was knapweed *(Centaurea* sp.*)* infesting 2.4 ha in the Municipality of Crowsnest. The following herbicides were used to control noxious and restricted weeds in the PBP Region: 2, 4-D, Banvel®, Dycleer®, Escort®, Sylgard®, Tordon 22K® and Tordon 101®. In sensitive areas where herbicide use is restricted or where some small infestations were found, weeds were hand-pulled. This year, there was no weed control in the Brazeau Forest Area.

Northwest Boreal (NWB) Region

In the NWB Region, the weed management program was limited to taking inventories of noxious and restricted weeds. These inventories were conducted in the Mackenzie, East Peace and Smoky River forest areas. Scentless chamomile *(Matricaria maritima* L.*)* was the main species found in the surveys. Within the Mackenzie Forest Area, scentless chamomile was found along portions of the Chinchaga Forestry Road and in areas near Worsley and Hines creeks. Within the East Peace Forest Area, scentless chamomile was found in areas near Seal Lake, Red Earth and Kimiwan Fire Lookout. In the Smoky River Forest Area, patches of scentless chamomile were found along the Simonette River and mayweed *(Anthemis cotula* L.*)* was recorded within some well-sites south of Sturgeon Lake.

Northeast Boreal (NEB) Region

In the NEB Region, the weed management program was limited to taking inventories of noxious and restricted weeds. Five weed technicians were hired to commence the weed inventories and to determine the severity of weed problem in the region. Next year, the focus of the regional program will be to establish the goals and objectives, increase public and industry awareness and to develop a plan for program implementation.



PEST MANAGEMENT OPERATIONS

INTRODUCTION

The current spruce budworm outbreak in Alberta was first recorded in 1987. Aerial spraying of pesticides to control this outbreak commenced in 1989 and continued up to this year. This spray program has succeeded in reducing increment growth losses and in keeping affected trees alive by reducing budworm defoliation in the sprayed areas.

The forest stands selected for spraying in 1999 were forecasted to have over 35% defoliation, based on the results of second-instar (L_2) surveys carried out in 1998. The objective of this spraying was to reduce increment growth losses and to keep the infested trees alive by reducing the budworm populations to endemic levels (i.e., limit future defoliations to less than 35%).

In 1999, Thuricide 48LV®, and Mimic 240 LV® were aerially sprayed to manage the spruce budworm outbreaks in Alberta. The details of this spray program are summarized in Table 2.

Table 2. Use of pesticides to manage spruce budworm outbreaks in Alberta, 1999

Pesticide	NWB Region		NEB Region		Total	
	Litres	Hectares[c]	Litres	Hectares[c]	Litres	Hectares[c]
Thuricide	210 073[b]	47 617	72091[b]	22707	282 164[b]	70324
Mimic	3755[a]	12 932	N/A	N/A	3755[a]	12 932
Total	N/A	60 549	72 091	22 707	N/A	83 256

[a]Litres of Mimic prior to mixing with water; 25 895 L of mixed product (0.290 L Mimic to 1.71 L water) was sprayed.

[b]Litres of undiluted Thuricide recorded from pump readings.

[c]Area calculated from the final spray summary report in FIRES program.

NORTHWEST BOREAL (NWB) REGION

Public Awareness

The general public and other stakeholders were kept informed about the spruce budworm management program by:

- advertisements in the local newspapers (The Echo, The Northern Pioneer, The Mackenzie Report, and The Banner Post);
- drop-in sessions held at High Level, Meander River, Rainbow Lake and Zama City; and
- signs posted along Highway 58 and at various points of access to the spray area.

In spite of this publicity, attendance by the general public was poor for these drop-in sessions.

Phenological Observations

Spruce budworm and spruce bud development in relation to the accumulation of daily heat units (degree-days) were monitored to determine the optimum timing for aerial spraying. For this purpose, three phenology sample plots were established in mid-May in areas slated for spraying. The sampling procedures are described in the "Spruce Budworm Management Guide." The number of degree-days accumulated from April 1 was calculated by using the weather data recorded at the High Level Airport. The rate of degree-day accumulation in 1999 was the lowest in any year between 1990 to 1999.

The spruce budworm larvae were spray ready (near the peak of fifth-instar) by June 11 (i.e., about one week later than usual). This is mainly due to the unusually cold, near or below zero-degree weather experienced in the spray blocks during the second week of June. Between June 8 – 14, the minimum temperatures in the Mimic spray blocks ranged from zero to -4.0 °C; minimum temperatures in the Thuricide spray blocks ranged from zero to -1.0 °C. These cold temperatures also slowed down spruce bud growth.

Prespray Sampling

A prespray sampling was carried out between May 31 and June 3 to confirm the abundance of budworms in the stands slated for spraying. Forty-three sample plots were established as follows: 23 plots were located in the stands slated for Thuricide 48 LV spraying; nine check plots were located in comparable stands located near Thuricide-sprayed stands. Seven plots were located in stands slated for Mimic 240 LV spraying; four check plots were located in comparable stands. Out of the 43 plots, four plots (three check plots and one later sprayed with Thuricide once) had budworm populations that would have caused moderate defoliation if left untreated; the other 39 plots had populations that would have caused severe defoliation. The average prespray counts in Thuricide-sprayed plots were 2201 budworms per 10 m^2 of foliage. The highest count in the Thuricide-sprayed plots was 23 210 budworms per 10 m^2 of foliage. This is the highest budworm population density recorded to-date in Alberta. The average prespray count in Mimic-sprayed plots was 3366 budworms per 10 m^2 of foliage; the highest count in these plots was 17 778 budworms per 10 m^2 of foliage.

Aerial Spray Operations

Insecticides

Two insecticides were used in 1999 to control the spruce budworm in this region. Thuricide 48LV® was the main spray product. This is an insecticidal formulation of a naturally occurring bacterium, *Bacillus thuringiensis* var. *kurstaki* (Btk). An estimated 210 073 litres of Thuricide were sprayed on seven spray blocks under this program. In addition, Mimic 240LV® was sprayed over two spray blocks (Figure 10). This is a chemical insecticide that mimics the action of an insect growth regulatory hormone. Both of these insecticides are highly specific in action to caterpillar pests thus minimizing their effect on non-target organisms.

Laboratory bioassays first conducted by the Microbiology Laboratories, Quebec Ministry of Natural Resources, showed that 78% of the randomly chosen Thuricide samples had marginal potency. However, subsequent testing of these samples by the manufacturer and another independent laboratory showed that the potency requirements were met. All the Thuricide samples tested met the acceptable level of contaminants.

Spray Area

In 1999, an estimated 60 549 ha were sprayed for spruce budworm control in the NWB Region (Figure 10). The sprayed area was divided into nine spray blocks. Out of this area, 47 617 ha in seven blocks were sprayed with Thuricide. Thuricide was sprayed undiluted at the rate of 30 BIU/ha (2.36 L/ha) twice over 41 067 ha and once over an additional 6550 ha. Mimic was sprayed over the remaining two blocks once at the rate of 70 g a.i/ha (i.e., 0.290 litres Mimic mixed with 1.710 litres of water per ha) over 12 932 ha.

Spray Aircraft

Nine spray aircraft operating in three groups (three Ayers Thrush S2Rs, three Air Tractor 502Bs and three Air Tractor 401s) were used in this year's spray program. Each group of spray aircraft was accompanied by a fixed-wing pointer aircraft (Cessna 172, Cessna 182RG, and Cessna 182 respectively) carrying a forest officer who monitored the spray operation. Each AT S2R and each AT 401 aircraft was fitted with six Micronair AU4000® atomiser nozzles. Each AT 502 B aircraft was fitted with eight Micronair AU4000 atomiser nozzles. Each spray aircraft was equipped with a Satloc Forestar® Global Positioning System that guided the pilot and electronically recorded the spray lines. The technical details of these aircraft are given in Appendix II.

Aerial Spraying

The aerial spray operation was carried out between June 11 and June 18 from the Mobil 11-28 Airstrip (NW-28-109-06-W6) southwest of Rainbow Lake. The details of spray weather conditions are given in Appendix III. The details of aerial spraying are given in the "1999 Northwest Boreal Region Spruce Budworm Management Program" report.

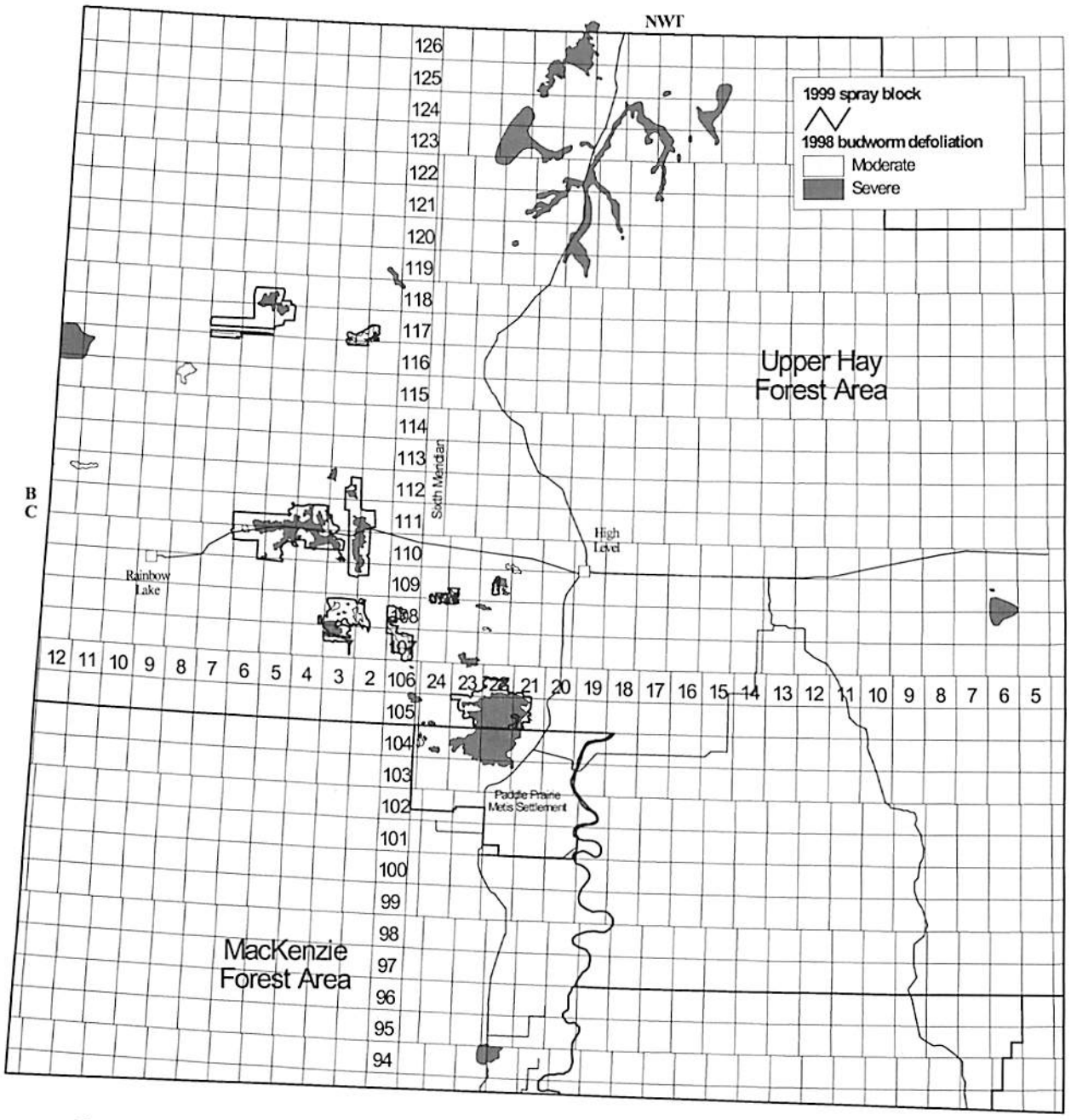


Figure 10. Aerial spary blocks in 1999, in relation to 1998 budworm defoliation in the Northwest Boreal Region in Alberta.

Efficacy of Aerial Spraying

In the fall, an L_2 survey was carried out to determine the effectiveness of aerial spraying in reducing the future budworm populations. Sixty-six L_2 plots were established in the sprayed blocks. In the nine plots sprayed once with Mimic, the mean L_2 populations forecasted nil defoliation in two plots and light defoliation in the other seven plots in 2000. However, three of the corresponding check plots also had similar reductions in mean L_2 populations; the other check plot had populations that forecasted moderate defoliation in 2000. This reduction of budworm population in the check plots may be attributed to unusually cold prespray temperatures recorded in the Mimic blocks.

Out of the 10 L_2 plots that were sprayed once with Thuricide, eight had L_2 counts that forecasted light defoliation in 2000, one had counts that forecasted moderate defoliation and the other had counts that forecasted severe defoliation in 2000. In comparison, the check plot had L_2 counts that forecasted light defoliation in 2000.

The L_2 counts of the 47 plots sprayed twice with Thuricide forecasted nil defoliation in three plots, light defoliation in 38 plots and moderate defoliation in six plots, in 2000. In comparison, the L_2 counts of the eight check plots forecasted severe defoliation in four plots, moderate defoliation in three plots and light defoliation in the other plot, in 2000.

Thirty of these 66 sprayed L_2 plots were also used as prespray plots. Out of these 30 prespray plots, 20 were sprayed twice with Thuricide; three were sprayed once with Thuricide and seven were sprayed once with Mimic. All 20 plots sprayed twice with Thuricide had prespray populations that forecasted severe defoliation in 1999. In these 20 plots, L_2 counts forecasted that aerial spraying would reduce the budworm population to a light defoliation level in 2000. All eight corresponding check plots had prespray counts that forecasted severe defoliation in 1999. In these eight check plots, L_2 counts forecasted severe defoliation in four check plots, moderate defoliation in three plots and light defoliation in the remaining plot in 2000.

Three of these prespray plots were sprayed once with Thuricide; one had moderate prespray counts and the other two had high prespray counts in 1999. The L_2 counts in two of these plots forecasted light defoliation and the counts in the other plot forecasted nil defoliation in 2000. The corresponding check plot had moderate counts in 1999. The L_2 counts predicted light defoliation in this plot in 2000.

The remaining seven prespray plots were sprayed once with Mimic. All these plots had high prespray counts in 1999. The L_2 counts forecasted light defoliation in all these plots in 2000. Two out of the four corresponding check plots had moderate prespray counts in 1999. The L_2 counts forecasted light defoliation in these two plots in 2000. The other two check plots had high prespray counts in 1999; one of these had L_2 counts that forecasted moderate defoliation and the other had counts that forecasted light defoliation in 2000.

Overall, nil to light defoliation is expected in most of the sprayed areas in this region. Out of the sprayed plots, 88% are expected to have nil or light defoliation in 2000. Thus, the spray program has achieved its objective of reducing the budworm population to endemic levels. Unusually cold temperatures experienced in the spray blocks in the days immediately before spraying appear to have had an impact in budworm control in 1999. This is the most likely cause for budworm mortality observed in the unsprayed check plots.

Cost of Spraying

The cost of applying Thuricide once was $15.38 per ha. This comprises the cost of the insecticide and cost of spraying at the rate of 2.36 L per application (30 BIU per application). This insecticide was applied undiluted. Most of the Thuricide-sprayed areas received two applications per ha (Appendix II). The cost of applying Mimic once was $24.09 per ha. This comprises the cost of the insecticide, cost of spraying at the rate of 70 g a.i. and $1.00 per ha paid to mix the insecticide with water. Mimic-sprayed areas received only one application per ha. The cost of spraying includes the cost of equipment, aircraft rental, calibrations, wages and bioassay but does not include the cost of labour used for sampling.

NORTHEAST BOREAL (NEB) REGION

Public Awareness

The general public and the stakeholders were kept informed about the spruce budworm management program by:

- a public information session;
- newspaper advertisements in local newspapers (Athabasca Advocate, Lac La Biche Post and Fort McMurray Today);
- a briefing note copied to the local MLAs and local radio stations;
- registered letters or facsimile messages sent to area trappers and land use and timber disposition holders; and
- telephone messages to other concerned parties.

The public information session was announced in the above local papers. It was held on February 4, 1999 at Fort McMurray. This was attended by two members of the general public who were satisfied with the outcome.

Phenological Observations

One plot was established at the northern end and another at the southern end of the spray block to observe the development of spruce budworm larvae and spruce buds in relation to the accumulation of daily heat units (degree-days). A sample collected on June 4, 1999 showed that most of the budworms were spray ready (i.e., in the fifth-instar stage). The buds were spray ready as well, being in condition-class five with the needles flaring.

Prespray Sampling

Fourteen plots were sampled between May 31 to June 4 to check prespray spruce budworm counts. Six plots were located within the spray block and the other eight plots were located outside. Three of the plots located within the spray block had high counts (range: 655 to 1571 budworms per 10 m^2 of foliage) and the other three had moderate counts (range: 206 to 383 budworms per 10 m^2 of foliage). Five of the check plots located outside the spray block had high prespray counts, two had moderate counts and the other had a low count.

Aerial Spray Operations

Insecticides

Thuricide 48LV was the only insecticide used in this operation. Altogether, 71 431 L of this product were sprayed at a rate of 2.36 L per ha (30 BIU per ha). The technical details of this insecticide are given in Appendix II.

Spray Area

An estimated 22 707 ha were sprayed during this operation. Out of this area, 15 724 ha were sprayed once and an additional 6983 ha were sprayed twice (Figure 11).

Spray Aircraft

A group of three Ayers Thrush spray aircraft (two AT 401B and one AT 401) and a pointer aircraft (C-172RG) were used in this spray operation. Each spray aircraft was equipped with six Micronair AU4000 atomiser nozzles and a GPS. The technical details of these aircraft are given in Appendix II.

Aerial Spraying

The aerial spraying was carried out between June 5 to June 15 from the Fort McMurray Airport. The spray weather conditions were favourable most of the time. Except for one case of load jettisoning by one spray aircraft, the spray operations were carried out without incident.

Assessing Spray Efficacy

In the fall, an L_2 survey was carried out to predict the severity of defoliation expected in 2000 in the budworm-infested areas. Thirteen of the prespray plots were used as L_2 plots as well. In the Athabasca Forest Area, three of these L_2 plots were located in the areas sprayed once; two of these plots were expected to have severe defoliation and the other was expected to have moderate defoliation in 1999. All these plots are expected to have light defoliation in 2000. In comparison, the three unsprayed check plots are expected to have moderate defoliation in 2000.

In the Waterways Forest Area, two L_2 plots were located in areas sprayed once. The prespray counts predicted severe defoliation in one plot and moderate defoliation in the other in 1999; these plots are expected to have light defoliation in 2000. The comparable check plots are expected to have severe defoliation in 2000. One L_2 plot was located in an area sprayed twice. The prespray counts predicted severe defoliation in this plot in 1999. It is now expected to have light defoliation in 2000 compared to the check plot that is expected to have severe defoliation in 2000.

Overall, spruce budworm defoliation is expected to be light in the sprayed areas and light to severe in the unsprayed areas in this region.

Cost of Spraying

The cost of the spray operation was $19.85 per ha per application. This comprises the cost of spraying, materials, personnel and travel.

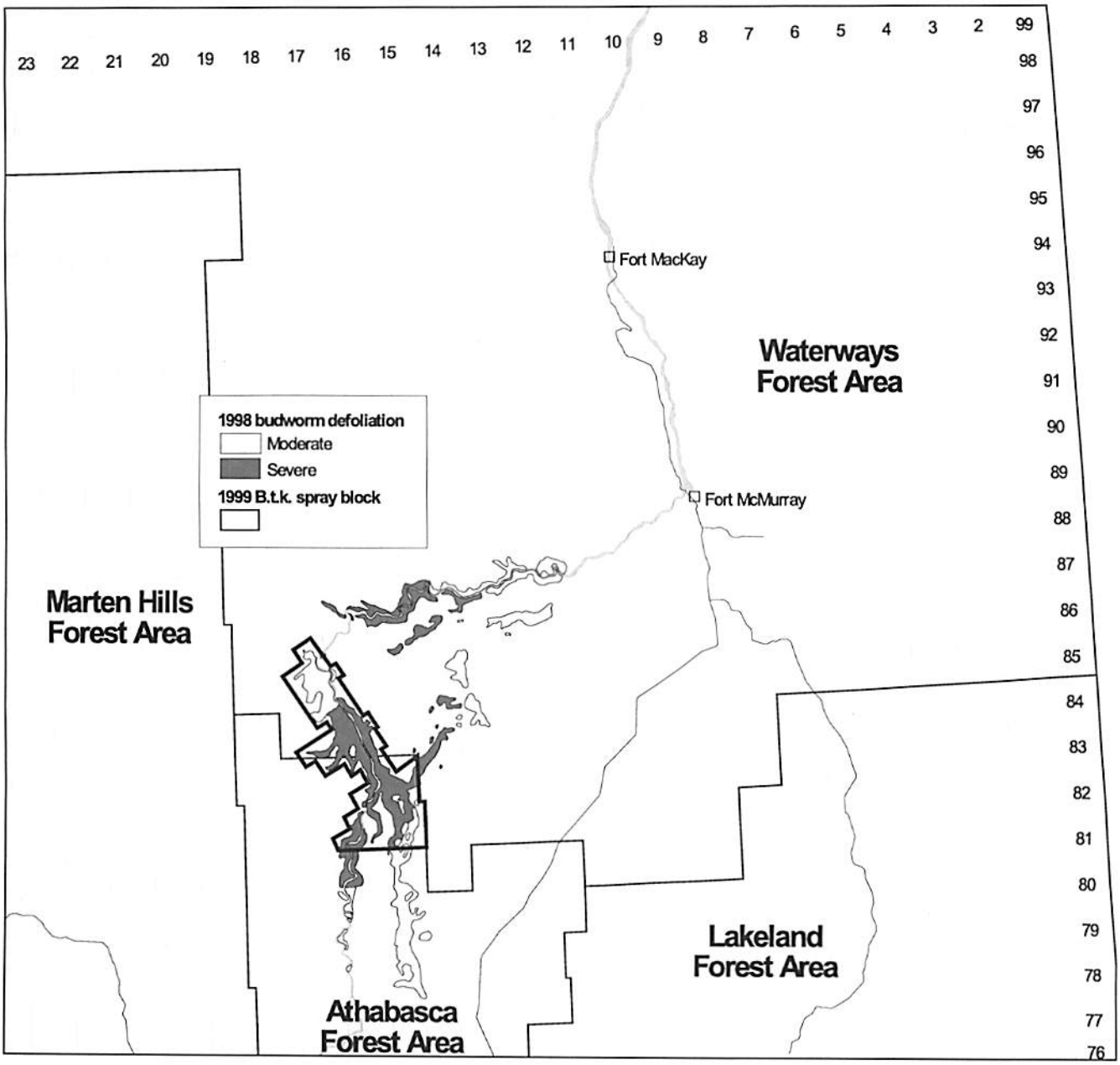


Figure 11. Aerial spray block in 1999, in relation to 1998 budworm defoliation in the Northeast Boreal Region in Alberta.

OTHER PROGRAMS

INCREASED AWARENESS AND TRAINING

Provincial

Increased Awareness

In 1999, the Forest Health Branch (FHB), in association with the Environmental Education Branch, produced two videos under the Forest Health Video Series. One video deals with dwarf mistletoe and the other with Armillaria root rot. These videos are designed for forest health workers and others interested in forest health, to educate them on the biology and management of the pest concerned.

These videos are available for purchase from:

FEESA, An Environmental Education Society
Suite 1100, 10506 Jasper Avenue
Edmonton, AB T5J 2W9
Telephone (780) 412-1497

The FHB also produced a pamphlet entitled "Management of Woodborers in Coniferous Logs" to educate the Land and Forest Service staff and forest industry personnel on this subject. This pamphlet is authored by Dr. Herb Cerezke. It was published in the aftermath of recent wildfires that burnt a substantial amount of conifer logs in the province. The pamphlet was produced because the impact of woodborers is a major concern in sequencing the salvage of fire-killed timber.

This pamphlet is available for distribution from:

Information Centre
Alberta Environment,
Main Floor, Great West Life Building
9920 – 108 Street
Edmonton, AB T5K 2M4
Telephone (780) 422-2079

In addition, the FHB published the "Forest Health Aerial Survey Manual" for internal use by the Land and Forest Service staff involved in aerial surveying of pest infestations. This year, the FHB published three issues of the widely circulated "Bugs and Disease" newsletter. The aim of this newsletter is to keep the readership informed about forest health-related news of concern to Albertans.

Training

The FHB personnel participated in teaching of "Wildland Firefighter Unit Leader I" course offered by the Environmental Training Centre at Hinton, Alberta.

Regional

Increased Awareness and Training

Northwest Boreal (NWB) Region

Numerous workshops were held during 1999 to increase the awareness among Land and Forest Service (LFS) staff and industry personnel regarding forest health issues. These include workshops held for staff at Daishowa-Marubeni International Ltd., Canfor (Hines Creek), Slave Lake Pulp Corporation and Ziedler Forest Products Ltd. A joint workshop was held to increase the forest health awareness among the staff at the Upper Hay Forest Area office and High Level Forest Products. A joint workshop was held to educate the LFS staff and industry personnel on related issues, in view of the potential outbreaks of wood borers following massive fire-kills that occurred in 1999.

Northern East Slopes (NES) Region

A weed awareness workshop was conducted in April for groups representing oil and gas industry, utilities, forestry and Alberta Infrastructure. This workshop was well attended and focussed on noxious and restricted weeds affecting the "Green Area."

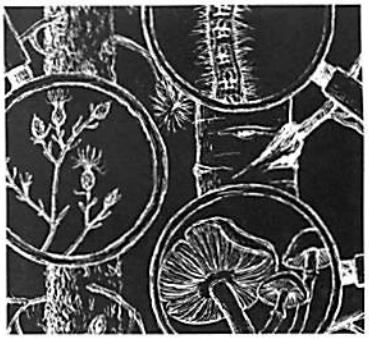
Parkland, Bow and Prairie (PBP) Region

A training session on mountain pine beetle concerns was held in November to educate the staff from LFS and forest industry. The topics addressed included potential impact, biology, survey methodology and options to manage this pest.

Regional IPM Working Groups

Northwest Boreal (NWB) Region

The first phase of development of an integrated pest management program (IPM) for this region was completed in 1999. This included compiling an IPM survey manual, an evaluation of permanent sample plot (PSP) networks existing in the region and preparing a budget to carry out this project. The Canadian Forest Service played a lead role in developing this phase of the program. Implementation of this program is conditional to availability of funding.



FIELD TRIALS

BRUCE SPANWORM OVIPOSITION TRAPS

This year, several oviposition traps designed by the Canadian Forest Service (Hébert and St-Antoine, 1999) were set up in the NES and PBP regions to collect Bruce spanworm eggs. The trap composed of a 10-cm plastic sewer pipe with a 10 cm-wide band of 6 mm-foam at the covered top. The egg counts and resulting defoliation in the following year will be recorded for several years. Eventually, the relationship between the number of eggs and defoliation severity will be used to formulate an index to predict defoliation levels. In addition, the eggs collected will be examined for parasitoids. In the PBP Region, five monitoring plots each with five traps were set up. A plot each was set up at Rose Creek, Shunda Tanker Base and west of Sundre and two plots were set up in the Procupine Hills. In the NES Region, two trap plots were established at Tom Hill and one plot was established at Deer Hill north of Edson in the Yellowhead Forest Area. Each plot consisted of five traps. An average of eight eggs per trap were found in one plot at Tom Hill, 56 eggs per trap were found at the other Tom Hill plot and 3996 eggs per trap were found at the Deer Hill plot.

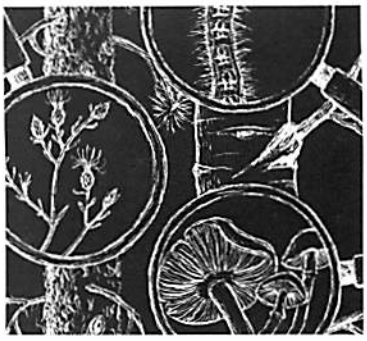
BLACK ARMY CUTWORM PHEROMONE LURES

Unitraps® baited with black army cutworm pheromones were set up at 18 representative sites within the infestation. Three types of pheromone lures (1 mg-lure, 3 mg-lure and a septa lure supplied by Phero Tech Inc., BC) were tested at each site. At each site, two traps were placed one metre above ground and 125 m apart from each other. The locations of the traps at each site were switched once, two weeks after their initial placement. The moths were collected at about 2 to 3-week intervals between the end of July and the first week of October. The traps baited with septa lures appeared to have a relatively higher mean moth catch than the traps baited with the other lures. However, the difference in mean moth catch per trap was not significantly different among the three lures used. Trap catches were minimal in plots located in 15-year old regeneration stands (range: 0 – 12 moths per trap) compared to those set up in the cutblocks. This indicates that black army cutworm moths prefer cutblocks to regeneration stands. The total moth counts were relatively low (range: 4 – 238 moths per trap) in the pheromone-baited traps set up in the cutblocks. Thus, the black army cutworm damage is expected to be light in 2000 in this area.

ARMILLARIA ROOT DISEASE MANAGEMENT

In the Bow Forest Area of the PBP Region, a field trial was initiated in co-operation with the Canadian Forest Service to evaluate the effectiveness of stump removal for managing this disease. This study will focus on the effects of stump removal on:

- reducing the impact of Armillaria on regenerated trees;
- cost effectiveness in relation to increased volume growth and reduced mortality in regenerated trees;
- other pests such as the root collar weevil;
- soil nutrients and soil erosion;
- plant biodiversity; and
- root persistence in soil.



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APPENDIX I

INFORMATION ON OPERATIONAL USE OF PHEROMONES IN ALBERTA, 1999

Gypsy Moth

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

Mountain Pine Beetle

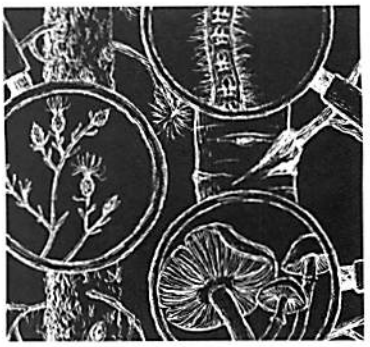
Chemical component(s):	trans-verbenol, exo-brevicomin
Lure type:	pre-packed tree-bait
Trap:	not applicable
Pheromone source:	Phero Tech Inc., Delta, British Columbia

Spruce Budworm

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

Black Army Cutworm

Chemical component(s):	95% Z-11-tetradecenyl acetate, 5% Z-7-dodecenyl acetate
Lure type:	1 mg load flex lure, 3 mg load flex lure, 1 mg septa lure
Trap type:	Unitrap
Pheromone source:	Phero Tech Inc., Delta, British Columbia



APPENDIX II

TECHNICAL DETAILS ON AERIAL SPRAYING TO CONTROL SPRUCE BUDWORM OUTBREAKS IN ALBERTA, 1999

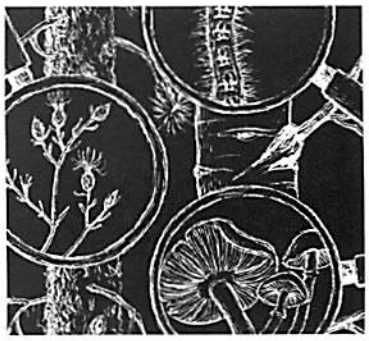
Insecticides

Thuricide 48 LV ®

Active ingredient:	*Bacillus thuringiensis* var. *kurstaki*
Formulation:	water-based
Additions:	none
Dilutions:	none
PCPA NO.	17980
Micro-contaminants:	*Bacillus* spp., Enterococci
Potency:	12.7 billion international units (BIU) per L
Supplier:	Thermo Trilogy Corp., MD, USA

Mimic 240 LV ®

Active ingredient:	Tebufenozide
Potency:	240g a.i. per L
Formulation:	water-miscible emulsion formulation
Ingredients:	Canola oil, Glycerol, Alkylaryl polyether alcohol
Dilution:	Water at a rate of 1.71L/0.29L of Mimic
PCPA NO.	24502
Additions:	None
Micro-contaminants:	not applicable
Supplier:	Rohm and Haas Canada Inc., ON



APPENDIX II (continued)

Spraying

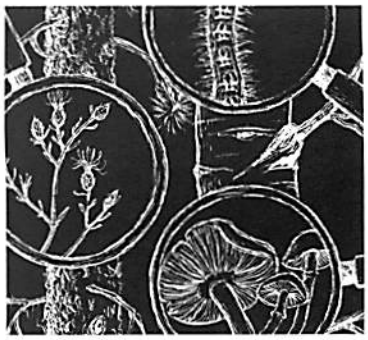
	NWB Region		NEB Region
Spray period:	June 11 - 18, 1999		June 5 - 15, 1999
Sprayed area:	Thuricide x 1	6550 ha	15 724 ha
	Thuricide x 2	41 067 ha	6983 ha
	Mimic x 1	12 932 ha	

NWB and NES Regions

Spray volume:	2.36 L/ha per application of Thuricide 2.00 L/ha per application of Mimic 4 - 5 day interval between applications of Thuricide
Application dose:	30.0 BIU/ha (Thuricide) 70 g a.i. per ha (Mimic)
Nozzles:	Micronair AU 4000

Aircraft Type	Nozzles/ Aircraft	Spray Speed (km/hr)	Swath Width (m)	Blade Angles
Ayers Thrush S2R	6	185	75	31
Air Tractor 401A & 401B	6	200	75	37
Air Tractor 502B	8	225	90	40

Flow rate:	8.43 L/nozzle per minute
VRU setting:	11 (Ayers Thrush S2R, Air Tractor 401 & 401B) 13 (Air Tractor 502B)
Volume Mean Diameter (VMD):	95 - 110 microns
Atomiser rotation:	7000 rpm



APPENDIX III

SPRAY WEATHER PARAMETERS AND WEATHER DATA RECORDED DURING SPRAY OPERATIONS

Weather Parameters

Temperature:	5 – 30 °C
Relative Humidity:	over 30%
Wind:	less than 15 km/hr
Precipitation:	none within 6 hours

Weather Data

Northwest Boreal Region[a]

Date	Temperature (°C)		RH (%)		Wind (km/hr)		Precip.
	Maximum	Minimum	0600 hrs	1200 hrs	0600 hrs	1200 hrs	mm
June 8	8	-1	100	76	CLM	SE 5	17.1
June 9	14	-2	87	44	NE 4	NE 15	1.4
June 10	17	-4	67	41	SW 7	SW 10	Nil
June 11	19	-4	85	36	NE 3	NE 5	Nil
June 12	19	0	85	36	NE 9	SW 15	Nil
June 13	21	-1	53	36	CLM	CLM	Nil
June 14	24	5	61	29	NE 5	SE 10	Nil
June 15	25	4	54	31	CLM	SE 10	Nil
June 16	29	7	57	22	NE 5	SE 16	Nil
June 17	19	8	59	43	SE 3	SE 13	Nil
June 18	30	15	82	38	CLM	SE 10	Nil

[a] as recordered at Adair Fire Lookout Tower