2007 Annual Report

Forest Health in Alberta

Alberta

Forest Health Vision

A healthy forest environment that provides sustainable fibre resources and a diverse forest ecosystem that supports biodiversity and critical wildlife habitats.

2007 Annual Report

Forest Health in Alberta

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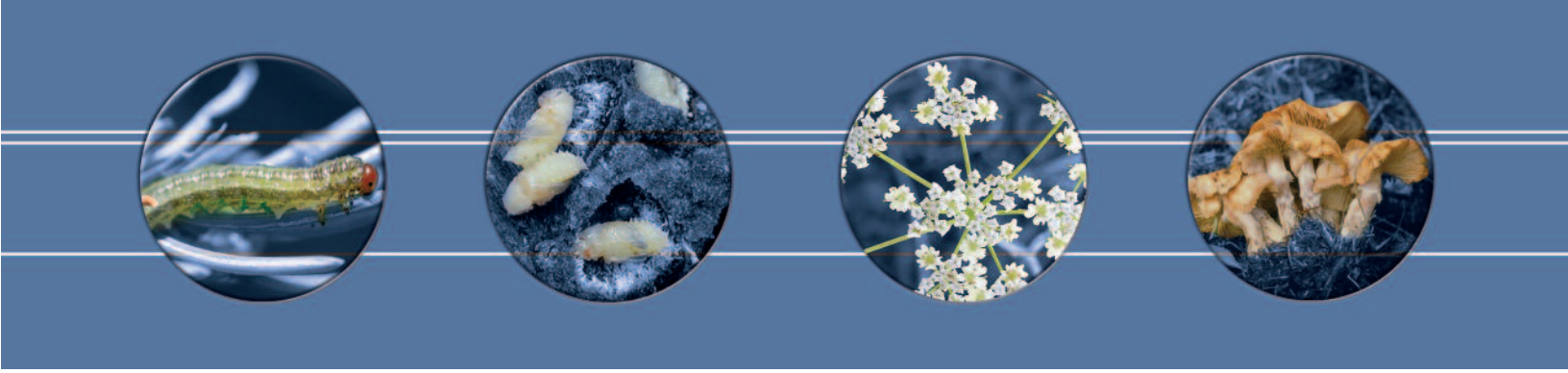


Forest Pest Management Programs

Mountain Pine Beetle Management

The estimated number of MPB infested trees in the province has steadily increased in the past few years (Figure 7). The number of infested trees in the province rose dramatically in the 2006/2007 beetle year due to a large influx of MPB from British Columbia to Alberta in July 2006. Alberta Sustainable Resource Development developed an Action Plan and set priorities for managing these infestations.

The MPB Control Program has two prime objectives:

1. To contain infestations and minimize the spread of the MPB north and south along the eastern slopes of Alberta.
2. To prevent the spread of MPB eastward into the boreal forest areas of lodgepole-jack pine hybrids and jack pine.

The main goal of this program is to maintain sustainability of Alberta's pine forests. The expected outcomes of this program included:

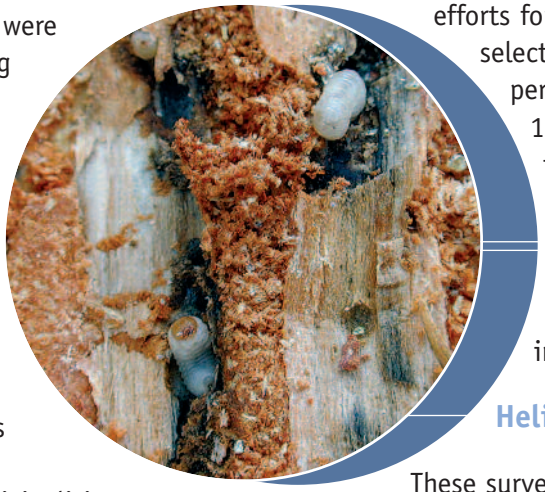
- Minimal MPB impact on watershed areas supplying water for major cities and prairie communities, to maintain quality and quantity of water flow;
- Protection of forest fibre resources in Alberta, to maintain long-term sustainable fibre supply;
- Protect high value areas such as genetics and tree improvement seed orchards and field trials, so that these sites can maintain their values for future years;
- Maintenance of a MPB-free buffer along the eastern edge of boreal jack pine forest adjacent to Saskatchewan, to reduce risk of eastward spread; and
- Conservation of pine forest ecosystems of special importance such as the stands of whitebark pine and limber pine.

MPB Detection Program

MPB presence was detected and monitored through survey programs involving aerial and ground surveys to assess beetle risk. Heli-GPS surveys were conducted in areas where MPBs were present in the previous year and infested trees were observable from the air. Some infested trees resulted from long-range dispersal events in the summer 2006 in northern and eastern Alberta could not be surveyed from the air until these trees became faders in 2007. A hotline was established for the general public to report infested trees to determine the extent of the infestation in areas where aerial surveys were not possible. SRD also conducted preliminary walk through detection surveys in highly susceptible stands to identify areas with MPB presence. In 2007 aggregation pheromones were used as baits to detect how far the beetles dispersed. Interception traps were mounted on fire lookouts in an attempt to detect long-range dispersal events over the Rocky Mountains.

Reports from the public and other stakeholders

In Woodlands, Lesser Slave, Smoky and Peace Areas where MPB attacks were detected for the first time in 2006, the infested trees all had green foliage and could not be detected from the air. To determine the extent of the infestation, a "beetle-hotline" (310-BUGS) was established for the general public, workers of the oil and gas sector and forest industry to report infested trees. Pamphlets describing the symptoms of MPB attack and advertising the 310-BUGS hotline were mailed to many municipalities across the province, which distributed them to residents in their communities. News broadcasts on television and radio informed the general public about the MPB infestation and encouraged them to report infested trees through the hotline. In addition, a series of open houses, public information sessions and information booths were held in all Forest Areas, providing information on MPB, SRD's Management Plan and promoting the 310-BUGS hotline.



Local Forest Health staff followed up on the calls that reported possible MPB infestations on Crown land. Reports through 310-BUGS of infested trees on municipal lands were forwarded to the respective Municipalities for follow up. Municipalities received grants to conduct surveys and control infested trees on municipal lands through the Municipal Grant Program.

Walk Through Detection Surveys

Walk through detection surveys provide a general overview of MPB presence and infestation intensity in a stand in a relatively short period of time. The survey covered ten to twenty-five percent of the stand area. If MPB were detected this way, the stand was surveyed in greater detail with concentric or transect procedures.

FHOs targeted stands with high susceptibility and further prioritized these by their connectivity to other susceptible stands. Stand susceptibility was identified using the stand characteristics used in the original Stand Susceptibility Index (Shore & Safranyik, 1992) combined with the Climatic Suitability Factor (Carroll et al., 2004). The resulting susceptibility model generated a probability for a stand to produce a successful beetle population in one year if it were infested.

In the Lesser Slave Area, stand susceptibility data were not available during the early stages and surveys simply targeted pure pine stands. Later, once the data was available four to five stands were selected per township, based on the moderate and higher stand susceptibility ratings.

In the Woodlands Area Seena Handel optimized efforts for good spatial coverage by selecting two highly susceptible stands per township. If MPB were detected, 10 more stands were checked in the same township. If MPB was confirmed in all 12 stands of the township, detailed transect surveys were completed in all stands with a stand susceptibility index of 30 or more.

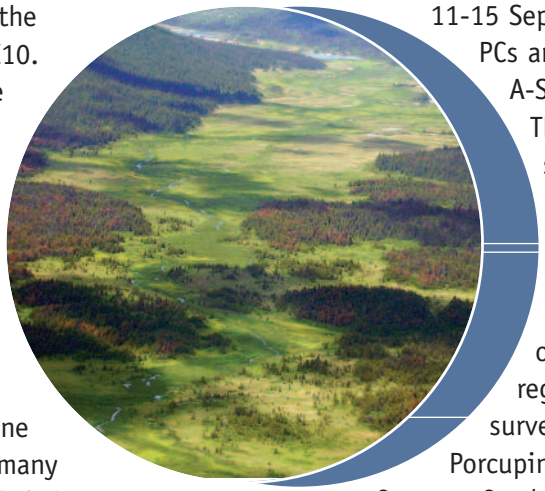
Heli-GPS Surveys

These surveys are carried out in late summer or early fall to detect and record locations of faders that resulted from MPB infestation in the previous year. The procedures for these surveys are described in the MPB Heli-GPS Manual (Anon. 2007). Generally, patches with three or more faders were recorded. However, in areas where trees were scattered and clusters of more than one tree were rare, the Forest Health Officers also recorded GPS coordinates of individual fading trees. The results of these surveys are shown in Figure 9. The survey data were used to plan MPB control action.

Foothills Area

The FHOs Brooks Horne, Erica Lee, Seena Handel, Tom Hutchison and the Forest Health Technician Warren Oates carried out Heli-GPS surveys from August 30 to September 8, 2006. They flew for 68 hours in an A-Star helicopter and recorded location of infested trees using a Tablet PC or a 076CS Garmin handheld GPS unit. Some data was recorded on a 1:75,000 scale map.

The surveyors detected infested trees in Willmore Wilderness Park and in the Forest Management Unit (FMU) E10. Faders were detected west of the Muddywater and Smoky River confluence with increasing infestation severity towards the Alberta/British Columbia border. Moderate infestation was recorded along the Sheep River; Muddywater River, Fetherstonhough River; Pauline River and the Jackpine and Pauline river confluence. In these areas many green attacks not associated with faders were found indicating immigration of MPB into these areas. Stressed trees around the perimeter of Edson Wildfires 173 and 109 were heavily hit by MPB. There were indications throughout the infestation that MPBs followed a two-year cycle and there were also signs of multi-year attacks.



Smoky Area

Mike Maximchuk (Forest Health Officer) and Natalie Henneberry (Forest Health Technician) conducted aerial overview surveys on 17-20 July 2006, followed by heli-GPS surveys on 11-16 September 2006. Using a tablet PC in an A-star B2 helicopter they flew a regular grid pattern to detect red or fading trees. They marked 276 trees as possible MPB attacks during the overview survey and detected an additional 808 trees during the heli-GPS survey. All trees detected were located south of Grande Prairie and west of Highway 40. The majority of the trees detected with discolouration were located in close proximity to the BC border in the Narraway River and Kakwa Park areas.

Southern Rockies Area

Bart McAnally (Forest Health Technician), Rupert Hewison (Forest Health Technician) and a contractor conducted aerial overview surveys and heli-GPS surveys in the Southern Rockies Area on 4-8 and 11-15 September 2006. They used tablet PCs and Bluetooth GPS equipment in A-Star B2 and Bell 407 helicopters. The overview and detailed Heli-GPS surveys covered approximately 85% of susceptible stands in the Southern Rockies Area. Outside of known infestation areas the surveyors conducted aerial overview surveys by flying in a regular grid pattern. The overview surveys covered Castle River, Porcupine Hills, Bob Creek Wildland, Cataract Creek, Highwood and Lake Minnewanka. Ground truthing of approximately 30 sites in these areas outside of the known infestations revealed that the discolouration of the foliage detected from the air was not due to MPB attack.

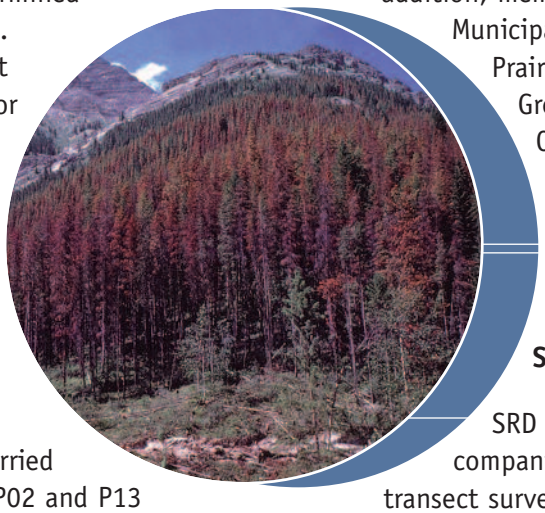
Bow Valley, Spray Lakes, Peter Lougheed Provincial Park, Oldman, Dutch Creek, Crowsnest Pass and Tent Mountain were surveyed in detail with heli-GPS surveys. The surveyors flew in a zig-zag pattern in the tight mountain valleys of these areas. They recorded detailed GPS locations of 1480 red tree sites. Ground surveys confirmed that MPB was the cause of mortality at 788 of these sites. The main areas identified as infested with MPB were the valley along highway 1 near Canmore; areas around the Spray Lakes reservoir; near Kananaskis Lakes in Peter Lougheed Provincial Park; along the Oldman River, Dutch Creek and the Dutch Creek Road; the Crownest Pass and south of the Crowsnest Pass.

Peace, Upper Hay, Woodlands and Lesser Slave Areas

No aerial surveys were conducted in Peace, Upper Hay, Woodlands and Lesser Slave Areas in 2006, the first year that MPB presence was recorded in these areas. All infested trees were in the green-attack stage, rendering detection from the air impossible. Hence, walk-through-detection surveys were conducted on the ground in stands with high susceptibility to MPB infestation.

Detailed Ground Surveys

After the aerial surveys or walk through detection surveys, ground surveys are carried out to detect and record individual trees containing living MPB brood. These trees usually have green foliage and are therefore not observable from the air. Transect surveys and concentric surveys are carried out in areas where aerial overview surveys have shown faders or where walk through surveys detected the presence of green attacks. Transect surveys are systematic surveys carried out to identify 100% of the infested trees along pre-determined transect lines in an infested area. Concentric surveys are carried out when faders are few, spread out or at locations with limited access. The procedures for these surveys are described in the procedure manual entitled Mountain Pine Beetle Detection and Management in Alberta.



Peace and Upper Hay Areas

SRD staff and four contractors carried out ground surveys in the FMUs P02 and P13 in the Peace and Upper Hay Area between October 17, 2006 and May 4, 2007. Most of these were transect surveys. A total of 37,365 infested trees were detected. SRD crews also carried out ground surveys throughout the fall and winter in P3, P4, P5 P8, P15 and P16 Forest Management Units (FMU) in an effort to find the extent of the 2006 beetle flight

Foothills Area

SRD crews and contractor crews carried out ground surveys between October 4, 2006 and June 3, 2007. These included concentric, transect, walk through detection and modified burn-edge transect surveys. The crews surveyed Willmore Wilderness Park and the FMUs E8 and E10. They detected 40,028 infested trees.

Smoky Area

Starting on 20 August 2006 until the spring in 2007 SRD staff and contractors surveyed across the entire Smoky Area with particular focus on Weyerhaeuser and Canfor Forest Management Agreement Areas and Crown lands embedded in the White Zone. Using concentric and transect procedures, red tree locations were inspected for presence of MPB and searched for new green attacks. Highly susceptible stands were also searched for the presence of MPB due to the large MPB immigration event that occurred in 2006 summer. A total of 20,061 green attack trees were confirmed on Crown land during these surveys. In addition, members of the South Peace Municipality group (Counties of Grande Prairie, Saddle Hills, Birch Hills, Greenview, Spirit River) and the City of Grande Prairie conducted ground surveys for MPB infested trees on municipal land and private land where reports from private landowners occurred.

Southern Rockies Area

SRD crews and four contract companies conducted concentric and transect surveys on crown land, provincial parks and protected areas in Southern Rockies from October 2006 until July 15, 2007. These surveys revealed 9,945 infested trees of which 7,257 were found in Kananaskis Country, with a particularly high density in the Spray Lakes infestation, and 2,688 infested trees were found in the Crowsnest area. In

addition, the Municipality of Crownest Pass, Municipal District of Bighorn and the Town of Canmore surveyed municipal and private land for MPB.

Woodlands Area

Ground Surveys commenced early October 2006 and were completed by the time the beetles flew in July 2007. Walk through detection surveys were used heavily as all the trees attacked in the August 2006 flight had not yet faded to red and there were no aerial survey points collected. Stands to be surveyed were identified through a Stand Susceptibility Rating Model so that efforts were focussed on the highly susceptible stands. SRD staff and contractors covered over 30,000 ha of working forest on Crown land and identified 724 infested trees. Quality Inspection was conducted on approximately 10% of walk through detection sites. In addition, First Nations performed similar surveys on the Reserves.

Lesser Slave Area

Initial walk through detection surveys of stands with high susceptibility index (SSI) were conducted by SRD staff in the winter of 2006/07 to determine presence of MPB in Lesser Slave Area. Once presence was confirmed, transect surveys were completed by contractors. The surveys covered Crown land and Winagami Wildland Park. At the 414 sites surveyed, 399 trees were identified as infested with MPB. These trees were in the first year of attack so no green/red ratios could be determined. The majority of infested trees were in the south-western corner of the Area.

Waterways and Lac La Biche Areas

SRD staff conducted walk through detection surveys from 20 March 2006 to 30 September 2007 in highly susceptible pine stands on Crown land. Primary areas of interest were stands in the vicinity of Smith and particularly those near the CFS funnel trap site where MPB had been captured in August. Stands near the hamlets of Flatbush and Fawcett were also surveyed. Additionally, stands around all genetic and tree improvement sites in the Waterways and Lac La Biche Areas were assessed. No MPB attacked trees were found in the surveyed stands.

Long Distance Dispersal Monitoring

Due to the large MPB population currently in central and northern British Columbia, it is possible for long-distance dispersal event to recur. Early detection of such a flight will facilitate developing operating procedures and priority setting. SRD is in close contact with the British Columbia Ministry of Forests and Range, who are monitoring beetle emergence and peak flights, to share their findings with Alberta.

Dispersal Baits

Strategic deployment of pheromone baits over large areas aids the detection of a long distance dispersal event. Monitoring sites were set up in 2006 by SRD in Willmore Wilderness Park, E8, E7 FMUs and by Hinton Wood Products (West Fraser Mills) on the Forest Management Agreement Area. Eighty-seven sites were baited with an aggregation pheromone (Phero Tech Inc., BC). At each site, baits were deployed on three trees located 50 metres from each other in a triangle in a susceptible pine stand. There was one site per township. The pheromone baits were deployed from July 5-15 prior to MPB flight. The baited sites were checked and baits were removed between 15–25 September. Baited trees at 16 sites had hits varying from 1-45 per tree. There were no spill-over attacks. The attacked trees were treated to remove the beetles.

The dispersal bait sites in the Foothills Area were successful in determining the southern extent of the dispersal flight from British Columbia in 2006. The program was expanded in 2007. A total of 603 bait sites were set up in townships throughout the areas that could be affected by a large flight (Table 8, Figure 19). The sites were monitored during the MPB flight period. At least 50% of the bait sites throughout the entire baited area were visited between August 1st and 9th. Final checks were conducted in September 2007.

Table 8
Number of mountain pine beetle dispersal bait[1] sites per Area in Alberta.

Area	No. of sites baited
Peace	41
Foothills	177
Lesser Slave	38
Waterways/Lac La Biche	43
Woodlands	81
Southern Rockies	76
Clearwater	147
Total	**603**

[1] Baits were deployed in May – July 2007.

Figure 19 shows that the furthest east the MPBs travelled in 2007 was the Lesser Slave Area. None of the baited sites in the Lac La Biche Area were attacked. In the Peace Area, beetles attacked baited trees in the northern most region where the baits had been deployed. In the Woodlands and Foothills Areas the beetles appeared to have reached only the western regions. In the Clearwater Area, the attacked trees were close to the boarder of Banff National Park where MPB presence has been known for some time. In the Southern Rockies Area attacked trees occurred almost throughout the range of baited sites.

In addition to the dispersal bait sites, SRD staff of the Waterways and Lac La Biche Area monitored two Canadian Forest Service Lindgren funnel trap sites. One set was located near Round Hill Tower north of Lac La Biche, and another set just west of the Athabasca River, near the hamlet of Smith. Two adult beetles were captured at the site near Smith in mid-August. They were positively identified as MPB by Darryl Williams (Forest Health Technician, Northern Forestry Centre, Canadian Forest Service) in November 2007. However, no attacked trees were found.

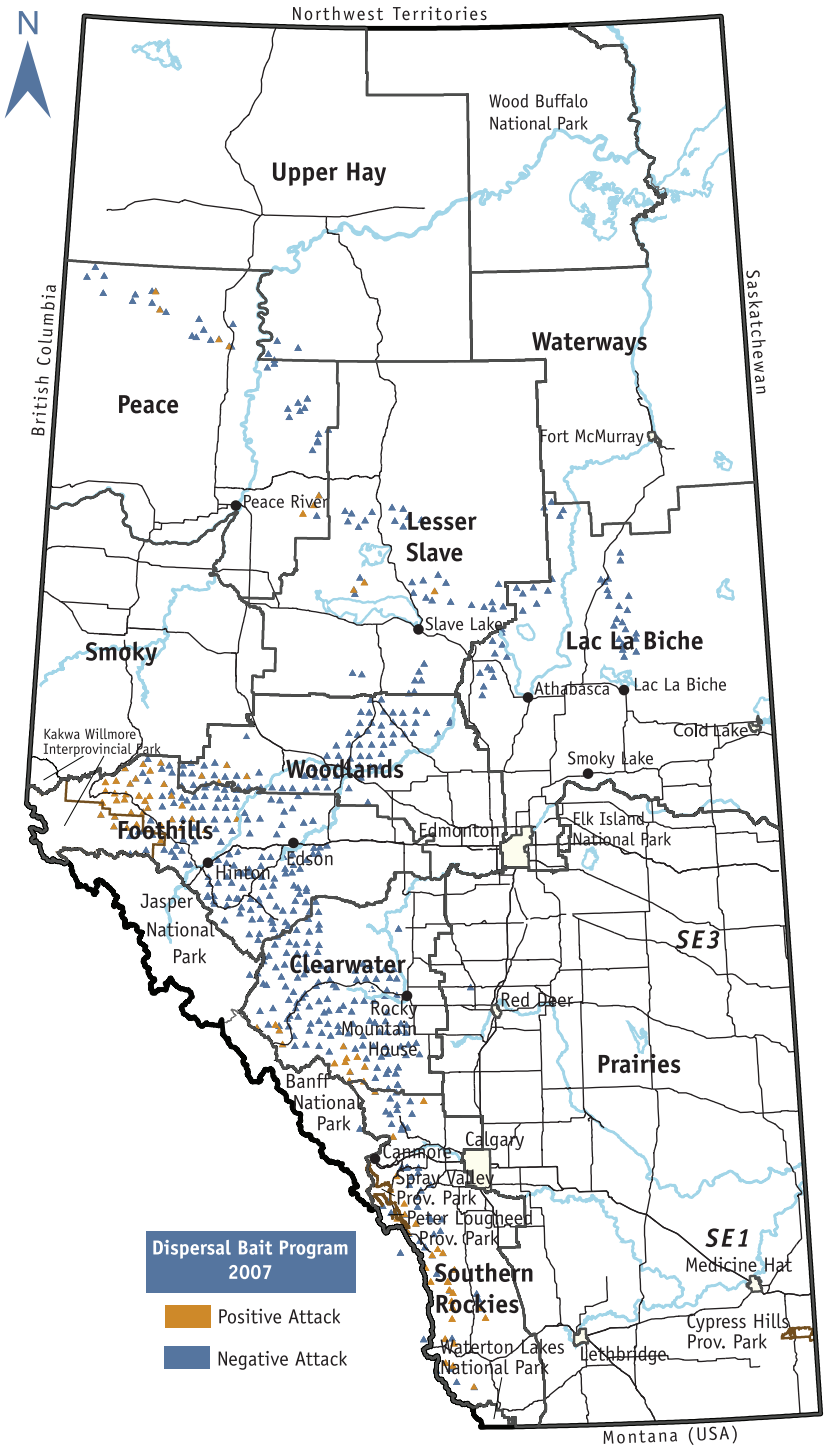


Figure 19
Locations of baits and results of the MPB dispersal monitoring program in 2007 in Alberta.

Interceptions Traps

Interception traps were set up on fire lookouts in the areas that may be in the path of a dispersal flight from British Columbia (Table 9). As the beetles either fly or become wind-borne they contact these traps and are collected. This will allow SRD to determine if the beetles flew into a certain area and when/if the flight from British Columbia occurred.

Table 9
MPB catches in interception traps mounted on fire lookout towers in Alberta, 2007.

Area	No. of MPB Caught
Smoky	4
Foothills	3
Lesser Slave	6
Lac La Biche	3
Woodlands	3
Southern Rockies	1
Clearwater	2
Total	**23**

The Fire Lookout observers were trained in collection and storage of the specimens. Collections were made daily from July 15 – August 15 2007. Specimens collected each day were placed in individual collection vials. Forest health staff arranged for the weekly collection of the samples and the identification of the specimens. The Lookout observers informed the Area of the status of the interception traps and specimens collected each day.

Summer Early Detection Overview Surveys (SEDOS)

The FHOs in a few Areas carried out SEDOS in June 2007 to detect early faders. SEDOS can only be carried out where trees were attacked by the MPB in the previous year. They commence with the appearance of early faders and ending shortly before the onset of next MPB flight in the summer. During this survey locations with currently infested early faders are digitally recorded along with the estimated percent of trees attacked. These results were used to plan a baiting program so that live MPBs in trees that could not be controlled before beetle emergence are concentrated over a small area in trees with known locations.

Control Program

Beetle Strategy

This strategy is implemented at two levels. At Response Level I, either single or small groups of infested trees are removed and treated to destroy the beetles. Onsite debarking, burning or grinding the boles are the treatments used to destroy MPB in these trees. Alternatively, they can be transported off-site for treatment through heli-assist operations. This may be the only strategy used in ecologically sensitive areas. Table 10 provides a provincial overview of the Level I operations conducted in the 2006/2007 beetle year.

MPB burn pile

Table 10
Number of MPB-infested trees detected and controlled with single-tree treatments in Alberta during the 2006/2007 beetle year.

Area	infested trees detected	Infested trees controlled
Southern Rockies	9,945	9,469
Foothills	40,028	35,363
Woodlands	724	443
Lesser Slave	399	218
Smoky	20,061	8,316
Peace	37,208	35,895
Provincial Total	**108,365**	**89,704**

Sites with infested trees that were not controlled before the beetle flight in 2007 were baited with aggregation pheromones in order to concentrate the emerging beetles into small areas. New patches of fading and red trees identified during SEDOS were also baited to limit the spread of emerging beetles. All the patches with 3 or more fading trees within the leading edge were baited. If time permitted, single and double trees also were baited. Large patches of fading trees in other areas were baited if it aided in reducing beetle spread. All SRD deployed bait information was stored in the Mountain Pine Beetle Database in the FIRES system. The baited trees were to be surveyed after the flight and controlled if they were infested.

At Level II Response, infested trees are harvested and processed. Table 11 shows the companies that applied for dues relief for harvesting infested wood as Level II response. A total of 815,869 cubic metres of wood were harvested from infested stands and claimed for dues relief in Alberta during beetle year 2006.

Table 11
Volume of wood hauled from mountain pine beetle infested stands under Response Level II during the beetle year 2006/2007 in Alberta.

Company	Volume (m^3)
Canfor	83,026
Alberta Plywood	118
Blueridge	33,211
Weyerhauser Grande Prairie	668,624
Mostowich	7,918
Charles Blake	3,310
Ainsworth	1,874
Jess Peachy	1,970
Colin Ruxton	8,673
David Peachy	4,886
Lonepine Holdings	2,259
Total	**815,869**

The Mountain Pine Beetle Log Management Directive sets out procedures for Level II Response that aims to protect Alberta's forest resource from spreading MPBs. The directive specifies procedures for hauling, storage, transfer, manufacturing/processing, residue disposal, scaling and harvest accounting, record keeping, compliance and enforcement, and pheromone monitoring at manufacturing and processing sites of Level II harvested pine with bark attached. Further details on the directive can be found online (http://www.srd.gov.ab.ca/forests/pdf/MPB%20Log%20Management%20Directive%202006-05.pdf). Companies can apply for reimbursement of the cost for some of the activities outlined in the required procedures through the Forest Resource Improvement Association of Alberta (FRIAA) program outlined in the FRIAA MPB Program in this report. Information on log yard management standards for which FRIAA funding is available can be found online www.srd.alberta.ca/forests/pdf/logyard_management_standards.pdf).

Peace and Upper Hay Areas

In Upper Hay and Peace Areas, SRD crews treated 8,008 trees and heli-assisted contractors removed another 27,887 trees between November 15, 2006 and June 30, 2007. Out of these trees, 30,836 were removed from 186 sites in the FMU P02 and another 5,060 were removed from 117 sites in FMU P13.

Foothills Area

In the Foothills Area, SRD crews and heli-assisted contractors treated 35,363 infested trees. In Willmore Wilderness Park, contractors removed 30,513 trees and SRD crews cut and burned another 3,818 trees on site. Another 82 trees were removed by heli-assist from E10 FMU. An additional 950 trees were cut and burned in the FMUs of E10 (791 trees), E8 (18 trees) and E7 (141 trees). The infested trees that remained untreated were trees that faded early and were detected when control crews were unable to reach the site in time before the flight. Containment baits were put up at these sites to prevent the emerging beetles from spreading in the forest. One pheromone bait was deployed for every five faders at new fader sites seen during Summer Early Detection Overview Surveys. From 1-15 July 2007 SRD crews put up 423 baits in 240 sites in Willmore Wilderness Park and 400 baits in 207 sites in Foothills FMUs. Sites were to be surveyed during the winter of 07/08.

As part of Level II response, Foothills Forest Products harvested one block containing infested trees in February 2007. The block was located east of Grande Cache and was 24 hectares in size.

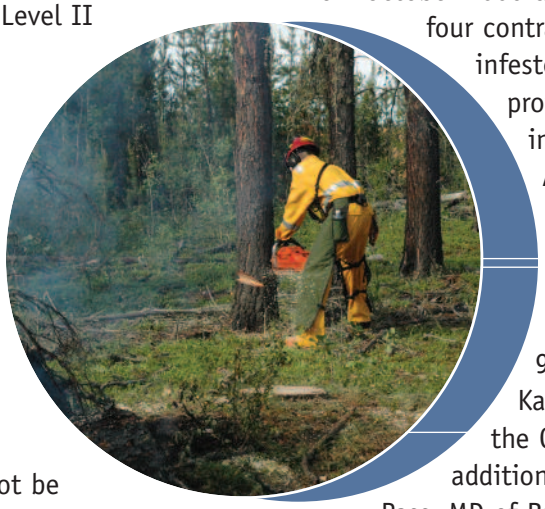
Smoky Area

In the Smoky Area, SRD staff and contractors treated 8,316 infested trees using primarily the fall and burn technique. Mulchers were used in some areas with higher density of infested trees. Adverse weather

conditions, posed operational challenges for controlling the trees that had been detected. Since 2006 was the first year the Smoky Area experienced an MPB epidemic, emphasis was put on identifying the extent of the infestation. The South Peace Municipality group (County of Grande Prairie, Saddle Hills, Birch Hills, Greenview, Spirit River) surveyed and controlled infested trees on private property in the White Zone. The City of Grande Prairie surveyed and controlled infested trees on private and public land in the city limits. Some stands on Canfor's Forest Management Agreement Area were baited and scheduled to be harvested under Level II response the following season.

Woodlands Area

Contract Type 1 Firetack and SRD staff conducted control work in the Crown forest from January until late June 2007. The beetle strategy in the Woodlands Area involved primarily Level I control where 445 trees were cut and burned or peeled. Baits were established on sites that could not be treated in time to contain the emerging beetles. There was a goal of 10% quality inspection implemented on control locations. As part of the Level II control program ANC Timber Ltd. harvested two infested stands. Millar Western Fox Creek Division (formerly Mostowich Lumber) harvested four infested stands in ANC Timber's FMA and one infested stand in Blue Ridge Lumber's FMA. Blue Ridge Lumber Inc. harvested six infested stands in their FMA and two infested stands in ANC Timber's FMA. The harvested wood was processed by 15 June 2007 in accordance with the Logyard Management Directive. Before the beetle flight, the Town of Fox Creek, under the Municipal Grant Program, felled and burnt twelve infested trees within the town limits. In addition to the control efforts conducted by SRD, industry and municipalities, Alexander First Nations surveyed and controlled infested trees on the Reserve.



Lesser Slave Area

In the Lesser Slave Area, 2006 was the first year of recorded MPB presence. The MPB populations detected in the Lesser Slave Area represented the eastern edge of the infestation in Alberta. In the spring and summer of 2007, SRD staff felled and burnt a total of 218 infested trees on Crown land and in Winagami Wildland Park.

Southern Rockies Area

From October 2006 until 18 July 2007 SRD crews and four contract companies controlled 9,469 infested trees on Crown land, provincial parks and protected areas in the Southern Rockies Area. Almost half of these were controlled by felling and burning the trees on site, while the rest were flown off-site during heli-assist operations. Altogether 9,469 trees were removed from Kananaskis Country and 2,596 from the Crowsnest infestation. In addition, the Municipality of Crownest Pass, MD of Bighorn and the Town of Canmore controlled infested trees on municipal and private land.

Forest Resource Improvement Association of Alberta (FRIAA) MPB Program

Funding has been made available through the FRIAA to support tenure holders and mill operators in assisting SRD in monitoring and control of the MPB. Under the FRIAA MPB program industry is reimbursed for doing work that would otherwise be the responsibility of the Province. The program was launched in July 2007. The funds are administered by the FRIAA, which reviews proposals applicants submitted to acquire funding for MPB management projects. Activities related to control and suppress the MPB are eligible under this program if they enhance the forest resource and are not the

responsibility of a timber disposition holder. Activities that are eligible for FRIAA funding include

- the use of aggregation pheromones for long-distance dispersal monitoring, containment baiting, mop-up baiting and log yard management;
- detection surveys including aerial surveys and ground surveys;
- single-tree treatments;
- protection of genetic trials, orchards and research projects with the use of anti-aggregation pheromones (verbenone);
- seed collection and seed orchard expansion.

FRIAA does not approve any proposals that would involve the provision of subsidies to the forest products industry. Details of the program can be viewed online www.friaa.ab.ca/mountainpinebeetle.html.

Municipal Grant Program

Since MPB infestations are a landscape level phenomenon, all affected jurisdictions need to work together for a MPB management program be successful. While SRD implemented aggressive MPB monitoring and control programs on provincial public lands, municipalities were engaged to manage MPB problems on municipal and private lands. Municipalities that were identified by SRD as having active MPB infestations were invited to partner with SRD in addressing the issue. For this purpose SRD allocated funds to aid communities affected by the MPB infestation with managing MPB on their jurisdictions. SRD also performed aerial surveys on these lands in some areas.

Municipalities applied for grants by submitting proposals that outlined their course of action for managing the infestation on municipal lands. In some cases multiple municipalities coordinated their programs and received grants for their entire program (Table 12). A total of 66,659 infested trees were controlled under this program during the 2006/2007 beetle year. Further details of the program can be found in the Mountain Pine Beetle Municipal Grant Funding Program Guidelines on the Forest Health website www.srd.alberta.ca/forests/pdf/2007_MPB_municipality_program_guidelines.pdf).

Table 12
Number of mountain pine beetle infested trees controlled under the municipal grant program in the bettle year 2006/2007 in Alberta.

Area and Municipality	No. of trees controlled
Peace	
Town of Fairview	105
MD of Northern Lights	0
County of Clear Hills	0
Town of Peace River	154
Northern Sunrise County	54
MD of Peace and MD of Fairview	738
Smoky	
South Peace Municipality (Counties of Grande Prairie, Saddle Hills, Birch Hills, Greenview, Spirit River)	63,769
City of Grande Prairie	634
Foothills	
Town of Grande Cache	60
Woodlands	
Woodlands County	0
Town of Fox Creek	12
Southern Rockies	
MD of Bighorn	4
Town of Canmore	156
MD of Crowsnest Pass	973
Total	**66,659**

Prevention Program

Reduction of Pine Stands with High MPB Susceptibility

Under the Healthy Pine Strategy, SRD is committed to reducing the amount of pine susceptible to the MPB to reduce the risk of potential environmental, social and economic impacts of future outbreaks. Susceptibility of stands to MPB attack is rated based on the stand characteristics used in the original Stand Susceptibility Index (Shore & Safranyik, 1992) combined with the Climatic Suitability Factor (Carroll, 2004). The resulting susceptibility model generates a probability for a stand to produce a successful beetle population in one year if it were infested.

Stands with high ratings are to be preferentially harvested over stands with low susceptibility ratings. Forest Management Agreement (FMA) holders are directed to amend their current management plans to reduce the amount of susceptible pine on their operating landbase to 25% of the anticipated level, over 20 years. This action changes stand age-class structure over the landscape thus enhancing resistance to MPB attack and spread (ASRD 2007).

Prescribed burns are another tool SRD aims to implement to reduce the amount of highly susceptible stands where the climate is favourable for MPB population expansion. Although planned, no burns have been carried out so far as unfavourable weather conditions rendered such action unfeasible or unsafe. Nevertheless, SRD will continue to attempt conducting prescribed burns for reducing the amount of pine susceptible to the MPB.

Use of Verbenone

Brooks Horne (Forest Health Officer) used pouches with Verbenone, an anti-aggregation pheromone, to prevent MPB attacks on cone-bearing whitebark pine in the Fetherstonhaugh Creek and Mount Sprague areas of Willmore Wilderness Park. His staff hung 275 pheromone pouches containing Verbenone on the trunks of all cone-bearing whitebark pines within a 7.5 hectare area with mixed pines. Pheromone pouches were not deployed on the lodgepole pines in this area.

Out of the 275 whitebark pines in this area, 19 (6.9%) treated trees were attacked by the MPB. In comparison, 31 out of 128 (24%) of untreated lodgepole pines were attacked. The beetles in the attacked whitebark pines had an R-value (an indicator of population increase) of >4 indicating a high risk of beetle expansion. Overall, the R-value of beetles in the lodgepole pines was 2-4, indicating a moderate risk of expansion. The results indicated that Verbenone pouches provide partial protection from MPB attacks under these population levels. It would be interesting to test effectiveness of Verbenone pouches under different MPB population levels.

In the Smoky Area, high value trees at Kakwa Falls and around Grande Prairie as well as some northern white bark pine stands were treated with Verbenone. The South Peace Municipality (Counties of Grande Prairie, Saddle Hills, Birch Hills, Greenview, Spirit River) also used a “push-pull strategy” by deploying aggregation baits to attack trees slated for removal combined with anti-aggregation pheromones (verbenone) on trees to be protected in the Iroquios area and in areas directly south of Grande Prairie.

Protection of High Value Seed Orchards and Genetic Sites

SRD has several genetic sites and seed orchards scattered throughout the province. These sites are highly valuable and are intensively managed. In an effort to protect these sites, 50 metre-wide area surrounding each of these sites was surveyed for beetle attack. If any trees within this 50-metre area were attacked, those were cut and burned before beetle flight.

In addition to survey and control outside of these sites, SRD Genetics and Tree Improvement staff will monitor trees within the sites. Some sites were

protected with the use of anti-aggregation pheromone Verbenone and contact insecticide Carbaryl ® sprayed over the stem.

Regulations to prevent infestation spread

The Mountain Pine Beetle Log Management Directive regulates all timber transported on public highways that was harvested from private and federal land in Alberta. It restricts the transportation of such infested wood with bark attached to the period between October 1 of the current year and June 15 of the following year. The directive came into effect on November 27, 2006 and is available online at: www.srd.alberta.ca/forests/pdf/MPB%20Log%20Management%20Directive%202006-05.pdf.

Another directive came into effect on November 28, 2006 to protect Alberta's forests and economy from destructive forest pests that can be unknowingly introduced with shipments of imported coniferous logs and forest products with bark attached. The directive stipulates that the Minister's approval is required to import such materials into Alberta. The Minister may withhold his approval, or restrict or prohibit transportation of such material within Alberta if the importation could cause or increase the damage to forest growth by insects or diseases. This directive thereby prevents human transportation of MPBs into Alberta from source populations in British Columbia and the USA. Coniferous forest products regulated by this directive include logs, cants, rough-sawed lumber, slabs, roundwood, hoopwood, split poles, pickets, stakes, staves, squared timber, lath, butts, tops and firewood of any conifer species, with >2% outer-bark attached; and shipments of hog fuel or any other wood residue or debris, containing >2% conifer bark by mass. The directive can be accessed online www.srd.alberta.ca/forests/pdf/Importation%20Directive%20Nov%202006.pdf).

Spread Control Overhead Team

The Canada-British Columbia (BC) Implementation Strategy – Mountain Pine Beetle Emergency Response (ERS) was established in September, 2005. The overall goal of this strategy is to minimize the spread of MPBs from BC into Alberta and the boreal forest. Four BC Ministry of Forests and Range Districts (Rocky Mountain, Columbia Forest, Headwaters and Peace Forest Districts) have assumed responsibility for bark beetle suppression along the BC-Alberta provincial boundary in part to complement suppression treatments conducted by SRD, BC Parks and Parks Canada.

The Spread Control Overview Team (SCOT) was created to develop a system to oversee the operational and tactical plans for MPB spread control activities that will be undertaken in the BC districts bordering Alberta. The team consists of entomologists and managers of the BC Ministry of Forest and Range, SRD, Canadian Forest Service, Parks Canada, an independent consultant, and a conservation analyst from the Ministry of Environment, Parks and Protected Areas Program. In November 2005, the team reviewed detailed information presented by the forest districts and licensees adjacent to the Alberta border for the first time. The team provided advice, suggestions to improve processes and activities, generated reports, and assessed progress towards the performance measures set out in the Mountain Pine Beetle Emergency Response: Canada-B.C. Implementation Strategy www.for.gov.bc.ca/hfp/mountain_pine_beetle/can_bc_implement.htm).

The team also supports and develops a work plan required by the BC-Alberta Memorandum of Understanding. Funding from other sources within BC and Alberta that are targeted to spread control activities in these districts are part of the overview assessment to achieve efficient coordination of funding and results. Other strategies used to mitigate the spread of mountain pine beetle, such as harvesting, are reviewed for overall effectiveness also.

Since December 2006, the team provides monthly updates to all members and relevant parties.

Education and Awareness

Education, Increased Awareness and Training are important components of the mountain pine beetle (MPB) management program. Education and increased awareness of the MPB helped to provide a better understanding of this pest by the general public, policy makers, industry and other stakeholders. These activities were carried out at the provincial and Area levels.

After the large-scale immigration of MPBs in 2006 from BC into previously un-infested areas in Alberta, aerial detection of infested trees was not possible until faders appeared in 2007 in these areas. To determine the extent of the infestation the 310-BUGS hotline was established in 2006 so that the general public and workers of forest-based industries could report sightings of infested trees. To educate the public about the symptoms of MPB attack and to create awareness of the 310-BUGS hotline, pamphlets were mailed to many municipalities across the province who distributed them to all residents in their communities. A series of open houses, public information sessions and information booths were held in all Forest Areas, providing information on MPB, SRD's Management Plan and promoting the 310-BUGS hotline. For more details see the Area specific information below.

Provincially, SRD hosted and/or participated in a number of media events. As part of the Province's "Minister for a Day" program, five grade 5-7 students and their parents were accompanied by SRD's Minister David Coutts on a flight from Edmonton to Prince George on October 17, 2006. During the flight Erica Lee gave the students an orientation to the MPB epidemic in Alberta. In Prince George, Greg Rawling, Prince George District Manager, British Columbia Ministry of Forests and Range briefed the students on the magnitude of the epidemic in British Columbia, the causes of the epidemic, steps being taken jointly by British Columbia and Alberta to address the epidemic's spread and programs to salvage the damaged timber before losing value. After flying to Grande Prairie, Mike Maximchuk gave the students a tour of infested areas in Grande Prairie. At the end of the day the students gave their recommendations as "Ministers for a Day" on actions to curb the spread of the beetle in Alberta. The event was captured by The Edmonton Journal, Edmonton Sun, Globe and Mail, Grande Cache Mountaineer, Canadian Press, CBC radio and TV, Global, CTV, a freelance radio (Let's Go Outdoors) and a freelance filmmaker.

On June 19, 2007 Dr. David Suzuki and a filming crew filmed cut-and-burn control of infested trees at High Prairie. This footage was part of filming for a two-part "Nature of Things" segment on climate change to air in November 2007. The film included interviews with Dr. John Spence (University of Alberta), Dr. Allan Carroll (Canadian Forest Service) and Erica Lee (SRD).

Reporters from four Edmonton TV outlets, four local radio stations, and four newspapers (*The Edmonton Journal, Grande Prairie Daily Herald Tribune, Calgary Herald and Beaverlodge Advertiser*) attended a media event SRD organized in Grande Prairie on July 19, 2007. The intent was to showcase joint efforts by SRD, industry and municipalities. Footage included SRD crews conducting MPB surveys near Graham Base and municipal control action in Evergreen Park in Grande Prairie. The media interviewed Erica Lee (SRD), Jerry Bauer (municipal MPB planner), Roger Loberge (Weyerhaeuser), Jim Stephenson (Canfor), Grant Williamson (Ainsworth), Parker Hogan (AFPA), Dan Piercy (Chamber of Commerce). SRD made three helicopters available which took the reporters on a flight touring sites of infested trees with red foliage.

SRD, along with the Forest Engineering Research Institute of Canada, hosted a technical information session on May 11 at the 2007 Northern Forestry Show in Grande Prairie. The Northern Forestry Show is organized by a small group of volunteers and features information seminars, displays and networking opportunities for the forest industry and the general

public. The session provided the forest industry, contractors, provincial agencies, and the general public with an update on the current MPB situation; insights into operations within MPB affected stands; and a forum for discussion.

A Hydrology Workshop, held on October 13 in Calgary, brought together provincial government employees, industry workers and academics to discuss impact of the mountain pine beetle infestations on groundwater, run-off, and ultimate quality and quantity of water available for downstream users. The event was hosted by SRD.

As a member of the Strategic Directions Council (SDC - composed of Parks Canada, British Columbia Parks, British Columbia Ministry of Forest and Range, SRD, Alberta forest industry, Canadian Forest Service, and Alberta Tourism, Parks and Recreation) SRD also has a brochure that provides information on mountain pine beetle and its potential impact on Alberta. This group also produced a key tag that describes the mountain pine beetle and provides photographs and descriptions on how to detect an infested pine tree.

Areas

Peace River and Upper Hay Areas

In 2006/07, Mike Maximchuk (Forest Health Officer) and Natalie Henneberrry (Forest Health Technician) made many presentations to increase MPB awareness in these Areas. These presentations were made to participants (councillors, agricultural fieldmen, seasonal staff, other stakeholders) of the Municipal Districts (MD) and towns taking part in the MPB Grant Program (Northern Lights, Northern Sunrise, Fairview, Peace, Clear Hills, Town of Fairview and Town of Peace River). They also made presentations to SRD staff at the Area Conference, High Prairie Council, Junior Forest Wardens, and Junior Forest Rangers, members of the Alberta Trappers Association, Forestry Week attendees and students at Fairview High School. In addition, MPB information sessions were conducted for the benefit of stakeholders (farmers, land owners) in the Peace River area and attendees of various meetings between forestry and forest industry groups.

Mike and Natalie conducted several courses to train survey contractors and auditors in these Areas. They also supported training courses conducted at Grande Prairie and Worsley.

Foothills Area

Brooks Horne (Forest Health Officer) and Christy Messier (Forest Health Technician) conducted MPB information sessions for Area SRD staff, the general public and other stakeholders. SRD personnel at these sessions were staff at the Whitecourt Area Office, Wildfire Information Officers, Wildfire Crews (HAC and RAP), Type I Wildfire Crew Leaders and Junior Forest Rangers. The industry groups included Oil and Gas Workers, Edson Community Timber Permit (CTP) holders, staff of Foothills Forest Products; Hinton Wood Products; Sundance Forest Industries; Weyerhaeuser Edson and their contractors. Other stakeholders at these sessions were members of the Concerned Oil and Gas Citizens, Yellowhead County Shelterbelt/Woodlot Association, Cold Creek Loggers, Edson Fish and Game Association, and West Yellowhead Mountain Pine Beetle Coordination Committee.

The general public of the communities of Grand Cache, Hinton and Edson attended the public information sessions. Two Members of the Legislative Assembly (MLA) (Ivan Strang MLA and George Vanderberg MLA) also attended MPB Information Sessions.

Southern Rockies and Clearwater Areas

In these Areas, Christie Ward (Forest Health Officer) increased MPB awareness by making presentations at meetings, visiting Interest Groups and through media contacts (local newspaper, radio station). She made presentations to the general public (Information Sessions, Open Houses); Industry (Conoco Phillips,

R10 Timber Operators, Sundre Forest Products, Shell); Associations (Woodlot Association in Water Valley, Alberta Native Plants Council, Ghost and Red Deer Watershed Associations, National Forest Pest Association); Schools (three Junior High Schools); Aboriginal groups (Blood Tribe), Municipal District of Rockyview; and Scouts.

Lesser Slave Area

Throughout the year Dale Thomas (Forest Health Officer) made presentations to members of various organizations (Trappers Association, Boreal Forest Discovery Camp, SRD staff in Lesser Slave Area), conducted tours for local media and handled inquiries from the general public. These presentations covered MPB biology, identification and management strategies.

Lac La Biche and Waterways Areas

Tom Hutchison (Forest Health Officer) conducted information sessions to increase the awareness of MPB by external stakeholders (Integrated Forest Pest Management Group, AlPac Staff) and SRD staff (Lac La Biche and Waterways Area staff). He also held information sessions for the benefit of the general public, Junior Forest Wardens and Junior Forest Rangers. Tom handled many MPB inquiries from mass media personnel and the general public throughout the year.

Woodlands Area

Seena Handel (Forest Health Officer) conducted information sessions for various groups (SRD staff, school children, forest industry, oil and gas industry, trappers, community groups and the general public), made several presentations on MPB-related activities and provided weekly updates at the Trade Shows, community forums and meetings with forest industry. She also received feedback from these stakeholders on planned MPB activities. She coordinated mailouts with the County of Woodlands, and the Towns of Whitecourt, Swan Hills and Fox Creek.

Smoky Area

The Forest Health Officers, Dylan Wood and Devin Letourneau, and information officers promoted public awareness by providing MPB information at the Agri-Fair in Beaverlodge and Sexsmith, the Forest Show in Grande Prairie and a Woodlot Owners Meeting in Saskatoon Lake. During a tree pest workshop in Grande Prairie they provided public consultation on how to protect pine trees from MPB attack. SRD staff from the Smoky Area as well as Provincial Headquarters also provided information on the provincial MPB program to mass media by responding to media enquiries and hosting media events in Grande Prairie, Graham Base and Sherman Meadows Base.

Training

Ground Survey Course

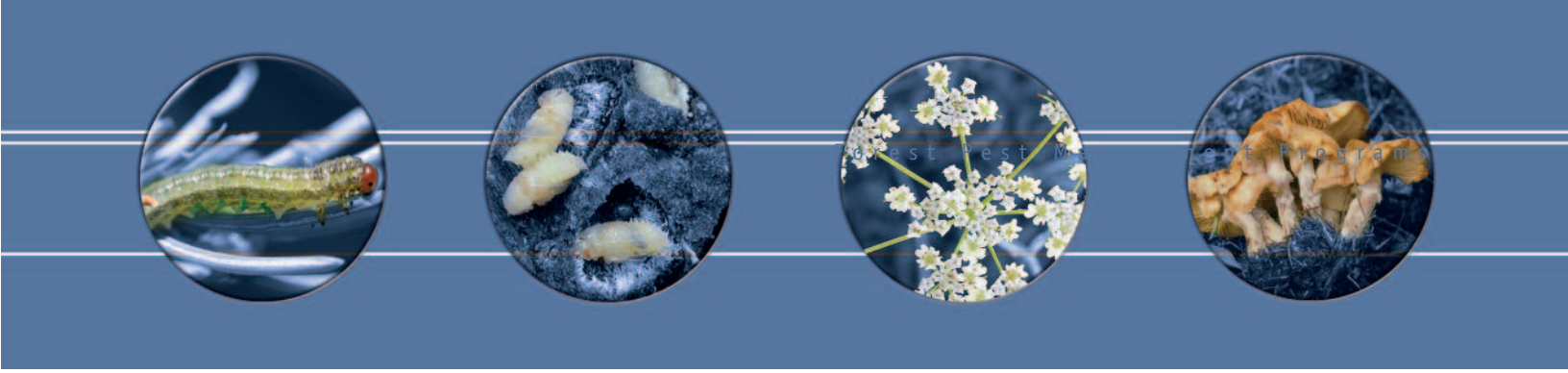
The Forest Health Training and Operations Assistant, Anina Hundsdörfer, developed a course to train SRD staff, contractors, FMA holder employees and municipal employees how to conduct ground surveys for MPB, as well as baiting and control techniques. The course covered MPB life cycle, damage symptoms and ways to distinguish MPB from other similar bark beetles, as well as provincial procedures for ground surveys, baiting, control and population forecast surveys.

Every course participant received a field manual containing information on MPB biology and identification and the provincial procedures for ground surveys, baiting and Level I control (ASRD, 2006). Presentations and exercises in a classroom were followed by a written exam at the end of the day. The second day was spent in the field looking at damage symptoms and practising survey procedures. Several burn piles of varying control quality were established in the Training Forest of Cache Percotte near Hinton where students could observe and discuss control techniques. Students were tested in the field for their ability to identify MPB, apply the

survey procedures and to navigate in the forest. Successful participants of the course received a certificate and their names were entered into a provincial database for future reference. With the help of the Forest Health Officers, Forest Health Technicians and Information Officers, 26 courses were held during the 2006 beetle year with a total of 562 participants.

Aerial Survey Course

Sunil Ranasinghe (Forest Entomologist) and Anina Hundsdörfer (Forest Health Specialist) organized a 2-day course on Heli-GPS surveying MPB infestations. This course was conducted on May 23-25 in Canmore Alberta. The trainers were Sunil Ranasinghe (Forest Entomologist), Brad Tyssen (GIS Technologist), Anina Hundsdörfer (Forest Health Specialist), Tom Hutchison (Forest Health Officer) and a contractor. There were 24 trainees consisting of SRD employees and industry personnel. The course commenced with a half-day classroom session to cover beetle biology and use of a tablet personal computer linked to a global positioning system to record the survey results. This was followed by aerial survey training for half a day and an evaluation on the following day. Each participant was supplied with a MPB heli-GPS Manual containing procedures, pictures for identifying tree species from the air and discerning MPB damage from other mortality agents, as well as instructions for using the tablet PC (ASRD, 2007).



Alberta Forest Pest Outbreak Warning System

Spruce Budworm

Forest Health crews deployed Multi-Pher I (Le Group Biocontrole, Quebec) traps baited with the female spruce budworm sex pheromones (Phero Tech Inc., British Columbia) to monitor male moth populations. The procedure for deploying these traps is described in the *Spruce Budworm Management Guide* (Ranasinghe and Kominek, 1998). Figure 20 shows the results of these surveys.

Spruce budworm pupa

Northeast Alberta

The results of male spruce budworm moth surveys are summarized in Table 13.

In the Lac La Biche Area 28 plots were established. Average trap catches indicated risk of new outbreaks occurring in 2008 was low in 7 plots (25%),

Table 13
Summary results of spruce budworm male moth surveys carried out by using pheromone-baited traps in northeast Alberta, 2007.

Area	Risk of New Outbreaks Occurring in 2008					
	Low		Moderate		High	
	No. of Plots	Moths/trap	No. of Plots	Moths/trap	No. of Plots	Moths/trap
Lac La Biche	7	163-460	15	597-1971	6	2044-2974
Waterways	1	338	8	618-1921	13	2213-5272

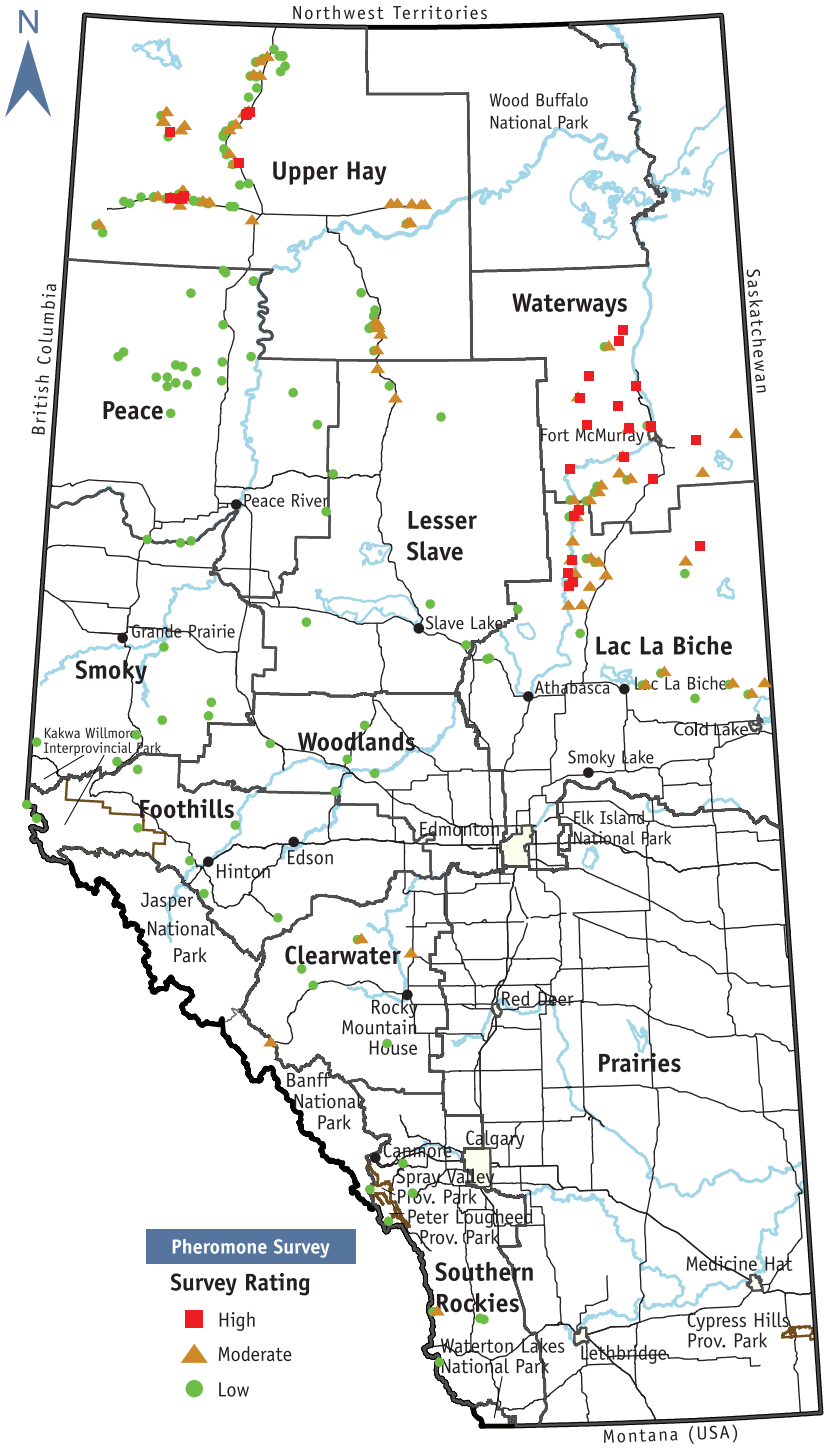


Figure 20

Forecast based on male moth catches in 2007 on risk of new spruce budworm outbreaks occurring in 2008 in Alberta.

moderate in 15 plots (54%) and high in 6 plots (21%). In comparison, only 7% of the plots indicated high risk of new outbreaks occurring in 2007. Thus the risk of new outbreaks occurring in 2008 has increased compared to that in 2007. Overall, the risk of new outbreaks occurring in 2008 is moderate to high in this Area.

In the Waterways Area, 22 plots were established. Average trap catches indicated risk of new outbreaks occurring in 2008 was low in 1 plot (5%), moderate in 8 plots (36%) and high in 13 plots (59%). Overall, the risk of new outbreaks occurring in this Area in 2008 remains high.

Northwest Alberta

Summary of 2007 male spruce budworm moth survey results and the risk of new outbreaks occurring in 2008 are shown in Figure 20 and Table 14.

In the Smoky Area trap catches in all the plots indicated low risk of outbreaks occurring in 2008.

In the Lesser Slave Area, the average trap catches indicated that the risk of new outbreaks occurring in 2008 was low in 5 plots (71%) and moderate in 2 plots (29%). The overall risk of new outbreaks occurring in this Area in 2008 is low.

In the Peace Area, the average trap catches indicated nil to low risk of outbreaks occurring in 2008.

In the Upper Hay Area, risk of new outbreaks occurring in 2008 was low in 58% of the plots, moderate in 37% of the plots and severe in 5% of the plots. Compared to the survey forecast for 2007, these numbers indicate an increase in the risk of new outbreaks occurring in 2008. The overall risk of new outbreaks occurring in this Area in 2008 is low to moderate.

Southwest Alberta

Nineteen plots were established in southwest Alberta as shown in Table 15.

Most of the plots in southwest Alberta are infested with the two-year cycle spruce budworm, i.e., high moth catches are expected in alternate years. In 2006 relatively high catches occurred in plots with the two-year cycle spruce budworm.

Table 14
Summary results of spruce budworm male moth surveys carried out by using pheromone-baited traps in northwest Alberta, 2007.

Area	Risk of Outbreaks Occurring in 2008					
	Nil - Low		Moderate		High	
	No. of Plots	Moths/trap	No. of Plots	Moths/trap	No. of Plots	Moths/trap
Smoky	9	4-191	0	-	0	-
Lesser Slave	5	0-332	2	924-1453	0	-
Peace	21	0-325	0	-	0	-
Upper Hay	53	0-495	33	549-1970	5	2212-3234

Table 15
Summary results of spruce budworm male moth surveys carried out by using pheromone-baited traps in southwest Alberta, 2007.

Area	Risk of Outbreaks Occurring in 2008					
	Nil - Low		Moderate		High	
	No. of Plots	Moths/trap	No. of Plots	Moths/trap	No. of Plots	Moths/trap
Southern Rockies	8[1]	199-463	0	-	-	-
Clearwater	4	53-474	2	567-772	0	-
Foothills	8	18-188	0	-	0	-
Woodlands	5	0	0	-	0	-

[1] Two plots in western spruce budworm stands

Consequently, relatively low moth catches were expected to occur in these plots in 2007.

In the Southern Rockies Area, trap catches in six plots forecasted nil to low risk of new outbreaks occurring in 2009. The other two plots located in stands infested with the western spruce budworm also had similar trap catches. In the Clearwater Area, trap catches at four out of six plots were indicative of nil to low risk of new budworm outbreaks in 2009. Traps in two plots had moth counts indicative of a moderate risk of outbreaks occurring in 2009. In the Foothills and Woodlands areas the trap catches indicated nil to low risk of new outbreaks occurring in 2009 (Figure 20 and Table 15). Overall, southwest Alberta has a low to moderate risk of new outbreaks occurring in 2009.

Western Spruce Budworm

An egg mass survey was carried out to predict the severity of defolaition occurring in 2008. The sampling procedure is described in Ranasinghe (2007); this procedure was based on a publication by the B.C. Ministry of Forest and Range (1995). Ten sample plots were established and the average number of new egg masses per 10 m2 of foliage were calculated. Figure 21 illustrates the results of this survey. The egg mass counts indicated likelihood of severe defoliation occurring in 80% of the plots in 2008. Severe defoliation is expected in 2008 in most of the currently infested areas.

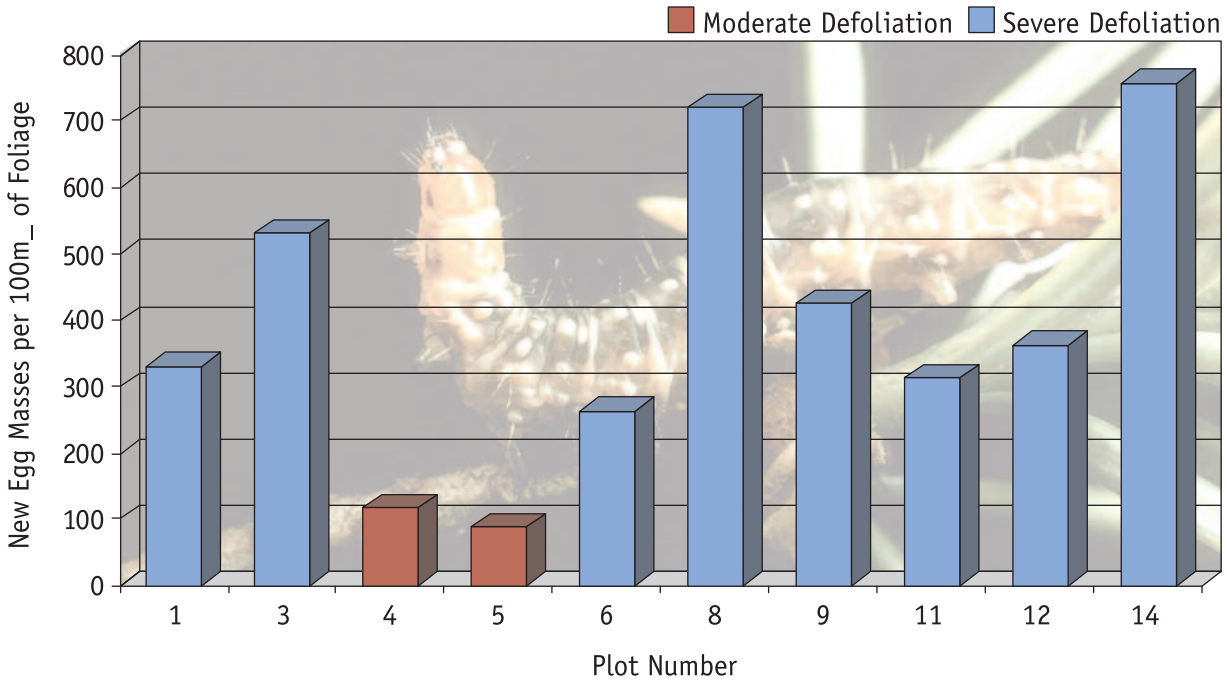


Figure 21
Forecast on western spruce budworm defoliation severity in sample plots in 2008 based on a survey of new egg masses carried out in the fall of 2007 in Porcupine Hills, Alberta.

Mountain Pine Beetle

To assess the natural growth trends of MPB populations in Alberta, province-wide population forecast surveys were conducted in the spring of 2007. Samples were collected from 1419 infested trees at 255 sites. R-values (the ratio of the adults that entered a tree to the living brood), a measure of MPB population growth, were calculated from these samples. Since climate deemed to be the most important natural factor limiting MPB population growth in Alberta, a sampling strategy was devised to capture the variation of climatic conditions in the infested areas of the province. A climate suitability model, developed by Dr. Allan Carroll and his co-workers (Carroll *et al.*, 2004), was used to develop the sampling strategy. This model, based on historical and current weather data, indicates an area's suitability to MPB development. In each climatic zone identified by the model fifteen to twenty plots were set up. Other considerations included the number of infested trees per site, spatial coverage and site access. Due to inconsistencies in determining mortality of eggs and some larvae the R-values calculated were not exact. However, these are the best estimates of the relative growth of MPB populations in the province.

In general, MPB populations in the south showed very high R-values (Table 16, Figure 22). Thus, if no control program had been undertaken, the 2007/2008 MPB generation in the south was to be significantly larger than the 2006/2007 generation. In northern Alberta, population growth was much lower than in southern Alberta. Overall, barring immigration of MPB, these northern populations may either remain static or decline in the next generation.

Table 16
Summary statistics for R-values from spring 2007 by Area.

Area	Site-level R-values		SD between sites	SD within sites	
	mean	max		mean	max
Southern Rockies	3.58	18.50	5.01	3.14	20.51
Foothills	0.31	2.78	0.56	0.63	3.91
Slave Lake	0.46	6.50	1.27	0.22	4.31
Smoky	0.52	5.00	0.87	0.81	5.87
Peace	1.14	4.33	1.29	1.67	5.93
Provincial	1.02	18.50	2.40	1.11	20.51

The geographic variation in R-values can be largely explained with winter survival of MPB. The predictions (Barry Cooke, personal communication) based on a winter-kill model (Régnière, Bentz & Cooke 2007, privileged communication) showed a good fit to the large-scale trend of the empirical data. However, within each Area, R-values varied greatly between regions and between individual trees (Table 16). Other factors that could contribute to population trends include microclimatic conditions, host resistance, phloem thickness, attack density, beetle fitness, competition with other bark beetles, predation, disease, stand conditions, drought and genetics.


MPB in a bark tube

The large-scale pattern in green-to-red ratios was consistent with the R-value trends; high ratios in southern Alberta and overall lower ratios in the northern Alberta.

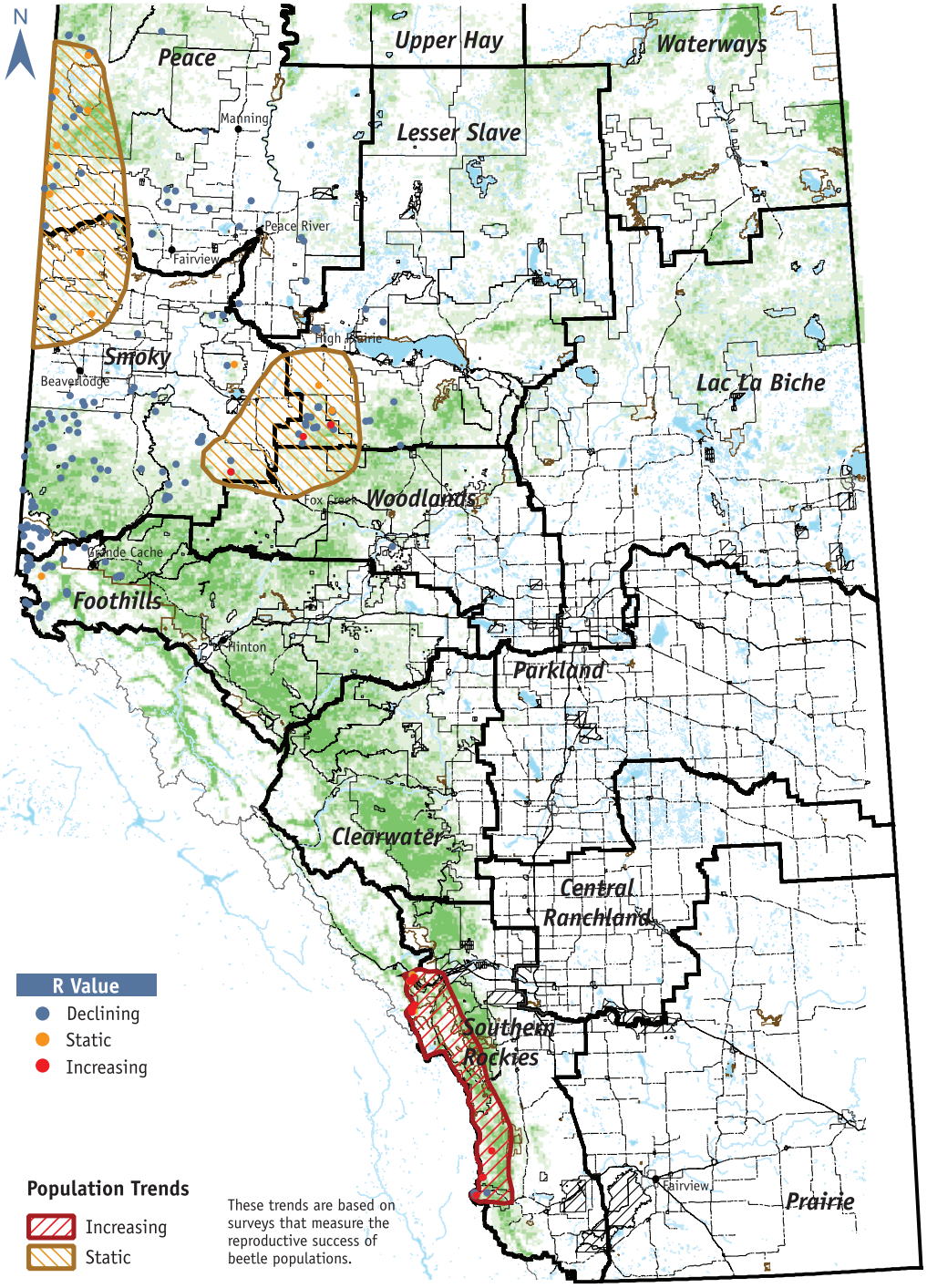


Figure 22
Forecast on mountain pine beetle population trends in 2007/2008 based on R-values collected in May 2007, Alberta

Forest Tent Caterpillar

An egg mass survey was carried out in the fall of 2007 to predict the severity of forest tent caterpillar defoliation in the Waterways Area in 2008. This survey was carried out in collaboration with the Municipality of Wood Buffalo. The sequential sampling procedure used was described in Ranasinghe (2007). Several aspen stands in the Waterways Area were surveyed by using this procedure. The survey results indicated possible occurrence of severe forest tent caterpillar defoliation in most of the surveyed stands in 2008 (Figure 23).

Gypsy Moth

The Forest Health Section coordinated deployment of 65 pheromone-baited Delta traps to detect gypsy moths in the Green Zone. The traps and the procedures were provided by the Canadian Food Inspection Agency. Traps were deployed at high risk locations across the Green Zone. No gypsy moths were detected in the traps deployed by SRD. The risk of a gypsy moth infestation occurring in 2008 in the Green Zone is nil.

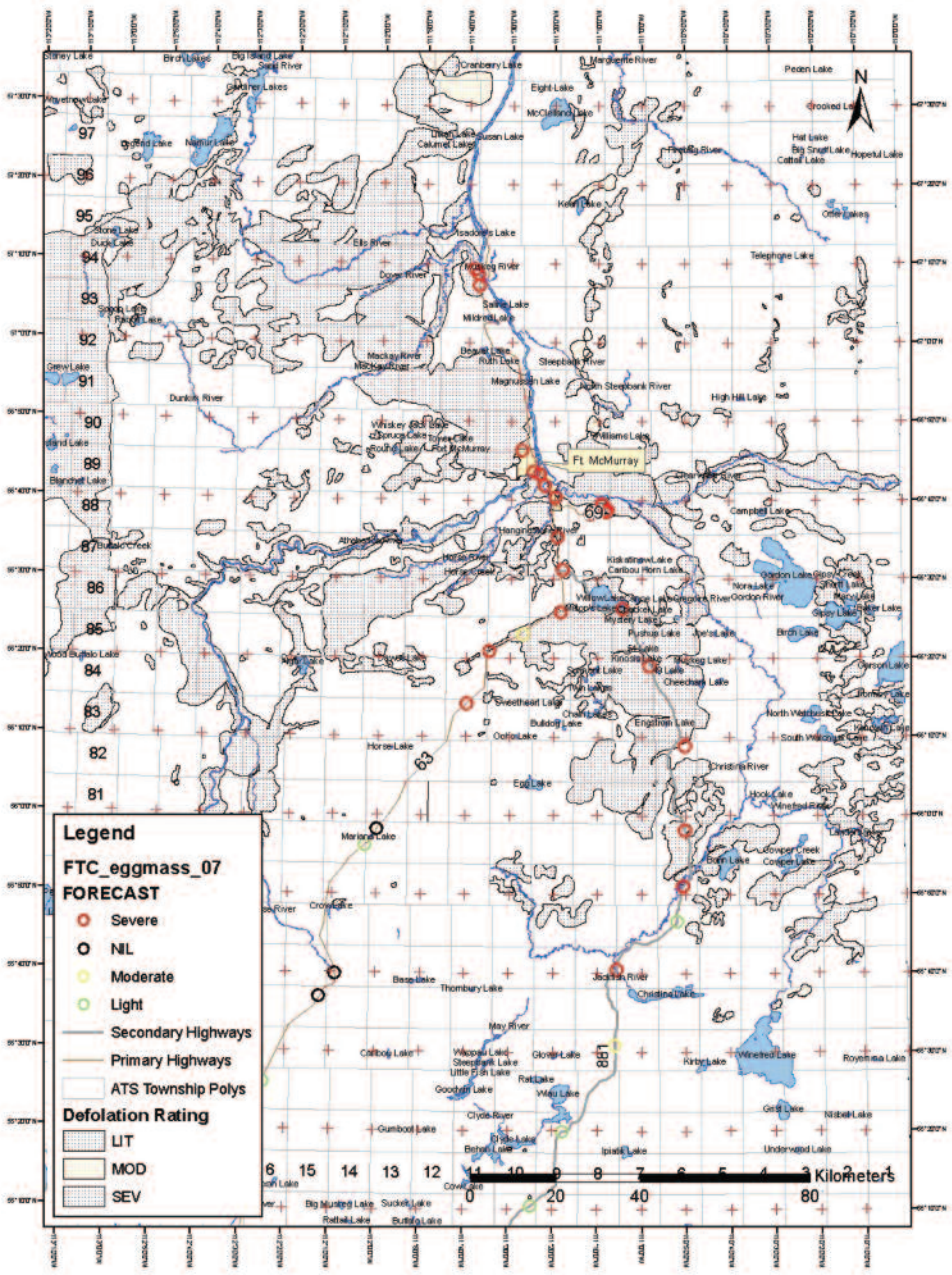
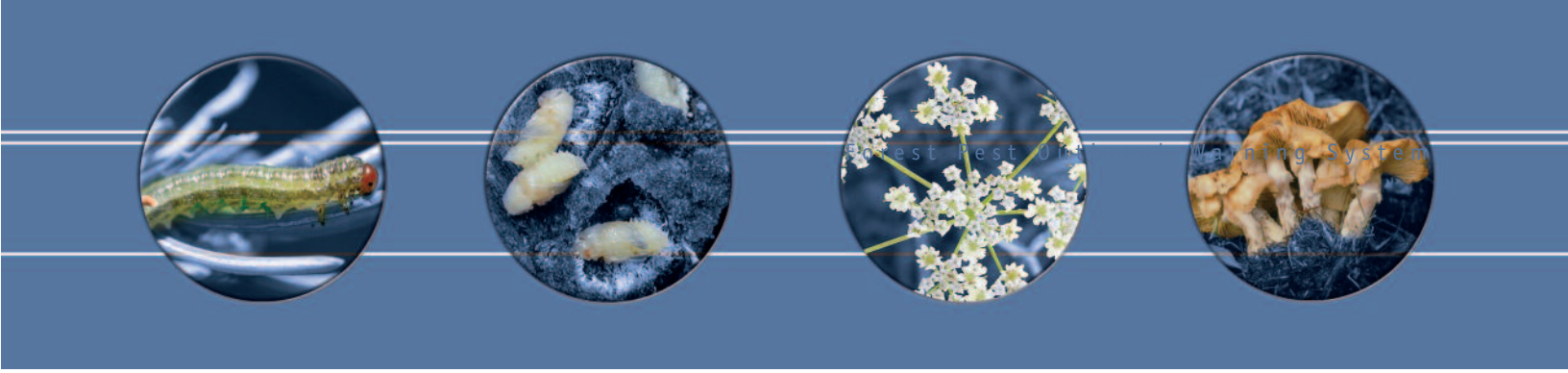


Figure 23
Map showing sampling locations with high egg mass counts that indicate severe forest tent caterpillar defoliation in 2008 in northeast Alberta.



Education and Awareness

Annual Report

The Forest Health Section published the 10th annual report in 2007. In 1997, this report succeeded the Forest Insect and Disease Survey Report published by the Northern Forestry Centre, Canadian Forest Service, Natural Resources Canada. The Forest Health Annual Report contains details on forest insect, disease and invasive species surveys, operational programs, research, education and increased awareness on forest health issues.

Bugs and Disease Newsletter

Three issues under the 17th Volume of this Newsletter were published in 2007. This publication covered numerous aspects of Alberta's Forest Health-related news, stories and poems. This informative publication has a Canada-wide circulation.

Beetle Bulletin

The Beetle Bulletin allows SRD to update the public on the mountain pine beetle situation, particularly on research initiatives, provincial operation updates, upcoming events and other important mountain pine beetle news. This publication has a readership varying from highly invested stakeholders to those new to the MPB story.

The Beetle Bulletin recommenced distribution in December 2007 after a six month hiatus. The publication is now distributed on a monthly basis as an e-newsletter that is delivered to subscriber email accounts via a website program called My Industry Mailout. Through an online reporting system SRD can assess factors such as which articles are being read the most to how many times the Bulletin is being forwarded on by a subscriber.

The publication is user-friendly as readers can subscribe via the internet or unsubscribe straight from the newsletter. Recipients of the publication are also able to forward the publication on to other people who can then choose to subscribe with a simple press of a button.

Provincial Integrated Forest Pest Management Forum

The 11th annual Integrated Forest Pest Management Forum was held on November 6, 2007 at the Northern Forestry Centre, Canadian Forest Service in Edmonton. This event was attended by representatives of the SRD, British Columbia Ministry of Forest and Range, Municipalities, Canadian Forest Service, academia and forest industry. The keynote address entitled "Murder and Attempted Murder: Mountain Pine Beetle Attacks Two Species of Spruce in Interior British Columbia" was delivered by Robert Hodgkinson, Regional Forest Entomologist, Prince George, British Columbia Ministry of Forest and Range. Other presentations at this forum covered updates on forest health conditions in provincial forested Crown land and national parks in Alberta; and, forest health-related research carried out in 2007 in Alberta.

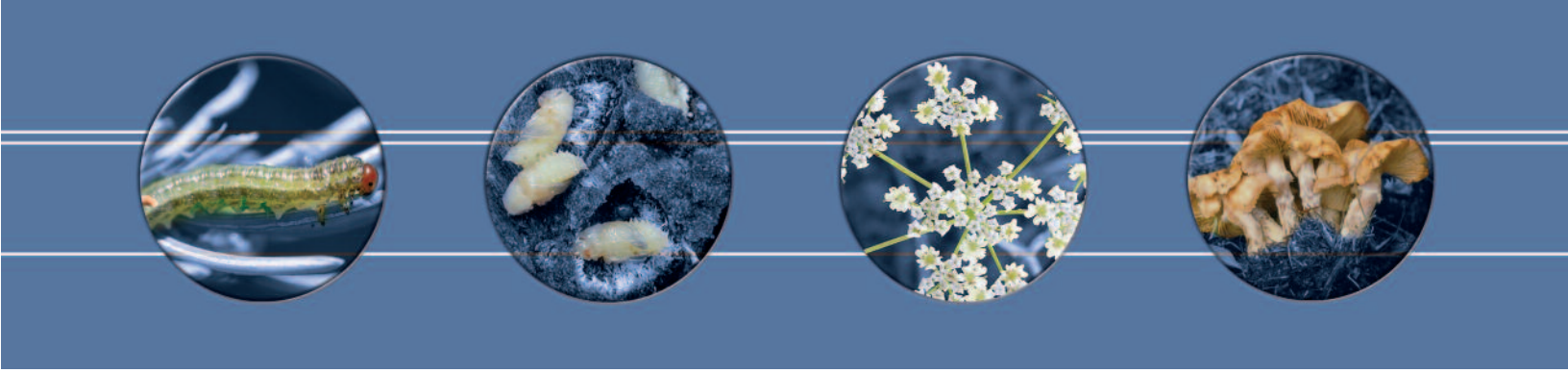
15th Annual Alberta/British Columbia Intermountain Forest Health Workshop

This two-day workshop was held from April 17-18, 2007 in Hinton, Alberta under the auspices of Natural Resources Canada, Canadian Forest Service, Northern Forestry Centre. An update of forest pest conditions in Alberta and British Columbia was followed by a session on current MPB research. The agenda included a session on whitebark pine conservation and another on invasive plants. Dr. Jan Volney made a thought-provoking presentation on "Assessing Sustainability of Canada's Forests." The proceedings of this Workshop are posted on: http://abbcforesthealth.blogspot.com/search

Workshops

The department co-hosted with the Sustainable Forest Management Network, Foothills Model Forest and College of Alberta Professional Foresters a workshop on understanding the hydrological implications of mountain pine beetle and salvage logging in October 2007. Speakers included specialists from British Columbia and the United States.

The department hosted a forest succession workshop in June 2007 which brought together various experts in stand dynamics to develop a common understanding of stand succession in beetle killed stands of pine.



Research and Technology Development

Mountain Pine Beetle

In 2006 and 2007 SRD provided either full or partial funding for MPB research projects within and outside of the Forestry Division. Approximately $1.6 million was committed to fund 15 applied research projects to increase MPB biology and ecological knowledge on the forest landscape. The Forestry Division also provided in-kind support (use of helicopters, camps and other Sustainable Resource Development facilities) for some researchers. The projects were coordinated through a variety of methods including; involvement on the Board of Directors (FRIAA), National Centre of Excellence, Foothills Research Institute and as members on committees such as the Strategic Direction Council. The Forest Economics Branch led research aimed at forest products and chemical attributes of beetle affected wood. The Branch participated on several sub committees with Advanced Education and Technology, coordinated the cross Ministry Assistant Deputy Minister's Working Group and with Employment, Immigration and Industry on community sustainability.

Funding requests originated from the Alberta Research Council, Canadian Forest Service (CFS), Natural Resources Canada, SERG International, Universities and companies. Details of major Sustainable Resource Development funded projects:

- Mountain Pine Beetle Genomics: Project contributors are Genome British Columbia, Genome Alberta, Alberta Sustainable Resource Development, Alberta Forest Research Institute and the University of Alberta. This is a multi-million dollar, long term, large-scale research project aimed at studying the genome of the mountain pine beetle, lodgepole pine and the blue-stain fungi associated with the mountain pine beetle. The main collaborators are the University of Alberta and Genome British Columbia in close association with the University of British Columbia. The objectives are to study genome and its environmental interactions and to create genetic landscape maps of the host tree species, beetle and the blue-stain fungi. This knowledge may help to develop beetle-resistant pine trees and to understand the dispersal history of MPB populations.
- Southern Rockies Watershed Project: This project is led by Dr. Uldis Silins originally investigating the effects of wildfire on water quality and quantity. It has been extended to allow future investigators to address issues related to mountain pine beetle salvage and water quality.
- Foothills Model Forest and University of Alberta-MPB Hydrology Study: This five-year study addresses hydrological questions at the stand level is led by Dr. Uldis Silins. The research team includes Dr. Ellen MacDonald of the University of Alberta and researchers Rita Winklar and David Spittlehouse in British Columbia.
- Overwintering mortality model: Dr. Barry Cooke, CFS validated an overwintering mortality model developed for Utah to local conditions in Alberta. His group monitored MPB mortality in relation to winter temperatures in Alberta and compared model predictions with observed MPB mortality. The goal for next year is to develop a map with predictions on overwintering MPB mortality as a decision-support tool for MPB operations.

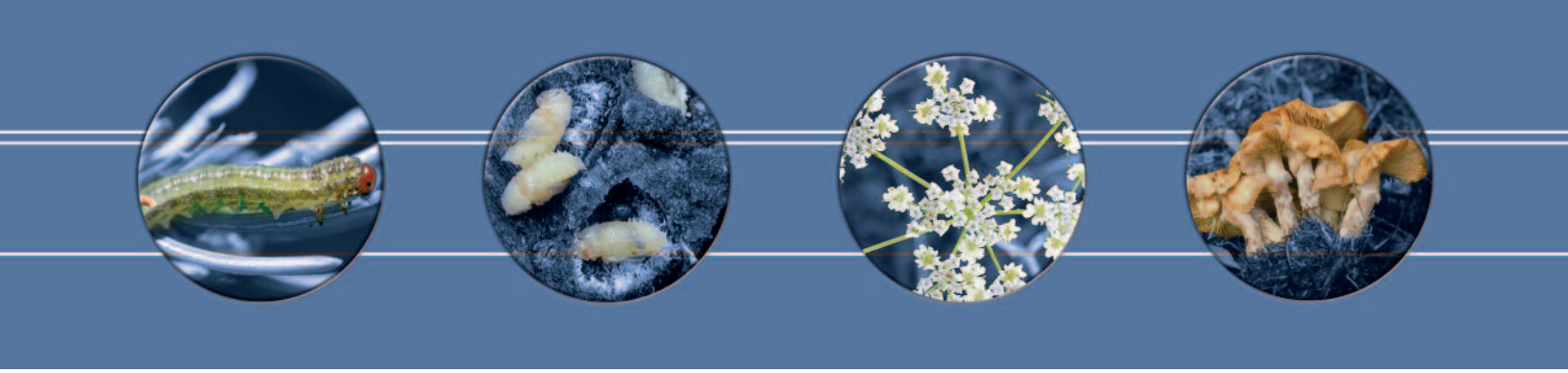
- Impact of MPB on woodland caribou: Debbie Cichowski from Caribou Consulting conducted a literature review to identify research gaps and make suggestions for future research on the impact of MPB on woodland caribou in Alberta.
- Risk of colonization of jack pine by MPB and phytopathogenic Ophiostomoid fungi: Dr. David Langor and his coworkers (CFS, Edmonton) tested host suitability of jack pine for MPB and associated phytopathogenic fungi.
- Transport and waste disposal options for MPB-infested pine wood in Alberta: Forest Engineering Research Institute of Canada (FERIC) reviewed related literature and compiled a document containing acceptable methods for transport of MPB-infested wood in Alberta and for disposal of wood waste after processing infested wood at sawmills.
- Impact of MPB-related harvesting operations on grizzly bear habitats in Alberta: Gordon Stenhouse (Foothills Model Forest) studied changes in grizzly bear habitat use in areas harvested to control the MPB in Alberta. Field work is ongoing.
- Modelling effects of removing selected forest stands on MPB dispersal: Andrew Fall (Gowlland Technologies Ltd.) and his co-workers developed a predictive model that will help SRD to refine the implementation of the Pine Strategy to slow the spread of the MPB infestation.
- Composting as a method of infested wood disposal: Dr. Mike Hamilton (Olds College School of Science and Innovation) monitored the winter temperature profile of standard and composted pine wood waste piles in Alberta. His results suggest that temperatures in a compost pine are high enough to kill MPBs. Hence, composting may be an option in dealing with small amounts of MPB-infested wood waste. This is especially useful for small sawmill operators in Alberta.
- Long-range dispersal of MPB over the Rocky Mountains: Dr. Peter Jackson et al. (UNBC) investigated the feasibility of using Doppler radar to detect and track airborne MPB heading over the Rocky Mountains from British Columbia to Alberta. The project involved aerial capture of MPBs and the use of radar to develop trajectories to predict locations where MPBs are likely to land in Alberta.
- Snow-caching MPB infested logs: Richard Krygier (CFS Edmonton) investigated the possibility of building snow caches over wood piles in the winter and slowing down MPB development while keeping wood fresh for processing later in the season. Results suggest that snow caches may be a viable and effective option for prolonging storage of MPB-infested logs.

SRD conducted internal research in its commitment to use the most efficient and effective methods for MPB operations. Mechanical treatment of wood infested with other insects has been effectively used for phytosanitary treatment of wood infested with other wood boring insects. The use of chippers, mulchers, grinders and debarkers for treating wood infested with MPB was potentially a cost-effective and time-efficient mechanical alternative to fire on specific locations. However, these technologies had never been tested for their effectiveness at killing MPB. Hence, Anina Hundsdörfer and other Forest Health staff conducted a study to identify a chip size where the risk of MPB survival was minimized to an acceptable level. In the summer of 2007 three heavily infested lodgepole pine trees were chipped into chips of 2.9 - 10.2 centimetre diameter and the number of emerging beetles counted daily. The study demonstrated that MPB survival in chips is reduced to an acceptable level in chips 5.1 centimetre or smaller. Provincial quality inspection procedures for chips from level 1 treatment of infested trees were generated based on this threshold chip size.

Technology

During the year, Forest Health Section compiled the following documents to transfer technology on Forest Health:

1. Forest Tent Caterpillar Egg Mass Survey to Predict Defoliation Severity in the Following Year (Ranasinghe, 2007).
2. Guide for Sampling Western Spruce Budworm Infested Stands to Predict Defoliation Severity in the Following Year (Ranasinghe, 2007).



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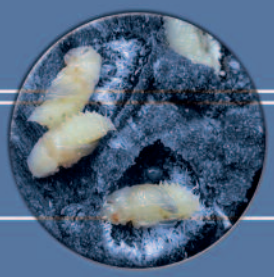

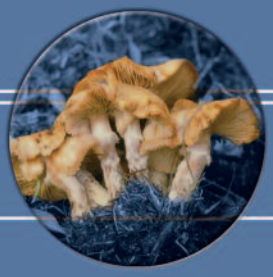

Appendixes

Appendix 1

Alberta Sustainable Resource Development Corporate Areas, December 2007.

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Appendix II

Information on Operational Use of Pheromones in Alberta, 2007.

Forest Tent Caterpillar

Chemical component(s):	Z5, E7 – dodecadienal
Lure type:	Flexlure®
Trap type:	Uni-trap®
Pheromone source:	Phero Tech Inc., Delta, British Columbia

Gypsy Moth

Chemical component(s):	(+)cis-7, 8-epoxy-2-methyloctadecane
Lure type:	Disparlure®
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:	Plastic lure
Trap type:	Multi-Pher I®
Pheromone source:	Phero Tech Inc., Delta, British Columbia

Appendix III

Common and Latin Names of Invasive Plant Species that Occurred in Alberta in 2007.

Bladder campion - *Silene cucubalus* Wibel

Blueweed - *Echium vulgare* L.

Bull thistle – *Cirsium vulgare* (Savi.) Ten.

Canada thistle - *Cirsium arvense* (L.) Scop.

Cleavers – *Galium aparine* L.

Common tansy - *Tanacetum vulgare* L.

Common toadflax - *Linaria vulgaris* Hill.

Dalmatian toadflax – *Linaria dalmatica* (L.) Mill.

Field bindweed – *Convolvulus arvensis* L.

Field scabious - *Knautia arvensis* (L.) Duby

Hound's tongue - *Cynoglossum officinale* L.

Knawel - *Scleranthus annuus* L.

Leafy spurge - *Euphorbia esula* L.

Orange hawkweed - *Hieracium aurantiacum* (L.)

Ox-eye daisy - *Chrysanthemum leucanthemum* L.

Perennial sow-thistle - *Sonchus arvensis* L.

Scentless chamomile - *Matricaria perforata* Merat.

Spotted knapweed – *Centaurea maculosa* Lam.

Tall buttercup - *Ranunculus acris* L.

White cockle - *Silene alba* (Mill.) E. H. L. Krause

Wild caraway – *Carum carvi* L.