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Current Facts & Statistics

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Environment and Sustainable Resource Development

Spruce Budworm

Spruce budworm (*Choristoneura fumiferana*) (Figure 1), sometimes called eastern spruce budworm, is one of the most severe forest defoliators in North America. It damages coniferous trees, mostly white spruce and balsam fir, by feeding on current year's needles (Figure 2). Budworm feeding does not kill trees immediately but can do so over successive annual attacks.

The department uses aerial surveys to monitor spruce budworm defoliation on Alberta public land. Ground-based pheromone surveys and larval surveys are also carried out to forecast the risk of population occurrence in the following year.

The spruce budworm typically has 20-year outbreak cycles. An outbreak is a temporary, large-scale eruption of a population. Spruce budworm outbreaks can reduce tree growth and affect tree health.

The spruce budworm can affect the aesthetic, recreational and economic values of our forests. Alberta currently has large areas of old spruce forests (i.e., trees older than 120 years), where outbreaks usually begin. Long-term budworm outbreaks can cause large-scale tree death. This could result in the forests taking a long time to recover from these outbreaks and may leave the remaining trees susceptible to secondary pests.

The department also monitors another closely related budworm species that defoliates Englemann spruce and alpine fir, called two-year cycle budworms (*C. biennis*). These budworms are similar to spruce budworms but are normally found at higher elevations and take two years to complete one generation. They usually do not spread as quickly as the spruce budworm, and therefore do not cause as much damage.

Figure 1. Spruce budworm larva on a branch.

Figure 2. Evidence of severe spruce budworm defoliation.

Alberta Government

Current Statistics

As shown in Table 1 and Figure 3, the results of 2011 aerial surveys showed a significant drop in the extent of spruce budworm defoliated area in Alberta. In the Upper Athabasca Region, where spruce budworm defoliated 2,146 hectares in 2010, there was no budworm defoliation visible from the air in 2011. In the Lower Athabasca Region, 4,431 hectares were moderately defoliated in 2011. This is a 96 per cent reduction in defoliated area, compared to that in 2010. In the Lower Peace Region, 30,972 hectares were defoliated in 2011. This is an 82 per cent reduction in defoliated area compared to that in 2010. In this Region, defoliation was moderate over 27,764 hectares and severe over 3,208 hectares.

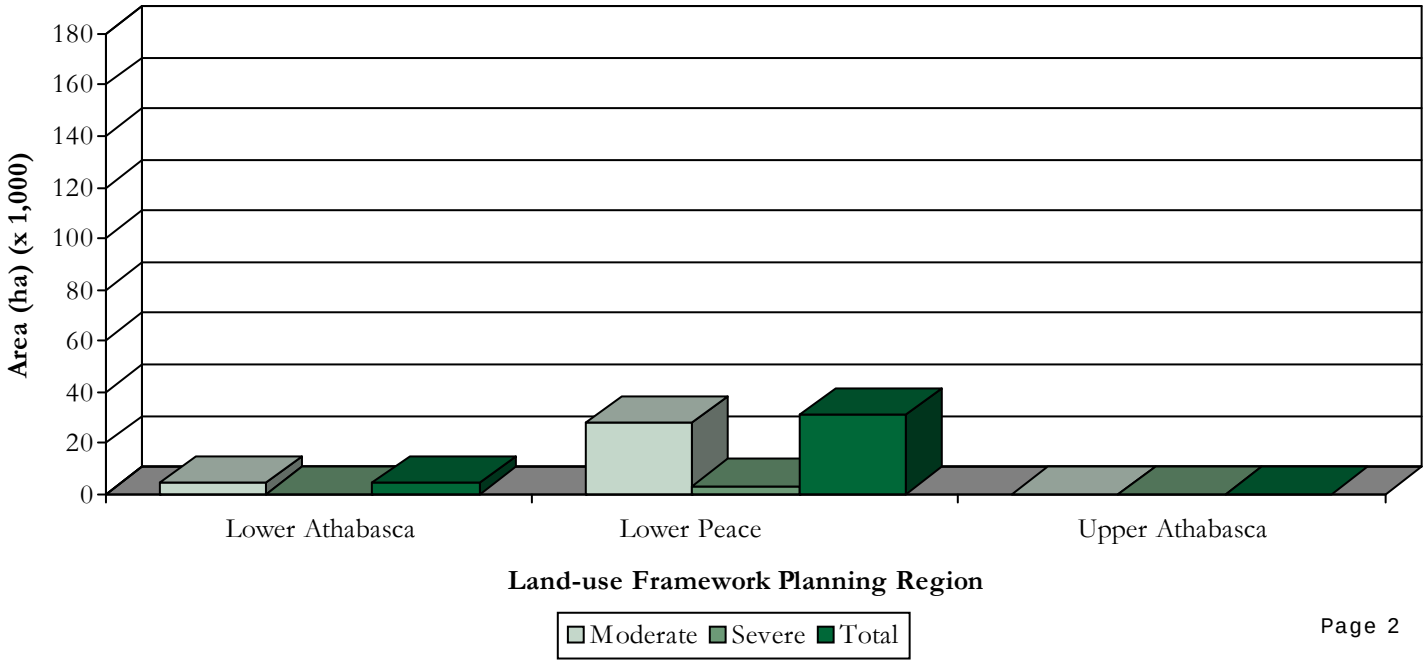
No budworm defoliation was reported in 2011 from the other Land-use Framework Planning regions in the province. During aerial surveys of spruce budworm defoliation, only moderate and severe defoliation are mapped because light defoliation is difficult to see.

Table 1. Spruce budworm defoliation on Alberta public land by Land-use Framework Planning Region, 2011.[1]

Land-use Framework Planning Region	Total area of defoliation (ha)[2]		
	Moderate	Severe	Region Total
Lower Athabasca	4,431	0	**4,431**
Lower Peace	27,764	3,208	**30,972**
Upper Athabasca	0	0	**0**
Provincial Total	**32,195**	**3,208**	**35,403**

[1]Preliminary results. [2]Data have been rounded to the next nearest hectare and have been estimated for each Land-use Framework Planning Region. This includes both inventoried and non-inventoried forest areas. These surveys were conducted over forested public land where infestations are known to occur, for operational purposes. There may be additional defoliated areas that are yet to be detected. The area excludes Wood Buffalo National Park. Only regions with spruce budworm defoliation are shown. Moderate = 36-70% defoliation; Severe = >70% defoliation.

Figure 3. Area of spruce budworm defoliation on Alberta public land by severity category, 2011.



Historical Trends

In Alberta, the last spruce budworm outbreak began in 1987 and collapsed in 2005. That outbreak affected white spruce stands in the Lower Athabasca and Lower Peace regions. Some late-spring frosts that occurred in the affected areas may have helped the collapse of the budworm population. Biological pesticide application helped reduce the damage. At the end of the outbreak, several white spruce stands that were not sprayed with pesticides had relatively high tree mortality. This was observed in long-term monitoring plots, called Permanent Sample Plots (PSPs), in the Lower Peace Region.

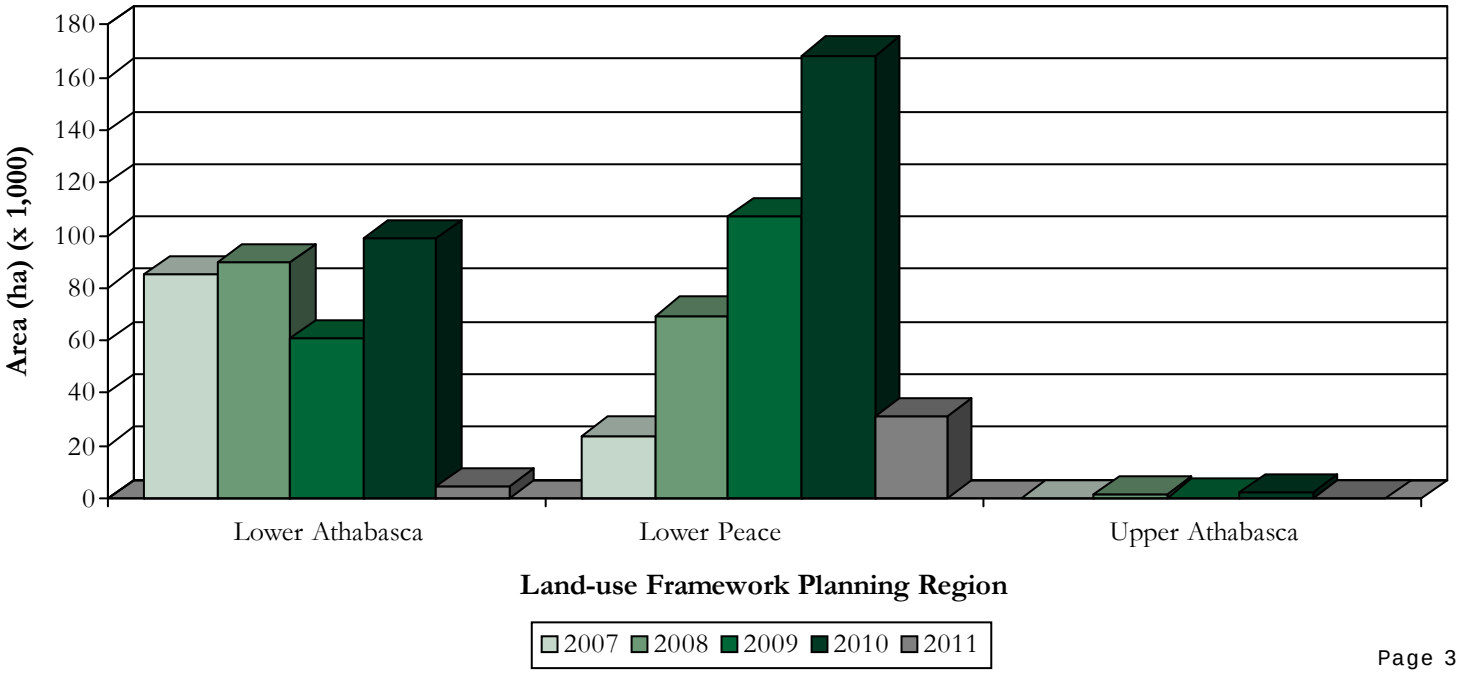
As shown in Table 2 and Figure 4, the budworm outbreaks have gradually increased in extent and severity through 2010, when it reached a peak of 269,365 hectares. In 2011, the outbreak collapsed. The defoliated area from these new outbreaks covers an estimated 35,403 hectares in the Lower Athabasca and Lower Peace regions.

Table 2. Spruce budworm defoliation (ha) on Alberta public land, 2007-2011.[1]

Land-use Framework Planning Region (Estimated)	Survey year 2007	2008	2009	2010	2011
Lower Athabasca	85,092	89,439	60,574	98,893	4,431[P]
Lower Peace	23,666	69,419	106,990	168,326	30,972[P]
Upper Athabasca	0	1,550	297	2,146	0[P]
Provincial Total	**108,758**	**160,408**	**167,861**	**269,365**	**35,403**

[1]Data have been rounded to the next nearest hectare and have been estimated for each Land-use Framework Planning Region. The defoliation includes both inventoried and non-inventoried areas. These surveys were conducted over forested public land where infestations are known to occur, for operational purposes. There may be additional defoliated areas that are yet to be detected. The area excludes Wood Buffalo National Park. Only regions with spruce budworm defoliation are shown. Moderate = 36-70% defoliation; Severe = >70% defoliation. [P]Preliminary results.

Figure 4. Spruce budworm defoliation on Alberta public land, 2007-2011.



Future Outlook

Based on the spruce budworm male moth catches in pheromone-baited traps (Figure 5) deployed at 149 sites in Alberta in 2011, the risk of budworm outbreaks occurring in 2012 has dropped. High risk of budworm outbreaks occurring in 2012 was indicated only in the Lower Athabasca and Lower Peace regions (Table 3 and Figure 6). In these regions, moth catches at eight sites (5.37% of total sites) indicated high risk of outbreaks occurring in the province in 2012. Trap catches indicating moderate risk of budworm outbreaks occurring in 2012 were found at 41 sites (27.52% of total sites) in the province. These sites were located in the Lower Athabasca Region; Lower Peace Region; South Saskatchewan Region; and the Upper Athabasca Region. Moth catches in the traps at the other 100 sites (67.11% of total sites) indicated nil to light risk of outbreaks occurring in 2012. This drop in risk was expected because spruce budworm populations declined in 2011.

No traps were set up in the Red Deer Region, as it is mainly comprised of non-forested private land.

Figure 5. A spruce budworm pheromone-baited trap.

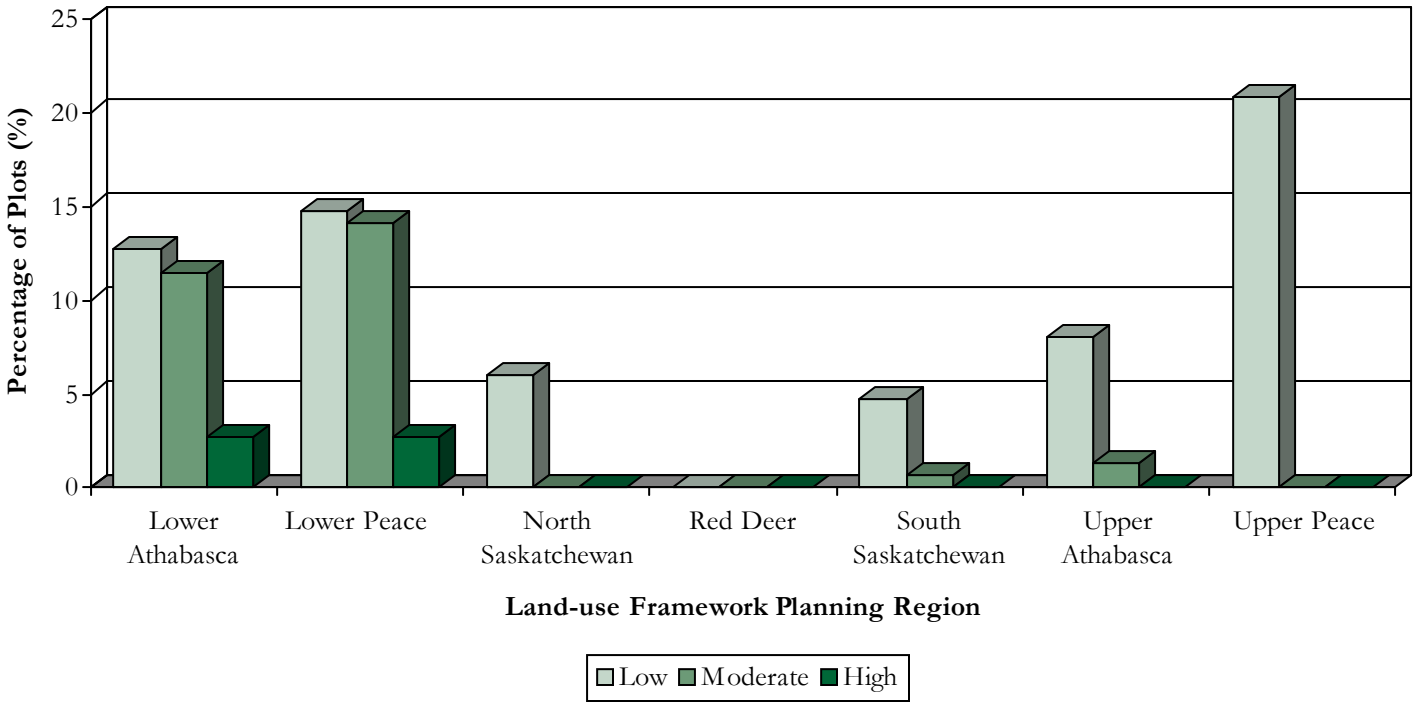
Table 3. Results of spruce budworm male moth surveys carried out by using pheromone-baited traps on Alberta public land, 2011.[1]

Land-Use Framework Planning Region	Number of moths per trap for each risk category [2]											
	Low				Moderate				High			
	Mini-mum	Maxi-mum	Aver-age	# of sites	Mini-mum	Maxi-mum	Aver-age	# of sites	Mini-mum	Maxi-mum	Aver-age	# of sites
Lower Athabasca	0	416	227	19	571	1,931	1,177	17	2,025	3,561	2,611	4
Lower Peace	26	445	198	22	525	1,725	1,002	21	2,025	2,567	2,258	4
North Saskatchewan	1	110	44	9	n/a	n/a	n/a	0	n/a	n/a	n/a	0
Red Deer[3]	n/a	n/a	n/a	0	n/a	n/a	n/a	0	n/a	n/a	n/a	0
South Saskatchewan	1	400	221	7	1,100	1,100	1,100	1	n/a	n/a	n/a	0
Upper Athabasca	0	305	108	12	1456	1,700	1,578	2	n/a	n/a	n/a	0
Upper Peace	10	290	64	31	n/a	n/a	n/a	0	n/a	n/a	n/a	0

[1]These results are preliminary. [2]Low = 0-499 moths/trap; Moderate = 500-2000 moths/trap; High = >2000 moths/trap
[3]No traps were set up in this region, as it is mainly comprised of non-forested private land.

Future Outlook cont'd

Figure 6. Results of spruce budworm moth surveys on Alberta public land by Land-use Framework Planning Region, 2011.



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