

Current Facts & Statistics

Fall 2011 ISBN No. 978-1-4601-0245-9 (On-line Edition) Pub No. I/614
Environment and Sustainable Resource Development

Mountain Pine Beetle Aerial Surveys

In North America, the mountain pine beetle (*Dendroctonus ponderosae*) (MPB) is the most destructive native insect of pine over 80 years old (Furniss and Caroline, 1977). MPB continues to threaten Alberta's forests. Preventing the spread of MPB infestations protects the health of forests and the values they provide to Albertans.

Since 2002, an unprecedented infestation of MPB in British Columbia has significantly threatened Alberta's pine forests. The British Columbia Ministry of Forests, Lands and Natural Resource Operations has projected that 59 per cent of the province's merchantable pine forests could be killed by 2016 (Walton, 2011).

Outbreaks of this beetle have occurred periodically in the southern interior of British Columbia and have extended into southern Alberta during two periods: 1941-1944 in Banff National Park (Hopping and Mathers, 1945) and 1977-1986 primarily in southwest Alberta (Alberta Forestry, Lands and Wildlife, 1986).

The department uses several tools, including annual aerial surveys to detect the presence of MPB. Results of these surveys indicate whether MPB population is spreading over Alberta's pine forests. Therefore, the department is implementing strategies to reduce the establishment, growth and spread of MPB populations.

Extensive areas of forest in southwest Alberta contain major watersheds that are at risk. These areas support highly susceptible lodgepole pine forests and have climates suitable for MPB to survive and spread. Other high-risk areas include the jack pine forests of central and northern Alberta that continue eastward across the Canadian boreal forest.

Most of the beetle's life cycle is spent under the bark of mature pine trees. There are two main ways MPB impact pine trees. One way is by adult female beetles boring into the bark (Figure 1) and introducing a blue stain fungus, which clogs up the water conducting vessels in the tree. The

Figure 1. Evidence of mountain pine beetle attack on tree bark.



other way occurs when the eggs hatch into larvae, which feed on the phloem or nutrient carrying tissue.

Pine trees will die, and the tree crowns will turn red approximately 10 to 12 months after being mass-attacked by MPB. These red trees can be detected by aerial surveyors in aircraft or by a variety of remote sensing techniques (Figure 2). Many of the beetles that emerge from the red trees attack the pines in the same area. By using the aerial survey results and other data collected, the number of currently-attacked trees can be estimated.

Figure 2. Red trees identified during an aerial survey.



MPB is not necessarily the cause of all dead, red trees identified from the air, especially at locations with low MPB populations. Lightning strikes, red belt, damage from bears and other mammals, and drought can all cause tree crowns to turn red in colour. The department's aerial surveyors are trained to distinguish between trees killed by MPB from those killed by other causes. New suspected MPB-attacked areas are ground-truthed to confirm that MPB is the cause of death.

The results in this summary represent the total number of red trees identified from aerial surveys on both Alberta public land and private land. The department only surveys locations with three or more red trees per patch. Single red trees are not surveyed and are therefore not included in this summary.

Current Statistics

Table 1 and Figure 3 show the estimated number of red trees identified during aerial surveys for 2011. Most of this information was collected using either a helicopter (heli-GPS) or by interpretation of aerial photography.

As shown in Figure 3, the Upper Peace Region contained the highest proportion of red trees in 2011.

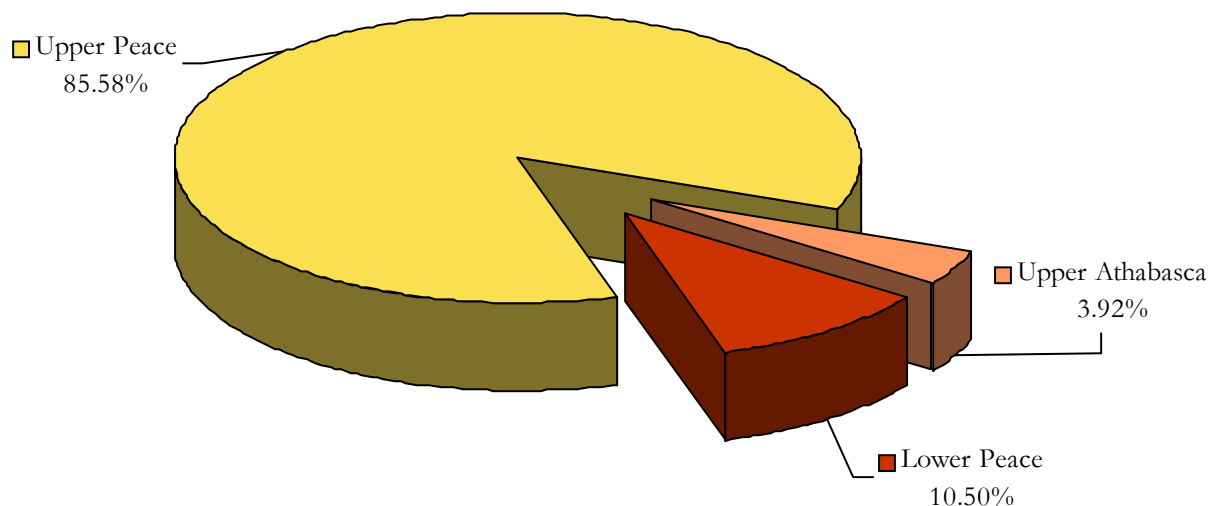
Table 1. Estimated number of red trees identified during aerial surveys in Alberta by Land-use Framework Planning Region, 2011.¹

Land-use Framework Planning Region	Estimated number of red trees
Lower Athabasca	0
Lower Peace ¹	228,895
North Saskatchewan	13
Red Deer	0
South Saskatchewan	117
Upper Athabasca	85,467
Upper Peace ¹	1,866,186
Provincial Total	2,180,678

¹Preliminary results. Red tree estimates from remotely-sensed satellite imagery are not included in the total tree count.

Current Statistics-cont'd

Figure 3. Percentage of estimated number of red trees identified during aerial surveys in Alberta by Land-use Framework Planning Region, 2011.¹



¹Excludes Land-use Framework Planning Regions with less than 0.01 per cent of red trees identified.

Historical Trends

MPB has remained endemic (naturally occurring low populations) in the area from the Crowsnest Pass to the United States border and in the Cypress Hills Provincial Park since the last outbreak in the 1980s.

The department has monitored the MPB population in the southern Rockies annually since 1977. The presence of MPB was confirmed for the first time on baited trees in west-central Alberta in 1992 (Cerezke and Brandt, 1993). Monitoring since then has indicated a steady population increase and expansion of distribution in southwest, west-central and northwest Alberta, at

the same time as MPB population expanded in British Columbia.

As shown in Table 2, the number of red trees in the Lower Peace and South Saskatchewan regions has decreased since 2009. However, the number of red trees in the Upper Athabasca and Upper Peace regions has increased.

In Figure 4, a peak in the number of red trees across Alberta in 2009 is highlighted. This peak is directly related to the high number of early-fading MPB-attacked pine trees in 2009.

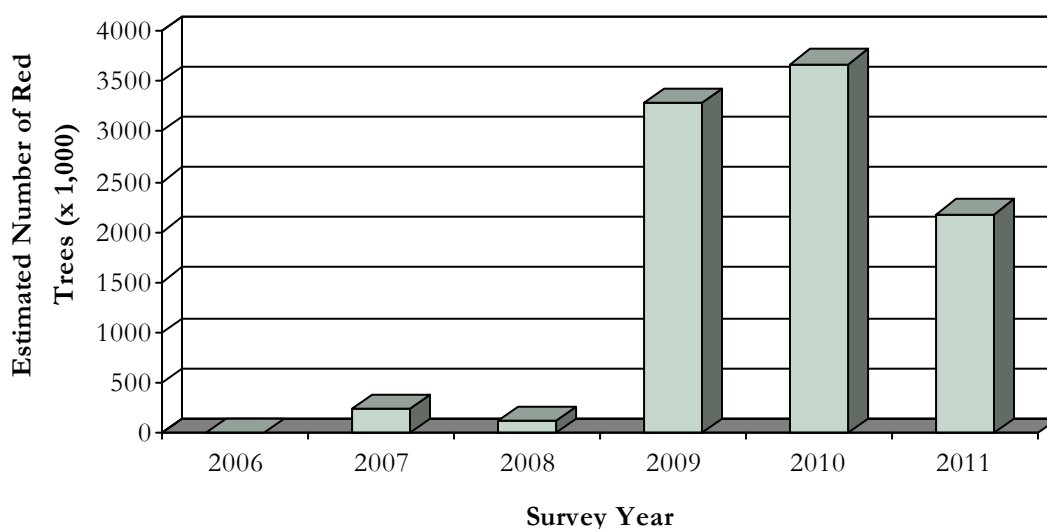
Historical Trends-cont'd

Table 2. Estimated number of red trees identified during aerial surveys in Alberta by Land-use Framework Planning Region, 2007-2011.¹

Land-use Framework Planning Region	Survey year 2007	2008	2009	2010	2011
Lower Athabasca	0	0	0	0	0 ^P
Lower Peace	112	2,222	335,724	2,532	228,895 ^P
North Saskatchewan	0	0	0	0	13 ^P
Red Deer	0	0	0	0	0 ^P
South Saskatchewan	1,560	12,967	16,383	1,569	117 ^P
Upper Athabasca	2,108	1,328	188,742	216,977	85,467 ^P
Upper Peace	238,000	107,995	2,735,451	3,447,611	1,866,678 ^P
Provincial Total	241,780	124,512	3,276,451	3,668,881	2,180,678

¹Not all MPB-infested areas were surveyed each year. ^PPreliminary results.

Figure 4. Estimated number of red trees identified during aerial surveys in Alberta, 2007-2011.



Future Outlook

British Columbia projects that MPB infestations will increase substantially over the next one to three years in the eastern parts of that province. This means that there will be a continued threat of MPB influx into Alberta.

Climate change studies indicate a potential increase in the range of habitat suitable for MPB

development, both in latitude and elevation. Consequently, MPB may be capable of significantly expanding its range in the coming years (Carroll *et al.*, 2006).

There is strong evidence that climate change is influencing the survival and spread of MPB. Historically, cold temperature extremes and

Future Outlook-cont'd

fluctuations limited beetle populations. Without cold winter temperatures, overwintering beetle broods are more likely to survive. Further, warmer summer temperatures enhance beetle development. If the summer is also dry, it may induce drought stress in trees thus making them more susceptible to beetle attack. This allows beetles to spread more readily into higher elevations and locations further north.

Successful survival of MPB in central and northern Alberta increases the risk for its

potential spread throughout the lodgepole-jack pine hybrid zone and eastward into the widely distributed jack pine forests of central Canada. Forest climatic suitability maps indicating favourable habitat conditions for MPB in Alberta and other provinces suggest that much of the boreal forest's climate will become suitable for MPB in the near future (Carroll *et al.*, 2004; Carroll *et al.*, 2006; Taylor *et al.*, 2006).

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