A PROPOSAL FOR A FEDERAL/PROVINCIAL PARTNERSHIP TO MANAGE MOUNTAIN PINE BEETLE IN ALBERTA

Alberta

Agriculture and Forestry

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EXECUTIVE SUMMARY

In 2018, Alberta submitted a funding request that outlined objectives and deliverables of a jointly funded federal-provincial Mountain Pine Beetle Management Program (MPBMP). A total of $20 million per year for five years was requested to support an expanded MPBMP in Alberta and Saskatchewan. Funding was not allocated for MPB management in Budget 2019. Since the submission in 2018, a significant expansion of MPB has occurred. Additionally, the Government of Alberta (GOA) increased their funding commitment by $5 million, to $30 million per year.

GOA has effectively limited the spread of MPB in Alberta (Carroll et al. 2017) but the outbreak has now reached a critical point in infestation management. GOA can no longer manage both the risk MPB poses to Alberta forest resources and to the rest of Canada. As such, the GOA is again requesting funds from the Government of Canada (GOC) to support MPB management in Alberta. GOA is requesting $60 million over three years from the GOC. Over the same time period, GOA will contribute a minimum of $90 million. The proposed funding levels equate to a 60:40 (provincial:federal) jointly-funded program. Financial assistance from the GOC will be used to support the following key outcomes:

1) Limit the spread of MPB into the eastern boreal forest;
2) Limit the spread of MPB along the eastern slopes of Alberta;
3) Mitigate damage to Alberta's pine resources in locations where MPB is already established; and
4) Generate knowledge and innovative management techniques through research on MPB.

In Canada, pine-leading stands cover 35 million hectares and represents over 4.6 billion cubic metres of standing timber volume (Nealis and Peter 2008). The current economic value of susceptible pine in Alberta's pine-dominated forests is greater than $11 billion. In 2018 the Alberta forest sector directly employed 18,700 people and paid over $1.6 billion in wages and salaries. Forest industry activity accounts for 7.7 per cent of manufacturing sector GDP and 10.3 per cent of Agriculture and Forestry sector GDP. To-date, the GOA has invested over $510 million to protect values-at-risk in Alberta. Without federal assistance, the GOA will allocate resources to protect provincial values-at-risk, which means outcome 1 above will drop in priority or be eliminated.

The GOC is committed to protect forests from pest infestations. In line with the GOC 2018-2019 Department Plan, federal support for the MPBMP will "ensure that the country's forests remain healthy now and for generations to come". This commitment was recently renewed in mandate letters to the Ministers of Natural Resources, and Environment and Climate Change. The GOC has generously provided $92.5 million in funding to a similar program to slow the spread of another forest pest, spruce budworm, in eastern Canada. The GOA will utilize federal funds to implement the *Strategic Approach to Slow the Spread of Mountain Pine Beetle across Canada* (Hodge et al. 2017) in eastern Alberta, and to mitigate damage to Alberta's pine forests resulting from uncontrolled infestations on federal land. Federal funding will reduce the threat that MPB poses to the Canadian boreal forest.

Total Federal funding requested (figures in thousands).

	Year 1	Year 2	Year 3	Total
Operations	$18,950	$17,910	$17,960	$54,820
Research	$2,250	$250	$250	$2,750
Manpower	$800	$800	$830	$2,430
Total	$22,000	$18,960	$19,040	$60,000

1.0 JOINT PROVINCIAL-FEDERAL MOUNTAIN PINE BEETLE MANAGEMENT PROJECT

Since 2006, the Government of Alberta (GOA) has effectively managed mountain pine beetle (MPB) to minimize impacts of the outbreak on Alberta forest resources and the boreal forest of Canada (Carroll et al. 2017). See Appendix 1 for a description of the proponent and the mountain pine beetle management program (MPBMP). The Government of Canada (GOC) provided a total of $18 million to Alberta in 2007, 2009 and 2010, but the vast majority of MPBMP has been funded by the GOA. Requests were made for federal funding in 2010, 2013, 2014 and 2015, and 2018 but support was not provided (Appendix 2).

Beetles migrating from the uncontrolled outbreak in Jasper National Park (JNP) have substantially impacted forest resources in adjacent Alberta forests. Although the outbreak in JNP has begun to subside, dispersal east and south from this large source population has increased infestation levels, expanded the population distribution, and amplified pine mortality on provincial lands. MPB populations in JNP began to build in 2014, and the number of infested hectares close to doubled each year since. In 2016, the number of trees attacked in the Hinton area, which had been relatively unchanged in the years prior, began to increase (Fig. 1). The number of red-attack trees rose from eight trees per km^2 in 2016 to 41 trees in 2019. Concurrently, other regions more distant from the source population, Grande Prairie for example, decreased during this same time period. Impacts are rippling out east and south, and red-attack tree densities in the Whitecourt and Rocky Mountain House Forest Areas have nearly doubled since 2017.

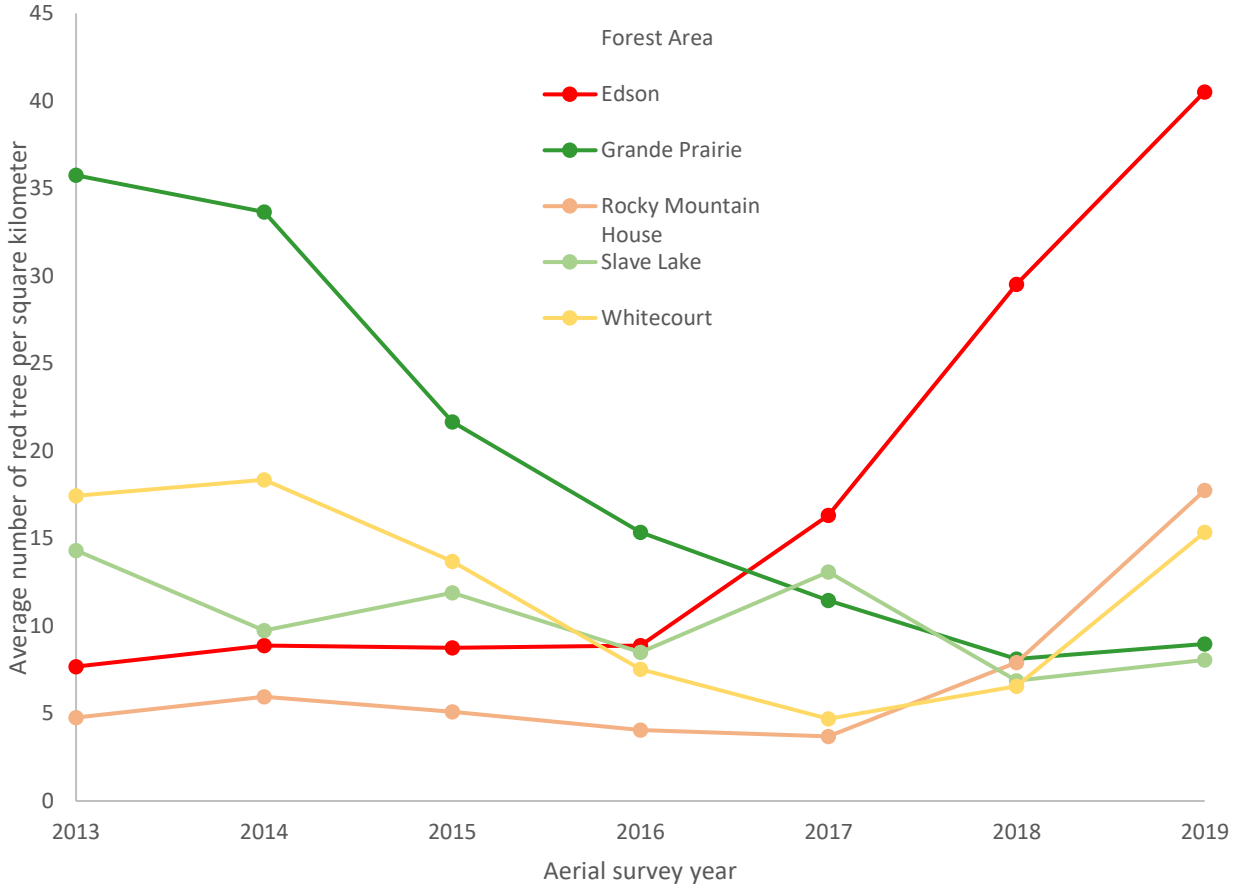

Figure 1. Average red-attack tree density per kilometre square recording during aerial surveys.

Alberta experienced significant cold events during February, 2019. Models used to predict MPB mortality suggest that temperatures were cold enough to cause greater mortality than had occurred in the years since 2015 (MacQuarrie et al. 2019). Additionally, the summer of 2019 was cool and wet which may have prolonged and delayed MPB flight and reproduction. The effect of the predicted mortality and reduced reproductive rates will likely not be evident until 2020 or 2021. Knowing that MPB populations are resilient, it is critical to capitalize on these events and aggressively control MPB populations in the coming years.

At current funding levels Alberta is focusing the MPBMP on the following objectives:

1) Limit the spread of mountain pine beetle along the eastern slopes of Alberta;
2) Mitigate damage to Alberta's pine resources in locations where mountain pine beetle is already established; and
3) Protect *Endangered* and *Threatened* species and their critical habitat.

Only funds provided by the Government of Saskatchewan under the Spread Management Action Collaboration will be used to lessen the risk of spread east into Saskatchewan by implementing management activities along the eastern edge of Alberta.
Given the risk that MPB poses to national forest values, Alberta is proposing a three-year jointly funded Mountain Pine Beetle Management Program. Federal funding will enable Alberta to also support the following nationally-focused objectives:

1) Reduce the spread of mountain pine beetle into the eastern boreal forest;
2) Participate and collaborate on interprovincial, territorial, and national spread mitigation initiatives; and
3) Support research to characterize national spread risk and inform management decisions.

Alberta requests that the GOC to contribute $60 million over a three-year period (i.e. $20 million per year for three years beginning in fiscal year 2020/21). Over the same timeframe, Alberta will fund a minimum of $90 million ($30 million annually for three years). These proposed funding levels equate to a 60:40 provincial:federal funding model.

Alberta's funding request for forest pest management support is not unique. The Healthy Forest Partnership is currently in year two of the second four-year agreement with the GOC to control the risk of a spruce budworm (SBW) outbreak in Atlantic Canada. Phase One, initiated in 2014, received $18 million and Phase Two, initiated in 2018, received $74.5 million. While SBW outbreaks can last up to 10 years and repeated defoliation over six years will eventually cause tree mortality, the damage caused by this pest is not as acute as MPB, which kills its host in a single year. The MPB outbreak in Alberta has spanned more than a decade, with no indication that populations will collapse, and millions of trees have been killed.

1.1 Values-at-risk Due to Mountain Pine Beetle Infestation

To date, over 2.4 million hectares of forest in Alberta have been affected by MPB. Infestation severity ranges from light with only a few attacks per hectare to severe where nearly all the pine is dead. In Alberta, over 5.5 million hectares of forest have a pine-dominated overstory (Fig. 2). A significant amount of forest contains pine that is either co-dominant or a secondary species. Based on the 2018/19 Pine Timber Damage Assessment Values for Alberta, the value of the dominant overstory pine is greater than $11 billion.

In addition to standing timber, MPB outbreaks threaten other forest values, namely watershed integrity and critical habitat for species-at-risk. Impacts to a variety of forest values from mountain pine beetle outbreaks have been documented in many reports and publications. Values that Alberta is mitigating are briefly described below.

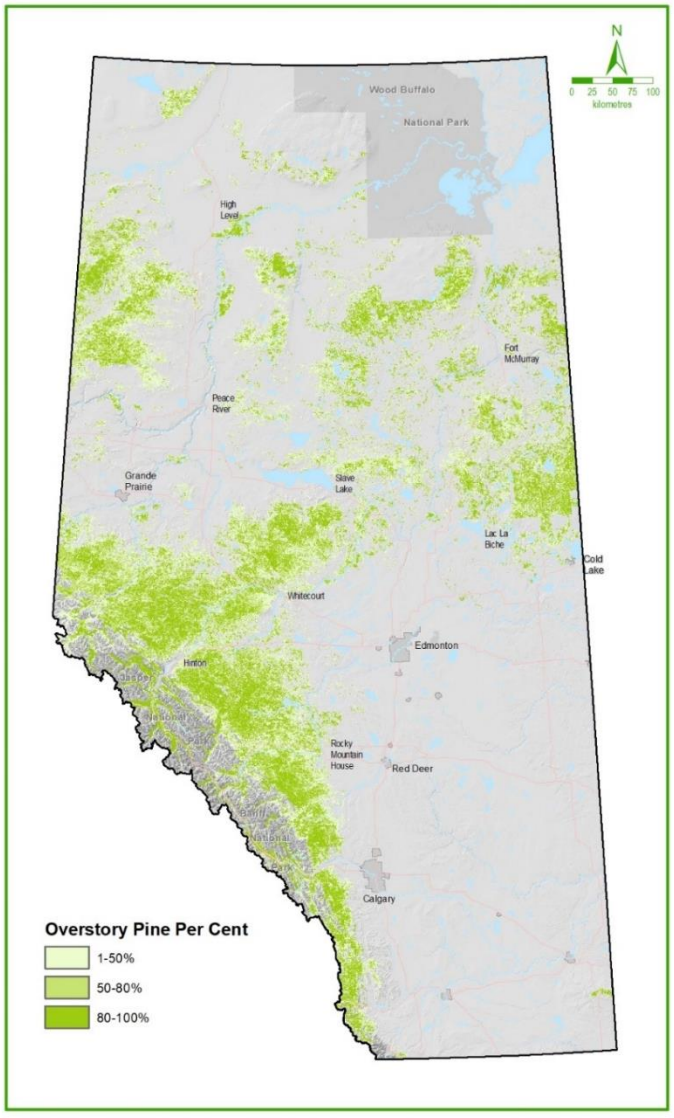

Figure 2. Distribution and per cent of pine present in the over-story component of forested stands in Alberta.

1.1.1 National Values

Canada's pine forests are a rich and extensive resource. Pine-leading stands cover at least 35 million hectares and contain over 4.6 billion cubic metres of standing volume across Canada (Fig. 3, Nealis and Peter 2008). The Canadian forest industry is an important employer nationwide and contributes to the economic and social welfare of all Canadians.

Until recently the threat of MPB to most of Canada's pine forests was restricted to the interior of British Columbia by physiological constraints placed on the beetle by its environment (Cullingham et al 2011). However, the pattern of MPB outbreaks are changing, most likely due to factors related to climate change and the degree of anthropogenic intervention (e.g. fire suppression) affecting forest composition (Dhar et al 2016).

Additionally, considerable evidence shows that boreal pine species are suitable hosts for MPB (Cullingham et al 2011). In fact, indications are that MPB can successfully attack and reproduce in a wide range of pine species, including jack pine (Nealis and Peter 2008). Considering that jack pine range extends from Alberta to Nova Scotia, the boreal forest should no longer be considered out of reach by

MPB. In fact, this evidence suggests that without aggressive management actions there are few impediments to the spread of MPB into boreal ecosystems and eventually into the more susceptible pine forests of central Canada (Nealis and Peter 2008). This makes MPB a concern on a truly national scale.

In general, boreal pine stands have lower volumes and less connectivity than pine stands in British Columbia. However, this appears to be less of a constraint to population growth and spread than was originally thought; and eastward spread of the beetle across disconnected stands in northern Alberta has been confirmed (Nealis and Cooke 2014). MPB now poses a larger threat east of the Rockies where it is attacking non-adapted (naive) pine. Research shows that such trees are less able to repel MPB, allowing more brood to survive and negating the disadvantage of more limited host supply available to the beetle (Massey 2013).

For forestry operations, the higher proportion of low volume stands in the boreal forest means that many companies operating in this region exist at the margins of operability. Therefore, even moderate losses of timber due to MPB will pose severe economic risks for some operators. Yet, the forest industry is only one sector that could be adversely affected by MPB's spread into boreal regions. Boreal stands are rich source of revenue from non-timber (nature) related activities such as tourism/recreation and trapping. A study by Environment Canada (2000) looked at the economic significance of non-timber related activities in various provinces. One of the findings was that the ratio of non-timber related jobs versus those related directly to forestry differed significantly from Province to Province. For example, in British Columbia one nature-related job exists for every three forestry-related jobs. In Alberta and Manitoba the ratio was approximately 1:1, and in Saskatchewan the ratio was 1:6 (Nealis and Peter 2008). The use and exploitation of non-timber forest resources is particularly important for First Nations who have engaged in economies based on these values since before contact with Europeans and still continue to rely heavily on them today (First Nations Forestry Council 2008). Any downturn in these sources of revenue will be more acutely felt in Boreal regions (Nealis and Cooke 2014).

Aside from revenue, boreal ecosystems provide a wide range of services that are non-material, yet very important for human well-being. Embrey et al. (2012) classify ecosystem services as: regulating, provisioning, cultural, and supporting. The relative importance of each of these classes will vary among people as they are dependent on human values (Dhar et al. 2016). For example, Indigenous peoples have diverse uses and relationships with their environment, including unique traditional, cultural, and spiritual needs. As such they, and other traditional users of ecosystem goods and services, may rank everything as important (MSES 2007). MPB has the potential to disrupt all classes of ecosystem services (Embrey et al. 2012).

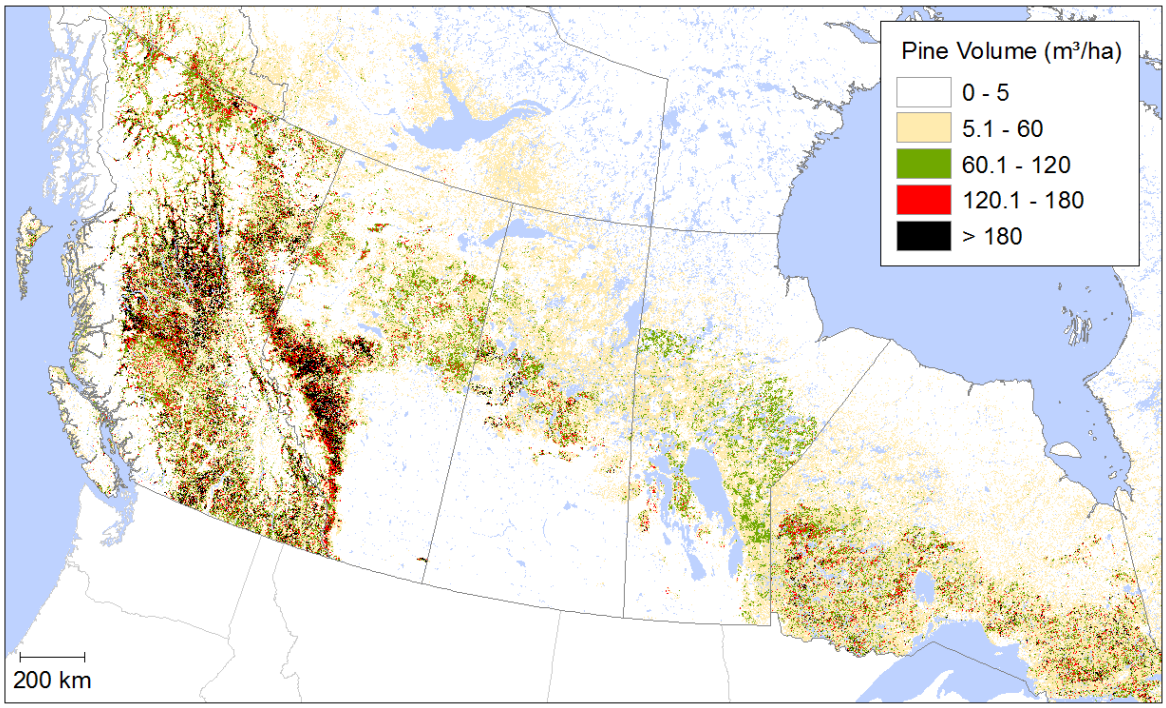

Figure 3. Provincial pine volume data obtained from the provinces of British Columbia, Alberta, Saskatchewan, Manitoba and Ontario overlaid on top of national "k Nearest Neighbours" analysis (kNN) data (Bleiker 2019).

1.1.2 Socio-economic Values

Forestry is the third largest resource-based industry in Alberta preceded only by agriculture and oil and gas. According to Statistics Canada's National Economic Accounts, the forest industry accounts for 7.7 per cent of manufacturing sector GDP and 10.3 per cent of agriculture and forestry sector GDP in Alberta. The Alberta Modified Canadian Occupational Projection System Outlook 2017 – 2021 expects employment in this industry to grow at an average rate of 0.8 per cent from 2017 to 2021 (Government of Alberta 2017). See Appendix 3 for a description of the Alberta and Saskatchewan forestry sectors.

Mountain pine beetle infestations threaten forest ecosystems, forest sustainability, and industry that relies on healthy forests. There are 5.5 million hectares of pine in Alberta that is susceptible to MPB. Using the 2019/20 Alberta Timber Damage Assessment value, this susceptible pine is currently valued at more than $11 billion. However, if these trees are killed by MPB prior to harvest, the stumpage rates will be significantly reduced. Lower stumpage fees will diminish the value of these stands to $483 million. The effects of tree mortality on forest industry sustainability are not immediate because companies can continue to harvest dead pine for 3-7 years post-death. The greatest impact is to mid-term timber supply. The Pine Strategy was implemented to protect the mid-term timber supply; the remaining live pine is critical for industry sustainability.

The forest industry, communities and the government does not want to see a repeat of the British Columbia situation in Alberta. Between 2005 (when the MPB outbreak peaked) and 2016, the number of major lumber mills in the interior of British Columbia dropped from 71 to 51 – a 28 per cent decrease (BC MFLNR 2018). Not all of these closures could be attributed solely to declining timber supplies that

resulted from MPB infestations. However, a report published in 2009 forecasted that that 16 major sawmills would close by 2018 coincident with, and related to, declining saw log availability in regions impacted by MPB (Taylor 2013). In 2019, four mills closed entirely while production curtailments in British Columbia affected nearly 6,000 workers at 25 mills. British Columbia Finance Ministry budget numbers show forest revenues were down 11 per cent in 2019 and projected harvest volumes of 46 million cubic metres, which are the lowest in years.

Uncertainty in many Interior British Columbian communities is high with the end of the elevated MPB harvest, low lumber prices and the ongoing Canada/U.S. trade. The British Columbia government has already allocated $69 million to fund forest worker support programs to help reduce the impact of job losses on communities and support community resilience, forest enhancement and wildfire prevention.

In Alberta, 25 large mills are reliant on pine to sustain operations. Community stability and economic prosperity will be threatened in areas where these companies operate if the outbreak continues. Even if it is deemed that MPB populations are beyond control in the future, all past investments are not discounted. It is important to recognize that reduced tree mortality resulting from the MPBMP benefits the forest industry and local economy.

Oil and gas resource development is the main revenue-generator and employer in Alberta. Unfortunately the oil and gas industry is prone to boom-bust cycles which makes it less reliable economically. It is also based on the development of non-renewable resources unlike the forest industry. The long-term nature of managing the forest and consistent demand for wood products makes the forest industry more stable overall. Undoubtedly, the importance of the forest industry as an employer will increase as jurisdictions seek to lessen their dependence on fossil fuels.

1.1.3 Watersheds

On the eastern slopes of Alberta's Rocky Mountains, mature pine makes up about 50 per cent and 20 per cent of forests in the Upper and Lower Foothills natural subregions respectively. These areas support highly susceptible pine forests that are climatically suitable for MPB survival. Watersheds along the east slopes of Alberta are at very high risk for severe impacts related to MPB outbreak and spread (Fig. 4). These critical source water areas provide the bulk of the water supply for agriculture and drinking water to both Alberta and downstream provinces and communities. In Alberta, 94 communities are dependant in part or entirely on surface waters originating from forested watersheds.

Watershed response to forest disturbance is complex, but can be generalized into three basic points of understanding (Bosch and Hewlett 1982, Hibbert 1967): 1) reduction of forest cover (i.e. by forest harvesting) increases water yield, 2) establishment of forest cover (reforestation/afforestation) decreases water yield, and 3) changes to water yields from vegetation manipulation vary depending on hydro-climatic conditions and watershed characteristics (e.g. climate, soils, geology, and physiography).

Changes to watershed hydrology as a result of severe (>60 per cent mortality) MPB infestations can cause increases in the available amount of water in both surface and subsurface runoff. This has the potential to cause elevated water tables (higher soil moisture), increased failure rates of drainage structures, and increased surface erosion and landslides. Additionally, the magnitude and frequency of peak flows may increase, which could lead to destabilization of and changes to stream channel morphology. These changes could negatively affect soil productivity, fish habitat, water quality and increase risks to public safety and infrastructure (Redding et al., 2018).

In British Columbia, large scale MBP outbreaks over the past decade have been examined for both stand level and watershed scale hydrological impacts. Much of this research is based on field observations at forest stand or smaller watershed level (< 300 hectares) scales and this work has been subsequently applied to hydrological models to investigate the potential larger scale hydrological effects.

Large-scale watershed experiments have also been carried out to assess the impacts of post-outbreak salvage harvesting on water yields and timing. In British Columbia large amounts of forested watersheds have been killed by MPB, many of which have been aggressively managed using salvage harvesting to capture the value of timber and speed up the hydrological recovery of the watershed through forest regeneration. Research in MPB attacked and salvage-logged watersheds found increases in both annual water yields and peak flows (Cheng 1989, Moore and Scott 2005). Similarly in Montana and Colorado, USA a 15 per cent increase in annual water yields with 35 per cent tree mortality within the watershed was observed (Potts 1984). Another Colorado study found that after 30 per cent MPB-caused tree mortality annual water yield increased by 16 per cent and the timing of snowmelt peak flows occurred earlier and were four to 27 per cent larger. Hydrological modelling predicted similar watershed response, however, at larger levels of stand mortality and salvage harvesting watershed response was predicted to be much greater. The Forest Practices Board (2007) completed a MPB modelling scenario for Baker Creek, near Quesnel, British Columbia and predicted that for a 54 per cent MPB affected watershed with 34 per cent salvage harvesting occurring after the outbreak, annual peak flows could increase by 60 per cent and the timing of snowmelt peak flows could advance by two weeks. A more severe scenario using an 80 per cent salvage harvest with a further 17 per cent of the area affected by MPB resulted in over a 90 per cent increase in peak flow volumes. Effects of salvage harvesting as modelled in British Columbia must be taken into account because in watersheds where rehabilitation is required to promote function recovery, harvesting and reforestation will likely be the method used.

Little research has been done in Alberta related to MPB outbreaks on stand level and watershed scale hydrology. Rothwell and Swanson (2007) applied a simple hydrological model to watersheds within the Grande Prairie area with a 75 per cent reduction in pine cover and predicted that water yields would increase between nine to 20 per cent. Peak flows were similarly projected to increase by seven to 53 per cent for a 1:2 year flood and 1-20 per cent for the 1:100 year flood return period.

Generally speaking, disturbance greater than 30 per cent of the watershed area (30 per cent loss of forest cover) has been shown to have detectable effects on watershed response (streamflow/water quality); levels less than 30 per cent are not expected to impact the function of the watershed. Disturbance levels between 30 to 50 per cent pose moderate risk, but if changes are observed the watershed is expected to be able to recover on its own over time. Disturbances greater than 50 per cent of the watershed area will likely cause changes to watershed function and might require rehabilitation. A large scale MPB infestation in the east slopes will likely be severe and difficult to respond to after the MPB becomes established.

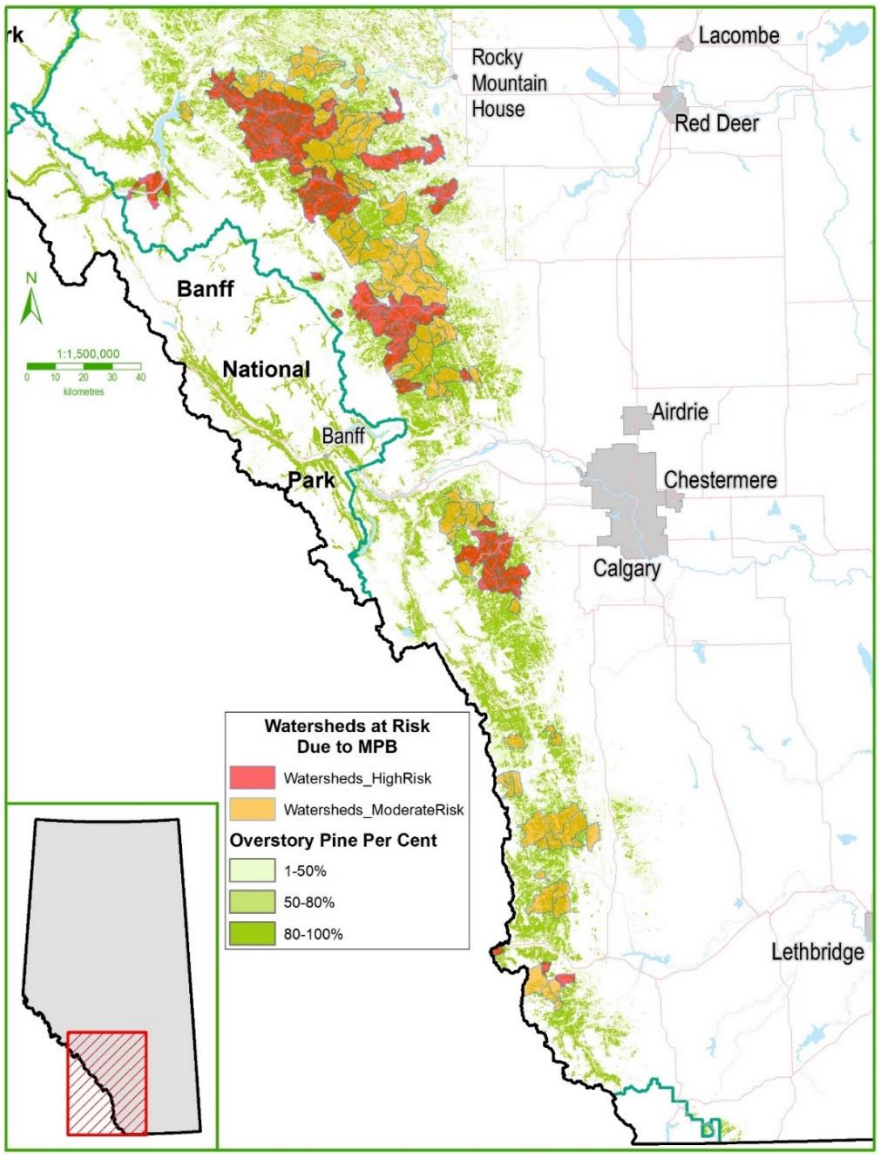

Figure 4. Watersheds along the eastern slopes of the southern Rocky Mountains categorized by risk due to mountain pine beetle.

1.1.4 Species-at-risk and Protection of Critical Habitat

Species-at-risk are the most vulnerable components of Alberta's biodiversity. The integrity of Alberta's ecosystems is dependent on their continued presence, and effective strategies are needed to sustain these rare and threatened species. Alberta's *Wildlife Act* is the main piece of legislation for management of species-at-risk on private and public lands under provincial jurisdiction, while the *Species at Risk Act* (SARA) applies to federal lands and requires provinces and territories to develop range plans to manage caribou and caribou habitat. Alberta's species-at-risk program is an integral component of the national process of working together to conserve and recover species at risk in all jurisdictions of Canada.

Several species that are listed as *Endangered* either under the provincial, federal or both acts are negatively impacted by outbreaks of MPB in Alberta. As such, GOA has legislative responsibility to protect these species by taking action to control MPB populations that are in proximity to or threaten habitat critical for the persistence of these species.

<u>Caribou</u>

In Alberta, Woodland caribou are separated into two groups – mountain and boreal. Both populations are currently designated as *Threatened* under Canada's SARA. The Woodland caribou (Boreal population) is listed as "At Risk" and designated *Threatened* under Alberta's Wildlife Act. Caribou recovery in each range depends on addressing habitat-related factors that result in both the loss of caribou habitat and increased predation rates on the population. This requires both short- and long-term strategies and actions to achieve self-sustaining caribou populations (Government of Alberta 2017). In Alberta, MPB infestations are occurring in key caribou habitat and adjacent forests (Fig. 5) and the resulting impact to pine forests threatens the recovery of these herds.

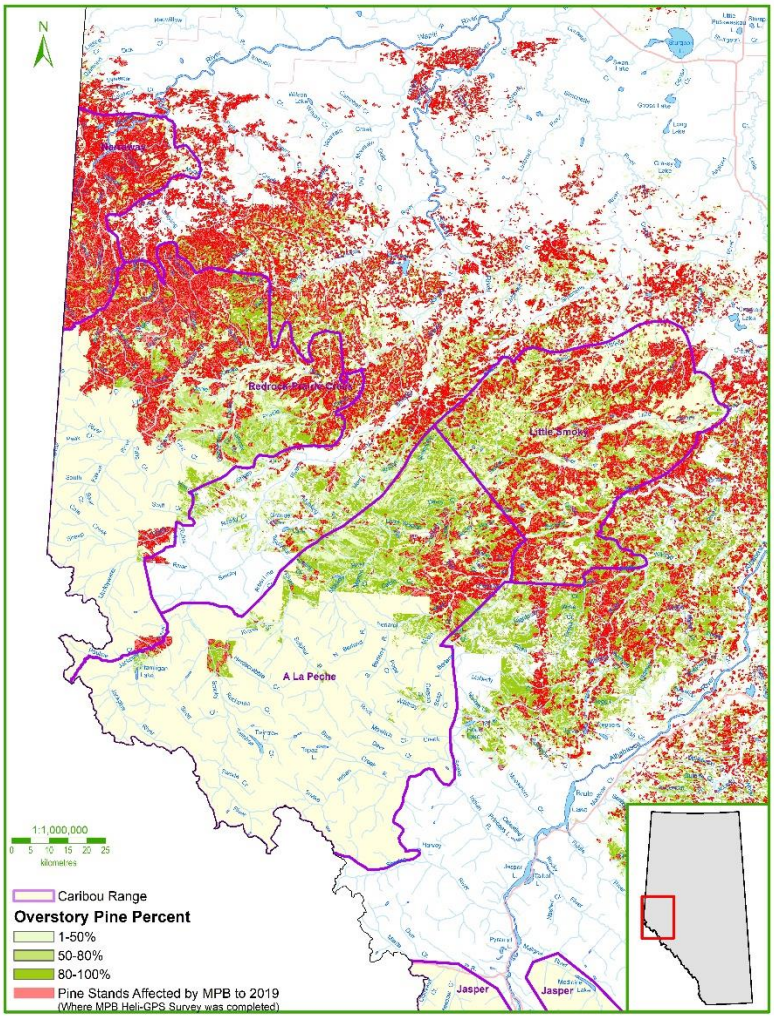

Figure 5. Distribution of mountain pine beetle population in relation to west-central Alberta caribou range.

The effect MPB has on caribou populations is poorly understood (Bunnell et al. 2011) Research on MPB/caribou interactions is quite preliminary and that, in many areas, MPB-caused disturbance had not occurred long enough in the past to make definitive conclusions (Bunnell et al. 2011, Dhar et al 2016). Addressing these uncertainties, however, should not take

precedent over taking action to address MPB spread. Waiting until knowledge gaps are filled may result in missed opportunities to reduce negative impacts to woodland caribou (Bunnell et al. 2011).

Approximately 1.3 million hectares of caribou habitat currently have some degree of susceptibility to MPB. Single-tree treatments at the time of MPB attack save caribou habitat at the front end, since management efforts prevent the spread of MPB and protect valuable caribou cover. Single-tree treatment is less intrusive and more cost-effective than salvage operations after the fact.

Alberta is undergoing range planning to comply with federal direction and has committed to protecting core habitat through single-tree treatment (Government of Alberta 2017). Alberta and the forest industry has created the Alberta Regional Caribou Knowledge Network. This newly created network is committed to understanding the role of forest practices such as silviculture regimes and integrate management and planning can contribute to sustaining Alberta's caribou populations.

Five-needle pines

Whitebark pine grows in the high mountain forests of western Alberta at treeline and in upper subalpine forests, while limber pine occupies the montane and lower subalpine natural subregions. These slow-growing and long-lived pine are keystone species. The distribution of both species in Alberta spans from the U.S. border to the northernmost extent of the Albertan Rocky Mountains (Fig. 6). In 2008, whitebark and limber pine were listed as *Endangered* under Alberta's *Wildlife Act*. Whitebark pine was listed as *Endangered* under the Federal SARA in 2012, and limber pine has been proposed for listing and is under review. Provincially, designation was sought because of population declines across the species' range caused by white pine blister rust and outbreaks of MPB.

Recent research has shown that whitebark and limber pine trees infected by white pine blister rust are preferentially attacked by MPB (Six and Adams 2007; Burns et al. 2008, Bockino and Tinker 2012). In the case of whitebark pine, smaller trees not attacked by MPB are still susceptible to infection, which may predispose them to attack by MPB once they reach cone-bearing age (Bockino and Tinker 2012). Furthermore, MPB prefer larger, mature trees which are also the most reproductively active. Therefore, the death of these trees has a disproportionately large impact on stand seed production (Kendall and Keane 2001). Finally, trees resistant to white pine blister rust, highly valuable for five-needle pine conservation, can also be killed by MPB, thereby reducing conservation options.

Provincial recovery plans were developed to guide the management of these *Endangered* species (Alberta Whitebark and Limber Pine Recovery Team 2014a and b). The long-term goal of both plans is to "conserve existing populations and habitat while restoring populations across current historical provincial range…to continue functioning in their ecological roles". Provincial recovery plans also set out actions that should be taken to accomplish these two objectives. As per the recovery plan, any MPB-infested pine near or in a high-value whitebark and/or limber pine stand must be controlled. MPB populations in the five-needle pine range have been low for the last few years but are anticipated to increase due to building beetle populations in Banff and Blairmore, and the infestation in Jasper. Over 1,900 *Endangered* trees were controlled in previous years. Resources will be required to control infestations that are detected in nearby habitat and to protect high-value trees.

Additionally, the conservation of genetic resources and the deployment of rust-resistant trees are crucial for the recovery of whitebark and limber pine. Until seed zone susceptibility ratings for MPB and white pine blister rust are set, Alberta proactively collects seed from both pine species as crops allow. This seed is screened for rust resistance in a cooperative program with the United States Forest Service, the Federal Government and British Columbia, and will be deployed as appropriate.

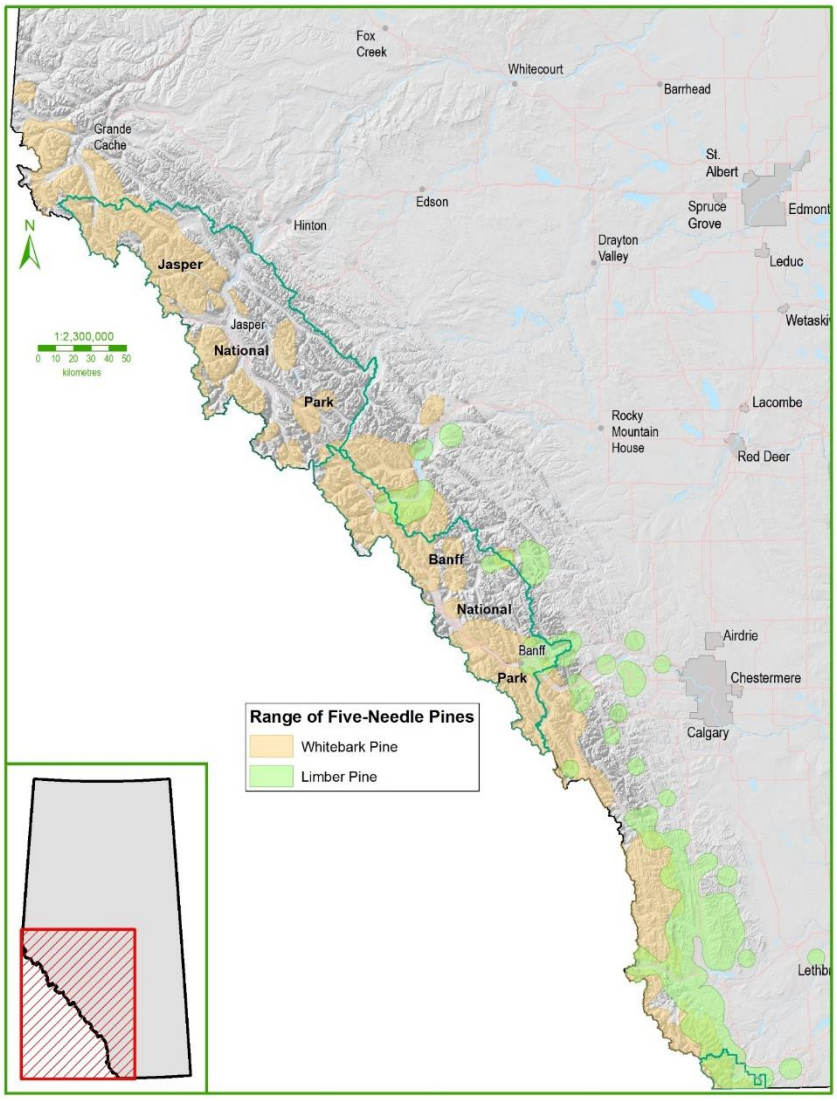

Figure 6. Whitebark and limber pine ranges in Alberta.

1.1.5 Wildfire

Wildfire is a natural and essential part of maintaining healthy forests. Excluding wildfires in natural forests can affect the composition and structure of the ecosystem. Much of the current landscape in Alberta contains more areas of standing mature trees and increased amounts of accumulating fuels. These two factors contribute to larger and more intense wildfires, and adding MPB-killed timber into this equation only intensifies the negative effect. Studies indicate that MPB, over time, can alter fuel and microclimates through changes in fuel chemistry and stand structure which can have potentially severe impact on fire behaviour (Parsons et al. 2014).

Wildfire hazard faced by communities varies based on type, condition, and arrangement of nearby wildland fuels. As MPB causes increased mortality in pine stands, fuel characteristics will change. This will ultimately influence wildfire frequency, intensity and rate of spread. These changes in wildfire behaviour increase the risk to human life and property, public health (i.e. smoke and damage to water quality and quantity), use of traditional, cultural and environmentally sensitive areas, and impacts local tourism.

The 2017 wildfire season in British Columbia was catastrophic in terms of observed wildfire behaviour and extent of burned area. It is estimated that up to 40 per cent of the 1.2 million hectares of wildfire occurred on lands described as having been severely impacted by MPB. These wildfires resulted in extensive home loss and mass evacuations, leading to tremendous negative impacts on social, economic and environmental values in the Province. While the impact of MPB in Alberta has not reached the same levels as British Columbia, tree mortality due to MPB infestations is increasing, and thus the likelihood of seeing wildfire interact with impacted stands is increasing.

2.0 TECHNICAL PROPOSAL

The technical proposal consists of two program areas: operations and research. Though the program areas will be functionally separate, both will follow a mandate that contributes to the following common outcomes:

1) Limit the spread of MPB into the eastern boreal forest;
2) Limit the spread of MPB along the eastern slopes of Alberta;
3) Mitigate damage to Alberta's pine resources in locations where MPB is already established; and
4) Generate knowledge and innovative management techniques through research on MPB.

Alberta has an active FireSmart program, and is in discussions with other federal departments to explore opportunities for additional funding for those communities where the risk could be augmented by MPB-related tree mortality. The operational and research programs will integrate with FireSmart where appropriate regardless of federal involvement. Activities and timelines for the operations and research programs are outlined in Appendix 4.

2.1 Operations Program

Outcome 1 is a nationally-focused outcome while Outcome 3 is centred on provincial results. Outcomes 2 and 4 are of interest to both federal and provincial partners. Alberta's financial contributions to the joint project will be concentrated on outcomes 2 and 3, and federal contributions would primarily support outcomes 1 and 4. Federal assistance would support the Alberta-based objectives once the needs for limiting the spread east are met.

2.1.1 Operations Team

Operational implementation of a joint provincial-federal funded MPB program to survey and control MPB in Alberta would be accomplished through Alberta's well established framework along with existing operational collaborators.

A multi-stakeholder operations team will be formed to develop annual implementation plans for the program. Additionally the operations Team will review current research applicable to operational procedures and make changes if necessary. The Research Team will provide the information to be considered. The team will communicate plans and results to stakeholders on a regular basis. A Terms of Reference will be drafted to inform how team members interact, how decisions will be made and conflicts, if any arise, will be resolved. A team lead will head the group and members will be drawn from a wide group of stakeholders. Ad hoc members will be invited to provide expert advice as needed. Alberta Director of Forest Health and Adaptation will be the team lead.

Other operations team members could include:

- Senior Forest Health Officer, GOA
- Alberta Environment and Parks (AEP) Operations Division
- Alberta Environment and Parks (AEP) Resource Division
- Forest Resource Management Lead, GOA
- Forest Health and Adaptation Information Management Technician, GOA
- Insect and Disease Expert, Saskatchewan Ministry of Environment
- Bark beetle Research Scientist, CFS

- Alberta Forest Products Association
- Non-AFPA
- Alberta municipal leader
- First Nations

The operations team will meet in early fall after Alberta has collected and analyzed the aerial and green-to-red ratio survey data. An operations plan will be developed and Alberta will implement the plan in conjunction with the provincial MPBMP. The Team will meet again in early spring to review the previous year's activities and discuss any needed changes for the coming season. Annual reports will be written.

2.1.2 Current Operational Collaborations

Over the years, several MPB special interest groups or management committees have been established. Some groups remain active while others were dissolved when the risk and impact of MPB was reduced in the region, and a few have morphed into information sharing venues. Regardless of the current state of each committee, the objectives were to share information on the status MPB and ensure that management efforts by various parties were coordinated. A diverse group of stakeholders are involved in these groups. Ministry staff are also members which ensures that consistent messaging and information is disseminated. The active groups will continue to function as they do now under the jointly-funded operational program.

West Yellowhead Mountain Pine Beetle Operational Coordinating Committee

This is a long-standing committee that was formed in 2000. The committee was struck in response to MPB activity in Mt. Robson Provincial Park that was posed to expand into Jasper National Park and eventually, provincial land. British Columbia Parks, Parks Canada and Alberta provincial staff conducted joint population monitoring, ground surveying and single tree control. As well, a large prescribed fire to reduce MPB habitat in Mt. Robson Provincial Park was planned and implemented by all three parties. The West Yellowhead committee actively coordinated the above-noted management activities.

The West Yellowhead area was marginally affected by the long distance migration events in 2006 and 2009. This group became an information sharing forum since there was little MPB management activity occurring in the region. However, now that MPB activity has intensified over the past three years, this committee is once again active.

Central Region Mountain Pine Beetle Committee

This committee was formed in response to the massive 2009 long distance migration of MPB into the central region of Alberta. Together, the forest industry and Alberta developed the 2010 Central Region MPB Plan to formalize and clarify processes to cooperatively manage the MPB infestation at the regional level. The committee reports annually on the status of MPB, and on Alberta and forest industry control activities conducted in the central region. In 2018, the Central Region Annual will be expanded to describe the status of MPB and control activities in the Foothills Region.

Spread Management Action Collaborative

In 2011, the Government of Saskatchewan initiated the formation of the Spread Management Action Collaborative (SMAC) with Alberta as a response to the increase in beetle activity in the eastern reaches of the province. The intent of SMAC is to stop the eastward spread of MPB through boreal pine forests

in Alberta and Saskatchewan. This objective is achieved through increased detection efforts and lowered control activity thresholds.

Alberta and Saskatchewan established a Memorandum of Agreement based on a set of guiding principles in 2012, which is renewed annually, which recognizes that MPB-related tree mortality in Alberta are causing significant loss and degradation of forest resources. Given that infestations have been detected close to the Saskatchewan-Alberta border, Saskatchewan wishes to assist Alberta with their monitoring and control efforts to prevent the spread of MPB into forested areas of this province. Both provinces agree that there is a significant and urgent need to suppress these populations and agree to cooperate to control MPB infestations located within the SMAC region. From 2011 to 2018, Saskatchewan allocated $6.15 million for detection and control work in Alberta, and will contribute up to $1 million for 2019 activities.

Mountain Pine Beetle Mitigation Committee

The need for a forest sector senior management/executive committee was identified to ensure that coordination between all forest companies and Alberta was supported and occurring. Co-chaired by the Assistant Deputy Minister Forestry Division and an Alberta forest company Senior Manager, this group meets twice a year to discuss priorities for each beetle management season, to share management program outcomes, and to provide comments on suggested changes to the MPBMP. This committee has been expanded to include representatives from Parks Canada and municipalities.

Hinton Mountain Pine Beetle Advisory Council

Municipal leaders in the West Yellowhead region of Alberta established this committee to provide Hinton Town Council members with an evidence-based approach regarding regional MPB infestations. The committee has four main goals which are to 1) protect communities from wildfire and safety-related effects of MPB; 2) control the population and limit the spread of MPB and manage the disruption to the region's natural ecosystems; 3) mitigate threats to the economic stability of the region posed by MPB; and 4) enhance awareness of the MPB threat to obtain funding and support. The committee brings together community and industry leaders, MPB experts, and engaged citizens to achieve these four goals.

2.1.3 Operations Plan

Federal funding will be utilized in Alberta to implement a management program that is consistent with the principles described in *A Strategic Approach to Slow the Spread of Mountain Pine Beetle across Canada* (Hodge et al. 2017). This strategy was developed by the Canadian Council of Forest Ministers (CCFM) National Forest Pest Working Group (NFPWG). A number of co-chairs oversaw the development of the strategy (Dr. Rory McIntosh, Saskatchewan Ministry of Environment; Dr. Taylor Scarr, Ontario Ministry of Natural Resources co-chaired and Dr. Barry Cooke). This report summarized the science of MPB management and identified opportunities to reduce spread potential and emphasized the need for further operational-based research.

Activities outlined below are those that were identified in the strategic document. An Operations Team would decide where and when to implement these activities on the landscape. Alberta has estimated the financial needs for each management activity based on past years actual costs.

Enhanced Detection and Control Activities

Successful management of MPB populations is contingent upon the detection and management of infested trees at a rate greater than MPB population increase. The most important and difficult step is detection of the newly infested, green-attack trees. Current detection techniques include aerial and ground surveys, and pheromone monitoring.

Aerial surveys

Aerial surveys are conducted in late summer and early fall to detect red-crowned pine trees symptomatic of MPB infestations. Generally, groups of three or more pine trees with red crowns are recorded using sketch mapping and heli-GPS in regions prioritized for control activities. The same region is not necessarily surveyed every year because of changes in control priorities; additionally, survey coverage does not span the province.

Aerial surveys are both financially- and time-intensive and are therefore restricted to regions of the province that are prioritized for control activities. With additional funding, aerial surveys would be expanded to encompass the eastern region of the province where no beetle populations have been detected but where sufficient high-quality habitat exists in close proximity to active populations. As well, sites with one or two red trees that are suspected to be infested with MPB would be mapped in high risk regions where MPB is active (Fig. 7). Mapping single and double red trees sites increases survey time by up to one-third. If there is a significant number of single- and double-red tree sites, the amount of time required could double.

The operations teams will develop aerial survey plans based on the location of previous year populations, stand susceptibility and pine stand connectivity. It is estimated that $772K would be used annually to perform an intensive aerial survey of 94 townships in Alberta and 10 townships in Saskatchewan (Fig.7). Total cost over the three year program is estimated to be $2.32 million (Table 3).

Future eastern spread of MPB could be limited by a series of historic fires in the northwest part of Saskatchewan and in the Cold Lake Air Weapons Range (Fig. 8). Substantial skip corridors and islands of living susceptible pine stands exist within these fire polygons. Saskatchewan requires financial support to aerially map this area to identify critical pathways within these fire polygons to help refine their SSI and guide the development of their risk analysis. It is estimated that $1 million ($0.50/hectare) will be required to complete this fire mapping work (Table 3).

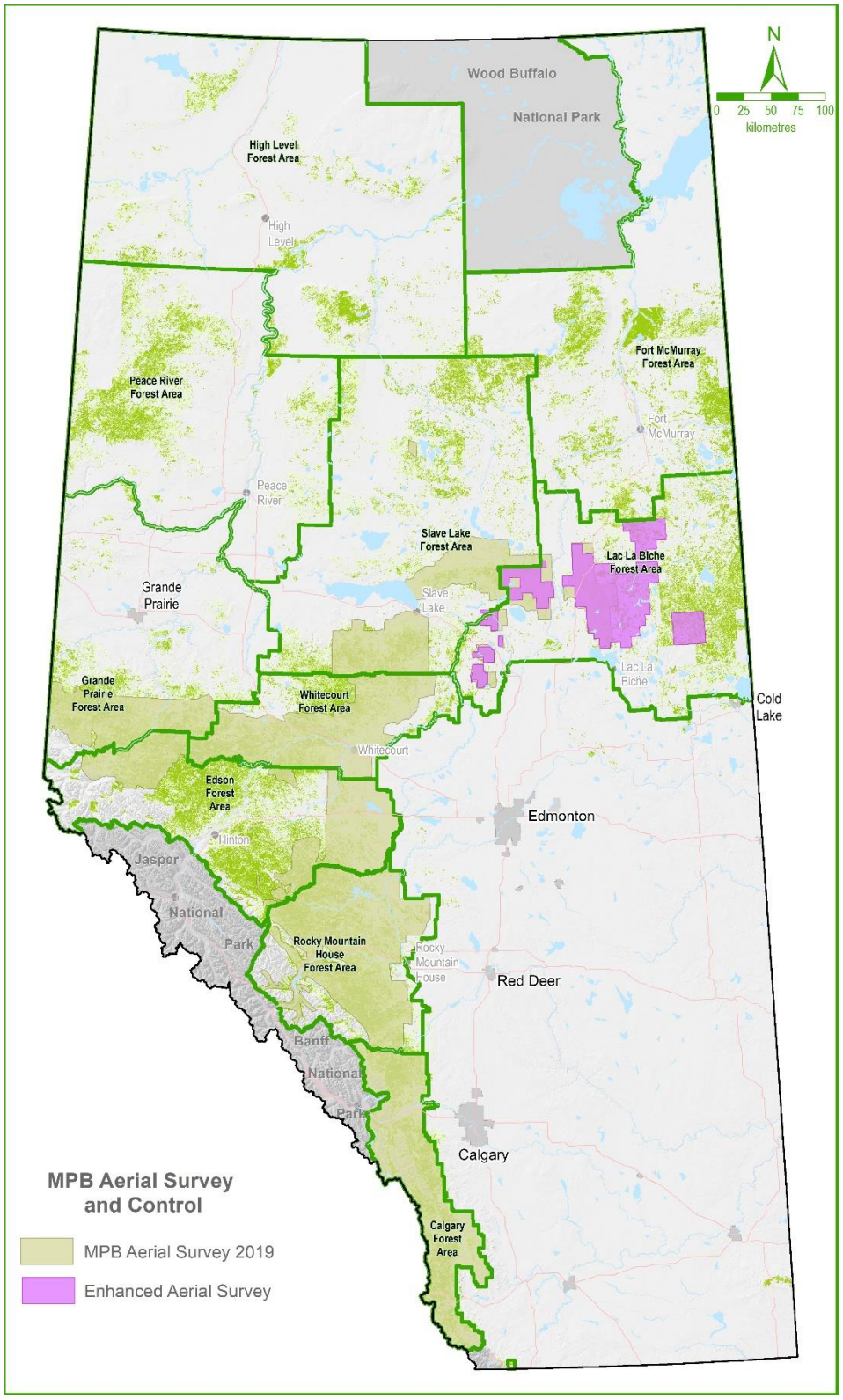

Figure 7. Map depicting regions of the province that were aerially-surveyed to locate MPB-killed trees, and proposed areas for enhance ground and aerial survey.

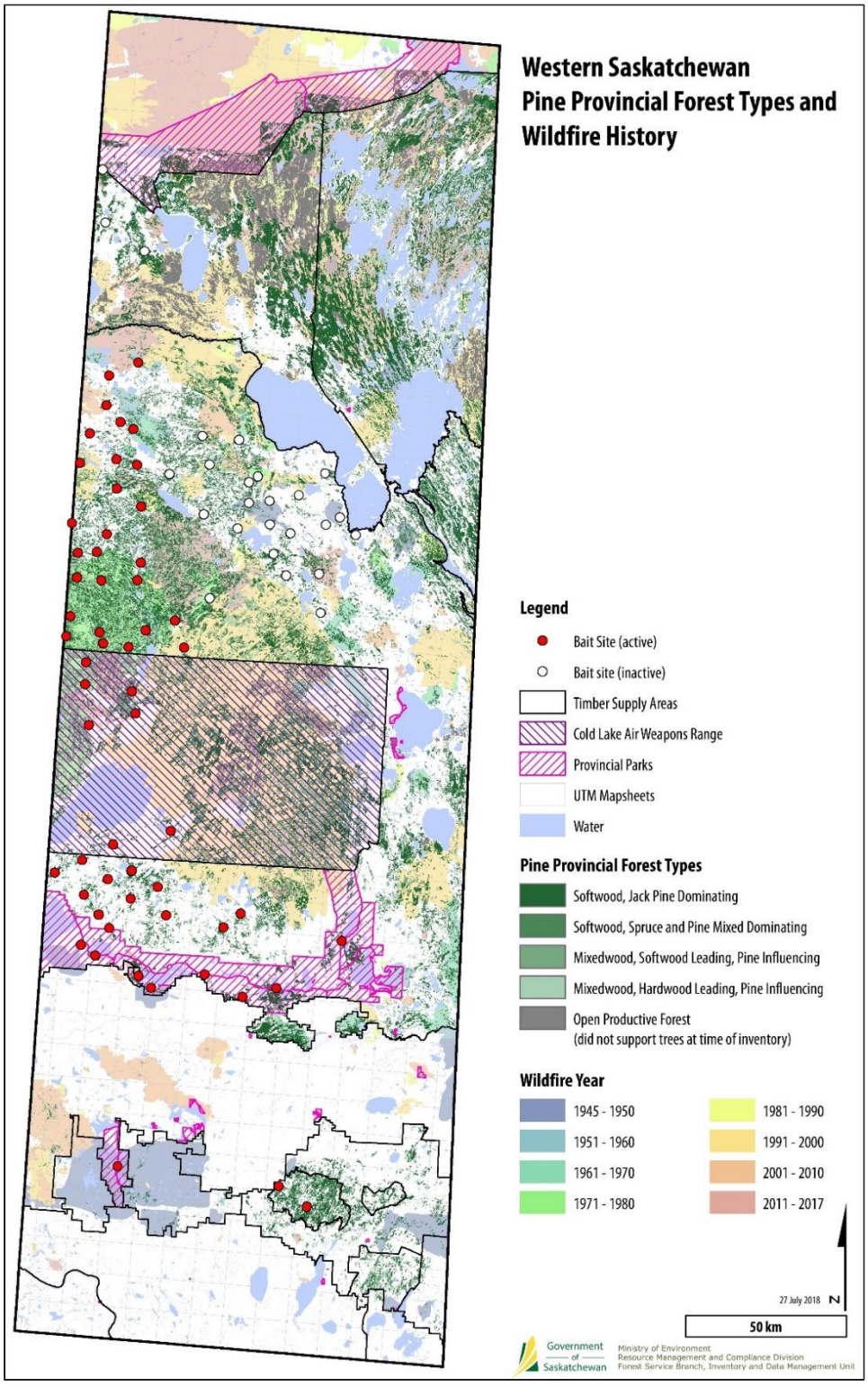

Figure 8. Proposed historic fire skip mapping areas in Saskatchewan to identify critical mountain pine beetle dispersal pathways.

Pheromone surveys

Pheromones are widely used for MPB detection and control. While a useful tool to detect MPB presence, pheromones cannot be used to estimate overall beetle population levels. Additionally, pheromones must be used with caution and be monitored due to attacks on nearby pine (ie. spill-over effects). Population densities may be artificially inflated as individual beetles in the area will concentrate in a smaller area because of the presence of synthetic pheromone. Because of the increase in the number of beetles, they may successfully mass-attack trees and produce brood. Any use of pheromones must be followed up by ground surveys and treatment of attacked spillover trees.

Low density MPB populations are difficult to detect through aerial or ground surveys. Managers can use aggregation pheromone-baited trees to identify the presence of small populations or pioneer beetles. Dispersal bait sites can be set up in advance of beetle populations to be used as an early warning detection system. Presence of beetles at a bait site indicates that further surveys are required, either from the air or from the ground.

Alberta sets up a dispersal bait network along the eastern edge of the province and south along the eastern slopes of the Rocky Mountains. In 2019, approximately 101 dispersal bait sites were deployed on the eastern edge of Alberta (Fig. 9). The number of bait sites has been increased over the past couple of years as the beetles advanced and retracted in this region. If federal funding is not secured, monitoring efforts in this area will be reduced from current levels or eliminated as more emphasis will be placed on the management of active MPB populations along the Rocky Mountain eastern slopes. Federal funding would facilitate continued and expanded dispersal bait monitoring in eastern Alberta. As noted, all dispersal baits must be followed up with ground surveys and, if needed, control; and many of the sites along the eastern edge are helicopter access only.

Saskatchewan has installed 57 dispersal bait sites within the western portion of that province (Fig 9). Early detection of MPB in Saskatchewan will allow the province to rapidly respond before populations can become established. There are few road networks throughout the northwestern portion of Saskatchewan pine forests. Therefore, all of the dispersal bait sites north of the Cold Lake Air Weapons Range must be accessed by helicopter. Additionally, there are not many natural openings where a helicopter could land which necessitates that vegetation be cleared to create heli-pads. If federal funding is secured for the MPBMP, an additional 25 dispersal bait sites, each requiring a heli-pad, would be established in western Saskatchewan, to expand and augment the existing network.

It is estimated that $365K would be required to implement a pheromone bait network in eastern Alberta and western Saskatchewan to support early detection and rapid response. This would enable the establishment of a proposed network of 130 bait sites in eastern Alberta and 25 additional sites in Saskatchewan for the duration of the three year program (Table 3).

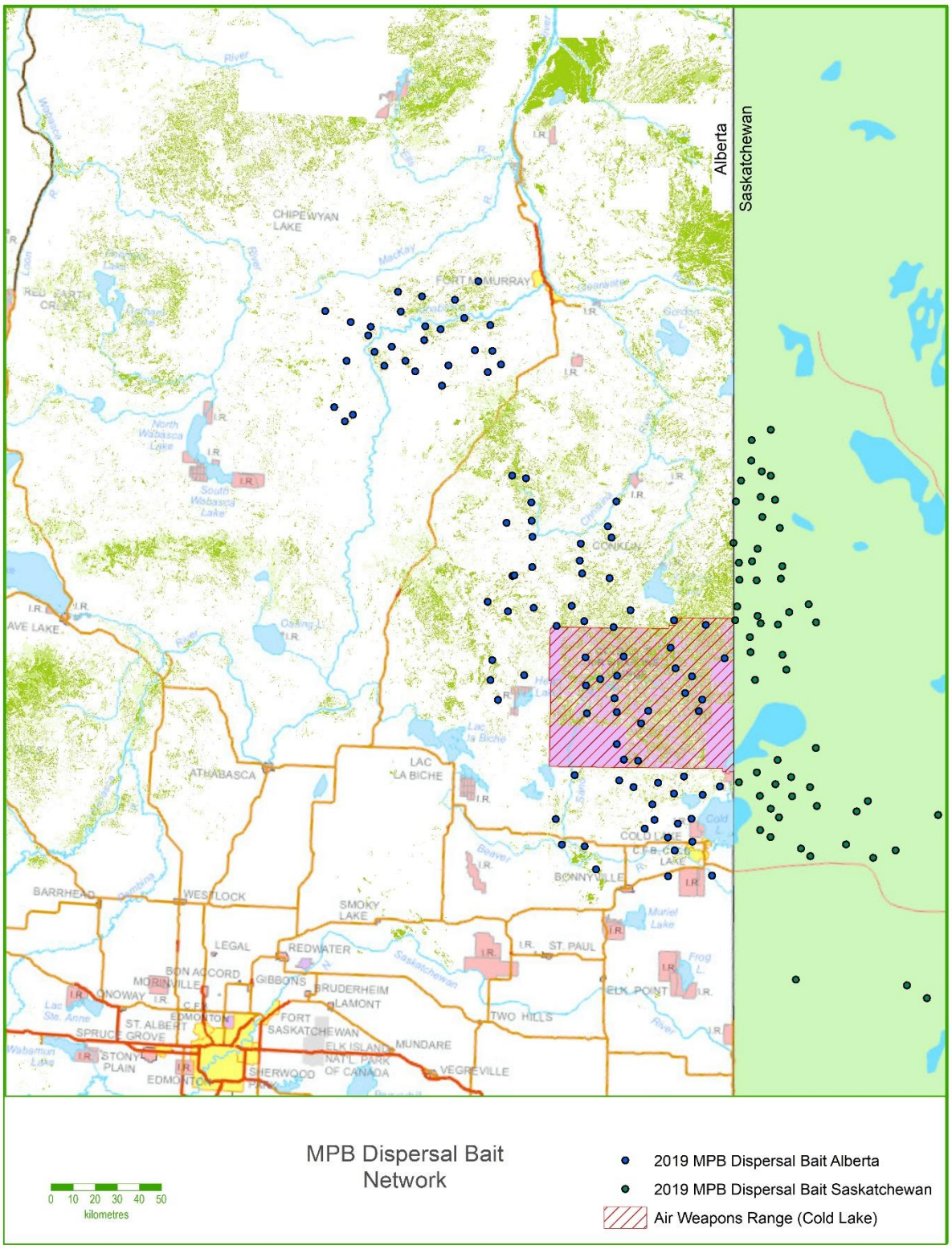

Figure 9. Locations of mountain pine beetle dispersal bait sites monitored in eastern Alberta in 2019 and Western Saskatchewan in 2018.

Green Tree Detection (Ground) Surveys

The number of potential green-attacked trees at each red tree site is calculated using aerial survey data and green-to-red ratio data. Currently only those sites with three or more potential green-attacked trees are considered a priority for ground survey and subsequent control, while those with two or less are not. In the area managed under the SMAC agreement in eastern Alberta, three additional criteria are used to increase the intensity of survey and control efforts. Sites identified from the air that meet the following criteria are also included in the ground survey program: 1) sites with at least 2.4 potential green-attacked trees; 2) sites with a high stand susceptibility ranking, regardless of potential green-infested tree number; and 3) sites where there are ten or more red-attacked trees, regardless of the number of potential green-attacked trees.

While funds from the Government of Saskatchewan offsets a portion of the additional ground survey costs, it does not cover the entire cost. Future discussions between Alberta and Saskatchewan will determine if the modified criteria will continue to be used in the future based on the level of funding from Saskatchewan and the number of additional survey sites identified. Federal funds would allow for the continuation of high-intensity ground survey work. As well, based on recommendations from operations and research teams, additional criteria may be used. Such recommendations could include increasing the ground survey plot size, employing transect surveys in high risk stands and other activities that may potentially increase the number of green-attacked trees detected.

In the Hinton area, the level of infestation has been increasing since 2016 and is anticipated to remain at high levels for the next 2-3 years – this significantly increases the number of sites to be ground surveyed. In 2019, an additional 7,880 sites were identified as being a priority for ground survey in the Hinton area; however, these sites were not surveyed due to resource constraints. Federal funding will reduce the provincial funding constraints to support management efforts in central and western Alberta, which will reduce source populations that are helping to fuel eastern spread.

The total funding ask to undertake approximately 7,500 hectares of ground surveying annually for three years in Alberta is $9.98 million (Table 3). It is unknown at this time what portion of this would be required to support Outcome 1 (limit spread east) versus Outcomes 2 and 3 (limit spread along eastern slopes and managing existing populations), as the situation is constantly changing. The potential influx of federal funds could more than triple green-attack tree detection efforts in eastern Alberta if needed.

Infested Tree Control

In Alberta's current program, only sites where ground surveys identified three or more green-attacked trees are treated. Sites with just one or two green-attacked trees are not treated because of the lower risk of spread and high treatment cost. On average, control sites with just one or two trees are more expensive due to the low productivity of falling and burning crews. Within the area managed by SMAC, one and two tree sites were treated until 2016, when decreased funding from both Alberta and Saskatchewan made it impossible to continue this practice.

The *Strategic Approach to Slow the Spread of Mountain Pine Beetle across Canada* (Hodge et al. 2017) report supports the concept of an "invasion front" that should be treated more aggressively than other areas. In the report, the eastern portion of the Leading Edge Zone is considered the invasion front. Treating sites that are below the three infested tree tolerance threshold has effectively reduced spread and kept populations below the eruptive threshold in eastern Alberta. As resources are reallocated to manage spread in west and central Alberta and to protect critical caribou habitat, the potential for population expansion on the eastern front increases. With increased federal funding, management can

be implemented in “source” populations within the western and central portions of the Leading Edge Zone as well as continue with a more aggressive treatment in “sink” areas in the eastern edge and invasion front area.

In the absence of long-distance migration, Alberta’s program has effectively reduced population spread. When these migration events occur, it is critical to aggressively control trees until movement subsides. The size of the Inactive Holding Zone has been increased since 2016; the entire infested are around Hinton was actioned in 2016. Given the population growth in the region and funding constraints an increasing amount of area has been not been treated. In 2019, 2.5 million hectares were placed in Inactive Holding Zone in the Hinton area. The number of trees controlled in the Hinton area must be increased in order to keep the population at a manageable level until immigration from the west slows. While controlling all the potential green-attacked trees may not be operationally or financially feasible, federal funding would again alleviate some of the provincial funding constraints and contribute to the further refinement of priority control areas and increase the number of green-attacked trees that could be treated.

The majority ($36 million) of the federal funding ask would be allocated to infested tree control. This equates to an additional 87,000 trees controlled annually in Alberta (Table 3). The current survey and control program in eastern Alberta requires $2 million on average annually. An enhanced program, as advocated for in the CCFM *Strategic Approach to Slow the Spread* report, would likely double program costs aimed at minimizing eastern spread. If Alberta federal ask is fully funded, a significant portion of the federal control funds would be used to limit spread along the eastern slopes and to manage existing populations in western and central Alberta.

Operational Manpower

Successful implementation of the joint provincial-federal funded MPB program will require additional manpower. Alberta’s current MPBMP is implemented by approximately 20 full-time forest health officers and technicians, a contract manager, and numerous administrative and program support staff. Although federal funding would essentially double the size of MPBMP, only an additional seven full-time equivalent positions are being proposed for the span of the project: six forest health technicians and one contract administrator. See Table 3 for manpower requirements and cost projections.

The duties of the forest health technicians would include: aerial/ground surveying, contractor liaison, quality assurance checking, and data management. The contract administrator would support the contract manager to deal with the significant increase in the number of contractors required to undertake the program.

2.1.4 Fund Administration and Management

The most efficient means to administer the finances would be for funds to be provided to the GOA on an annual basis. This would allow for the funds to be administered as per GOA financial policies. Operations would be seamless between GOA and federal programs, and funding from GOA could be used to augment federal allocations and vise-versa where needed and appropriate.

- Fund Tracking:
  Financial accounting codes would be set up to track and report on the federal allocation separate from the provincial allocations.

- Fund Reporting:
  As per standard GOA procedure, quarterly forecasting and variance tracking would be completed.
- Contract awarding:
  All contracts issued by the GOA must be posted to the Alberta Purchasing Connection for a minimum of ten days. Contractors for the MPBMP must pre-qualify prior to submitting a bid. All contracts must be approved and signed by an appropriate GOA Expenditure Officer. Performance Deposits and Holdbacks are applied to each contract and invoice respectively.
- Contract payment:
  Invoices are processed every two weeks. Invoices are reviewed by GOA staff and appropriate GOA Expenditure Officers approve all invoices. Quality Inspection is completed on all work and financial penalties are applied based on field-based quality inspections.

2.2 Research Program

The unprecedented outbreak of MPB in Alberta revealed knowledge gaps that could limit the Province's ability to make science-based management decisions. The spread of MPB from its historical range into novel habitat in Alberta suggests that there are no host-related barriers to prohibit further expansion, which may put the Canadian boreal forest at risk. Additionally favorable winter temperatures have reduced the amount of overwinter mortality which further facilitates the establishment and spread of MPB populations through Alberta and threatens the eastern Canadian boreal forests.

Along with the 2017 *A Strategic Approach to Slow the Spread of Mountain Pine Beetle across Canada,* the CCFM NFPWG completed a research gap analysis which highlighted the need for continued work to understand MPB ecology, dynamics of invasive MPB spread, and the impact of MPB on the forest and community resilience (Cooke 2016). The newest CCFM National Mountain Pine Beetle Risk Assessment incorporates the most recent research findings to highlight crucial knowledge gaps (Bleiker 2019). All of these documents will be used to define the research program. The research program will address national as well as provincial research priorities that support effective and efficient operational decisions.

2.2.1 Research Team

A team will be struck to develop the research program, evaluate proposals for funding and review deliverables. A Scope of Project document will be developed to document research gaps and priorities, deliverables, and approximate timelines. A Terms of Reference will inform how team members interact, decisions will be made and conflicts resolved. The research team members would be decided upon by consensus between the participating agencies but membership should include leading specialists in bark beetle and landscape ecology, hydrology, wildlife, and wildfire behaviour, in addition to provincial (Alberta and Saskatchewan) and federal government representatives, and at least one forest industry member.

A research team lead will chair the committee to ensure that projects are relevant to the goals of the research program and meet GOC strategic priorities. In addition, the lead will ensure that projects do not overlap with those occurring outside of the project such as with fRI Research and SERG-I. Furthermore, the lead will make certain that projects are on target for completion, and that technology transfer is occurring. Caroline Whitehouse, Forest Health Scientific Specialist with GOA, has been identified for this role. A Research Project Manager will be hired to manage routine project

administration and communication between researchers and the Research Team Lead. The manager will provide direct support for field logistics between GOA and the researchers, and report to the Research Team Lead.

2.2.2 Current Research Collaborations

The GOA has an established network of research collaborators that involves academics, industry and federal research scientists across Canada. GOA supports research conducted through SERG-International, TRIA-Net, and the fRI Mountain Pine Beetle Ecology Program which have provided many successful outcomes. Additionally the GOA internally conducts small-scale research to address operational questions. The GOA has spent $6.1 million on MPB research over the last decade. Current research and knowledge transfer will be linked with these organizations and other research facilities whenever possible.

SERG-International is an association of forest management organizations, regulatory and research agencies, and pesticide suppliers focused on forest pest management. The mandate of SERG-I is to improve pest management methods associated with the use of pest control products in the context of integrated forest pest management. SERG-I members cooperatively fund research projects by pooling financial and/or in-kind resources, which leverages other sources of funding to conduct research. Research results are shared amongst the members at an annual workshop.

The GOA was a partner in the Turning Risk into Action for the Mountain Pine Beetle Network (TRIA-Net), an initiative first funded in 2007 under the Natural Sciences and Engineering Research Council of Canada's Strategic Network Grants program. The mandate for TRIA-Net was to protect Canadian forests through science-based strategies to control spread of the mountain pine beetle in Canada. This was a collaborative research initiative directed by Dr. Janice Cooke (University of Alberta) and co-directed Dr. Joerg Bohlmann (University of British Columbia). Eighteen scientists, in addition to government, not-for-profit, and industry organizations participated in TRIA-Net. This successful program concluded in June 2018.

fRI Research is the foremost agency through which Alberta-focused MPB research has been conducted. The Mountain Pine Beetle Ecology program (MPBEP) was created within fRI Research in 2007 to administer research, transfer knowledge and facilitate collaboration between stakeholders regarding MPB in Alberta. An Activity Team comprised of Alberta forest industry members, GOA employees, University of Alberta scientists, and Jasper National Park staff directs the research funded through MPBEP.

2.2.3 Call for Proposal Process and Reporting

Once the research priorities for this program have been defined in early 2020, a call for proposals will be made (Appendix 4). Given the three-year timeframe for this funding request, projects will need to be completed within two to three years. Members of the Research Team will evaluate the proposals for merit and recommend which should receive funding, along with justification for the endorsement. GOA and GOC senior executives will make the final decision on funding based on the recommendations provided by the Research Team.

Principal investigators will be required to submit interim reports at the end of each fiscal year and a final report when the project is complete (Appendix 4). A research team meeting will be held in the first quarter of each year to review interim project reports. Research may extend into 2023 but all projects must be completed by the middle of the fiscal year so that the synthesis of all projects can be written. This report will include recommendations for changes to the monitoring and management of MPB, and the risk that MPB poses to pine forest east of Alberta.

2.2.4 Research Plan

The last decade of research has enabled GOA to use science-based strategies to limit the spread of MPB in historic and novel habitats, to evaluate current management practices, and to assist the regeneration of forests and recovery of ecosystem processes post-attack. Socioeconomic analyses has improved Alberta's understanding of how MPB has impacted communities and what benefits have been achieved through aggressive management of infestations.

Nevertheless, information gaps remain and further research is required to build on the foundational knowledge gained during the last 10 years. Through the NFPS a research gap analysis was completed which highlighted the need for continued work in the ecology and dynamics of invasive MPB spread and the impact of MPB on the forest and community resilience (Cooke 2016). The 2019 revision of the CCFM National Mountain Pine Beetle Risk Assessment has incorporated the most recent research findings to highlight crucial knowledge gaps (Bleiker 2019). Additionally, the recent federal containment strategy (Hodge et al. 2017) emphasized the need for further operational-based research.

Research projects will focus on topics that could improve aspects of the provincial MPBMP and address national priorities. To that end, research funded under the joint program will fall into one of five strategic themes: 1) MPB biology; 2) MPB dispersal and spread; 3) detection and management of MPB; 4) ecological and social impact; and 5) wildfire behaviour after MPB. Below is a discussion of research needs that GOA propose to address through the federal funding program.

<u>MPB Biology</u>
Mountain pine beetle encounter novel habitat as populations move east into the hybrid and jack pine forests of Alberta. Novel habitats did not evolve with MPB as a disturbance component and as such, MPB biology might be different in the new habitat. Many uncertainties exist regarding their interaction with novel hosts, fungal associates, natural enemies, and competitors and in new climates. This information is required to better understand the risk MPB poses to eastern pine forests.

Potential projects:

- Investigate the triggers that cause shifts from endemic to epidemic population dynamics and how this varies with weather, tree stress, pine species, inter- and intraspecific competition. Incorporate these factors into monitoring and management decision support tools.
- Develop a method to measure local population growth rate (include aspects of cold tolerance), and relate this to a monitoring and control threshold to achieve local management objectives. Incorporate these factors into decision support tools.
- Validate the discoveries made in Janes et al. 2014 of genes undergoing selective adaptation.

MPB dispersal and spread

Mountain pine beetle spread through a landscape by short- and long-distance dispersal to establish within a forest and to expand their range. In the expanded range, MPB are challenged with a more heterogeneous pine forest, hybrid lodgepole/jack pine and a vastly different climate than in their historical range. All of these factors affect their dispersal capability and impact population expansion.

Potential projects:

- Model potential dispersal corridors on a local and landscape scales given heterogeneous and non-contiguous pine forests in eastern Alberta to increase monitoring efficacy.
- Explore host selection and colonization in jack pine, and integrate information into management practices.
- Determine how forest composition affects dispersal and spread of MPB.
- Investigate the effect of MPB on local biodiversity and vice versa.

Detection and management of MPB

Appropriate tools to confidently detect MPB are key to successful management of populations. Analysis by Carroll et al. (2017) indicates that MPB single-tree control efforts in homogenous stands in western Alberta was effective at limiting spread. Control efficacy is partially limited by the ability to effectively detect green-attack trees. Historically provincial detection efficacy ranged between 54-68 per cent (Carroll et al. 2017). Provincially, detection accuracy within the 50 metre concentric survey plot averages 98.5 per cent. Increasing the survey plot radius to 75 metre or 100 metre provides minimal gain, which suggests that survey techniques must be flexible given a range of conditions.

Management of MPB involves both short-term beetle-focused (single-tree treatment) actions and long-term host management strategies that target forest composition at a larger scale. These strategies rely heavily on stand susceptibility models, operational decision support tools and MPB spread models.

Potential projects:

- Determine how to incorporate MPB population state (e.g. incipient versus endemic) and actual rates of population increase into operational models.
- Develop technology to accelerate interpretation of remote sensing data to provide timely operational responses.
- Develop innovative technology and survey methods for detecting green-attack trees that are widely dispersed, occurring at low densities and not in close proximity to red-attack pine.
- Develop an operationally-feasible, accurate MPB spread model that incorporates recent research.
- Validate, re-parameterize or adapt the stand susceptibility index for jack pine stands.
- Determine MPB-attacked tree density thresholds in jack pine where control efforts can successfully supress populations.

Ecological and social impact

MPB outbreaks cause ecological changes in pine forests. These changes may be less predictable in the MPB expanded range and research on the impact of MPB in these new ecosystems is required. Through fRI Research MPBEP, research has been initiated to assess the response of endangered species to MPB-killed pine forest, as well as the effect of MPB on the hydrology and stand regeneration. This information needs to be incorporated into management strategies and will inform future risk assessments.

Potential projects:

- Reassess the Southern Rocky Mountain eastern slopes watershed risk analysis.
- Determine the effect of management activities on *Endangered* and *Threatened* species critical habitat.
- Investigate whether there is an alteration of the carbon balance in the expanded range.

Wildfire behavior after MPB

Studies have shown that tree mortality resulting from MPB infestations alter fuel and microclimates through changes in fuel chemistry and stand structure, which can have potentially severe impact on fire behavior (reviewed by Parsons et al. 2014). Parsons et al. (2014) noted that MPB-killed trees may increase the frequency and intensity of wildfire, and may also contribute to a more rapid rate of spread and a greater likelihood of crown fires (as reviewed by Nealis and Cooke 2012, Parsons et al. 2014). However, many knowledge gaps remain, particularly in light of climate change and the movement of MPB into novel habitat.

The GOA and the Canadian Forest Service are currently collaborating with fRI Research to address existing knowledge gaps. One specific goal of current research related to wildfire is to gain a greater understanding of how MPB mortality may contribute to landscape level wildfires. This research should continue given its tremendous value to the provincial FireSmart program as MPB impacts more forested communities.

Potential projects:

- Determine the interactions between MPB, fire behaviour, climate change and the alteration of forest succession.
- Compare fire growth from ignition point in MPB versus non-MPB-killed stands.
- Investigate how the mosaic of tree death (green, red and grey trees) affects fire behaviour.
- Determine how snags influence rate of spread and intensity in grey phase MPB-killed stands.
- Determine how changes in microclimate affect fire behaviour through all stages of MPB killed stands.
- Improve modeling software to predict and validate fire behaviour in MPB-killed stands.

2.2.5 Fund Administration and Management

All research will occur through fRI Research as a program complementary to, but separate from, the Mountain Pine Beetle Ecology Program. fRI Research has a robust framework within which to administer research, and their practices and policies will be adhered to. Though this format has been successful, GOA would like to proceed with a different committee structure for the new research program as outlined above in the Research Team description.

2.3 Project Oversight

As all aspects of the project will be managed as one MPBMP, and GOA will lead the Operations and Research Teams. Senior Executive approval from both the implementation (i.e. GOA) and funding organization (i.e. GOC) will be sought.

It is essential that concurrent activities of the Operations and Research Teams are strategically aligned. The Project Co-ordinator, along with Team Leads, will develop an annual Scope of Work plan that

outlines key activities for each of the three project teams. This Scope of Work plan will be submitted to the Alberta Agriculture and Forestry, Forestry Division Assistant Deputy Minister and the Director General, Atlantic Forestry Centre, Natural Resources Canada for approval at the beginning of each fiscal year. Following approval of the work plan, each team will create implementation plans for each program that align with the overarching scope of the approved Work Plan. All reports will be submitted prior to formal submission and/or public release and Team meeting minutes will be provided to the executive of both agencies.

2.4 Project Coordination

Two project teams will be developed and led by GOA staff. These teams will be responsible for the overall direction and objectives for each program. To ensure the effective and efficient development and implementation of the Operations and Research Programs, a Project Co-ordinator will be hired for the duration of the project.

The role and responsibilities of the Project Co-ordinator are, but not limited to the following:

- Provide a one-window contact for the Project for both federal and provincial agencies.
- Prepare a Scope of Work document annually.
- Attend Operations and Research Team meetings and provide progress reports to each team.
- Integrate FireSmart with Operations and Research programs when applicable.
- Ensure that activities undertaken by each program align with federal and provincial objectives.
- Lead the production of reports with support from technical experts for each program area.
- Support the Operations and Research teams to advance the project (conference calls' and meetings' planning, logistics).
- Develop and update Project key messages in collaboration with federal and provincial agencies;
- Support Communications Team (should one be developed).
- Prepare the final Project Report.

Janice Hodge, owner of JCH Forest Health, is a forest health professional with over 37 years experience, who is uniquely positioned to be the Project Co-ordinator. As a contractor, she has worked for or with, all levels of government on various forest health issues across Canada for 23 of those years. For the last nine years Janice has been the National Forest Pest Strategy (NFPS) Technical Coordinator for the Forest Pest Working Group of the Canadian Council of Forest Ministers (CCFM). She has a well-established network of forest health connections, including provincial and territorial forest pest experts and research scientists (federal and academic) across Canada.

Janice has significant experience with the development of pest-specific or landscape-level forest health management plans/strategies, early detection and rapid response plans, pest risk analysis, and various management-oriented plans. Sample national projects include development of a containment strategy to slow the spread of MPB across Canada, climate change vulnerability assessment, identification of national forest pest research priorities and needs, identification of forest pest diagnostic and taxonomic capacity and gaps, and pest risk analyses for MPB and emerald ash borer. She most recently planned and facilitated a MPB Summit in Edmonton with provincial and federal attendees, and prepared and co-facilitated a science workshop that provided essential information for the revision of the national MPB risk analysis. Because of her vast experience in cross-jurisdictional pest-related projects and detailed knowledge of the Alberta MPBMP and the national containment strategy, Janice has been identified to fill this role.

3.0 FINANCIAL INFORMATION

3.1 Historical Financial Information

Alberta's early MPB program was funded through the Forest Health annual allocation of $500,000 from the Environmental Protection and Enhancement Fund. Forest industry assisted the GOA by providing resources for pheromone surveys and control. When MPB was detected in the Willmore Wilderness Park in 2005, funds and manpower from the provincial wildfire program were re-directed to survey and control MPB. MPB was declared a provincial emergency after the 2006 in-flight and a significant amount of funds were allocated to the MPBMP from the Environmental Protection and Enhancement Fund. MPB continued to be categorized as a provincial emergency until 2014 when it was recognized that the situation was no longer an emergency and instead should be treated as a long-term commitment to forest management. With this change in status, funds for the MPBMP were allocated from the Provincial Base Budget. Table 1 outlines MPBMP funding categorized by funding agency for each fiscal year since 2004/05.

Table 1. Mountain pine beetle management program funding (figures in millions).

Fiscal year	Federal contribution	Saskatchewan contribution	Alberta expenditure	Total expense
2004/05	--	--	$0.95	$0.95
2005/06	--	--	$7.04	$7.04
2006/07	--	--	$49.10	$49.10
2007/08	$8.00	--	$69.00	$77.00
2008/09	--	--	$59.80	$59.80
2009/10	$10.00	--	$26.50	$36.50
2010/11	$0.37	--	$32.03	$32.40
2011/12	--	$0.15	$32.64	$32.79
2012/13	--	$0.45	$40.79	$41.24
2013/14	--	$1.10	$43.91	$45.01
2014/15	--	$1.10	$37.34	$38.44
2015/16	--	$1.25	$34.40	$35.65
2016/17	--	$0.30	$28.10	$28.13
2017/18	--	$0.80	$25.70	$25.78
2018/19	--	$1.00	$25.76	$26.76
2019/20*	--	$1.00	$30.00	$31.00
Total	**$18.37**	**7.15**	**$543.06**	**$567.59**

* Estimated maximum funding.

MPBMP activity costs are tracked annually (Table 2). Direct population management activities (detection, control and quality inspection) accounts for 63 per cent of the annual expenditures, while infested tree control is approximately 38 per cent of expenditures (Fig. 10). Annual work plans are developed by estimating the number of ground survey sites required and number of trees to be controlled.

Table 2. Mountain pine beetle management program costs.

Activity	2014	2015	2016	2017	2018	Average
Per ground survey site	$404.00	$384.88	$380.19	$328.20	$337.00	$367.01
Per tree controlled	$130.28	$140.00	$146.84	$114.00	$114.23	$129.07
Per quality inspection man-day	$850.00	$860.20	$737.50	$741.40	$793.75	$796.57

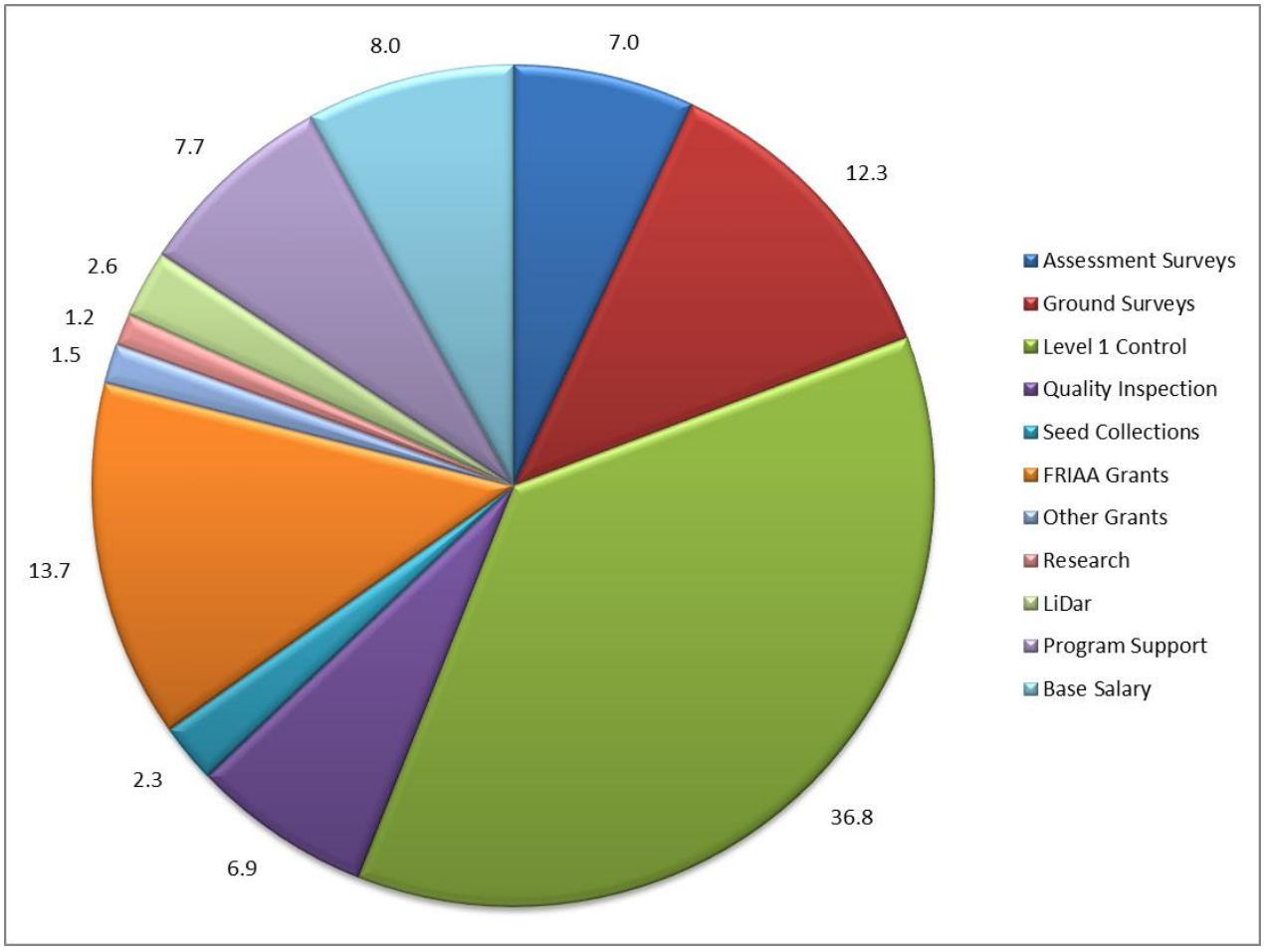

Figure 10. Annual mountain pine beetle management activities partitioned by per cent of annual budget.

3.2 Project Financing

The proposed federal contribution over the three-year period is described in Table 3. If fully funded as proposed, funding levels would equate to a 60:40 per cent provincial:federal funding ratio.

Table 3. Total funds requested from the federal government (figures in thousands).

	Jurisdiction	Units	Year 1	Year 2	Year 3
Operations:					
Aerial surveys	Alberta	94 Twps, 295 hrs	$700	$700	$700
	Saskatchewan	10 Twps, 30 hrs	$75	$75	$75
Pheromone surveys	Alberta	~130 sites	$90	$90	$90
	Saskatchewan	~25 sites (heli-pad dev't – yr 1, monitoring)	$60	$20	$20
Ground surveys	Alberta	~7,500 hectares	$3,500	$3,500	$3,500
Control	Alberta	~87,000 trees	$12,000	$12,000	$12,000
Quality inspection	Alberta	15 per cent of survey and control sites	$1,500	$1,500	$1,500
Five-needle pine	Alberta	Seed collections (all yrs) Health transect (yr 3)	$25	$25	$75
Fire mapping	Saskatchewan	2,000,000 hectares	$1,000	--	--
		Subtotal	$18,950	$17,910	$17,960
Operations manpower:					
Program Co-ordinator[2]	Project	1	$95	$95	$95
Forest Health Technician	Hinton	2	$160	$160	$160
	Slave Lake	2	$160	$160	$160
	Lac la Biche	2	$160	$160	$160
Five-needle pine wage staff	Alberta	2	$45	$45	$75
Contract Administrator	Alberta	1	$90	$90	$90
		Subtotal	$710	$710	$740
		Total operations:	$19,660	$18,620	$18,700
Research:					
Research funding	Project		$2,250	$250	$250
		Subtotal	$2,250	$250	$250
Research manpower:					
Program Manager	Research Team	1	$90	$90	$90
		Subtotal	$90	$90	$90
		Total research	$2,340	$340	$340
Total funding requested/year:			$22,000	$18,960	$19,040
Grand Total (over 5 years)			$60,000		

[1]Five-year averages were used to arrive at these figures. [2]The contract for this position would be extended for three months at the end of the project to prepare final reports. Funds for this would be provided by GOA.

4.0 COMMUNICATIONS & ENGAGEMENT

Mountain pine beetle is not a new or emerging issue in Alberta. Communications have been occurring at regional, provincial and national levels for many years.

Past communication

Presentations have been given to various stakeholder groups which include forestry-focused public advisory groups, town councils, special interest groups, as well as at university and grade schools. A variety of extension products have been developed for distribution to educate stakeholders and the general public. Up-to-date information on the Alberta program is available on the GOA webpage.

Current communication

The MPBMP is widely viewed by affected stakeholders as crucial for mitigating the negative impact of MPB to Alberta values at risk. These stakeholders see that Alberta requires financial assistance in order to continue to aggressively manage MPB infestations along the eastern slopes of the Rocky Mountains and in the eastern region of Alberta which shares a border with Saskatchewan. Letters of support have been written by members of Alberta forest industry organizations, leaders from Alberta municipalities, as well as Ministers from provinces east of Alberta.

Future communication

Any federal funding contributions to the Alberta MPBMP would be highlighted in communications created by GOA. Recognition of the additional management activities and research projects occurring under this program would be made during presentations to stakeholders, as well as in GOA publications such as newsletters and annual reports. The Alberta MPB website would be updated to reflect the financial and expert advice contributions to the program.

At this time a formal communications plan has not been drafted. Should a plan be required, a small team can be formed with at least one representative from each of GOA, Government of Saskatchewan and Canadian Forest Service. The project co-ordinator would also participate and ensure linkages to the other teams are made.

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APPENDIX 1: DESCRIPTION OF THE PROPONENT AND THE MOUNTAIN PINE BEETLE MANAGEMENT PROGRAM

A1.1 Description of the Proponent

Alberta Agriculture and Forestry is responsible for the policies, legislation, regulations and services related to the sustainable development of Alberta's agriculture and forest sectors (Government of Alberta 2019). The Ministry aims to build public confidence in safety of the province's food production systems, protect Albertans from the risk of wildfires, strengthen rural communities and Alberta's agriculture and forest industries, and manage Crown forests. Agriculture and Forestry also engages in research and extension services geared toward industry development. Working collaboratively with other ministries, industry partners, farmers, ranchers, Indigenous communities, and Albertans, the ministry enables Alberta's agriculture and forest sectors to grow and prosper.

All business undertaken by the Ministry is guided by the following desired outcomes:

1. Growth and sustainability of Alberta's agriculture and forest sectors.
2. Public health and safety.
3. Responsible resource management.
4. Thriving rural communities.

To achieve the above-noted outcomes, the Ministry will protect and enhance the health of Alberta's forest resources, which includes managing risks associated with pest outbreaks like MPB. This also includes reducing the risk of wildfire to communities and to promote healthy ecosystems, ensuring access to current and new markets, and delivering services that enhance the quality of life for rural Alberta. Managing these risks requires collaboration with other ministries, industry, communities and governments. This includes collaboration with other jurisdictions concerned about eastward spread of MPB.

A1.2 Alberta's Current Mountain Pine Beetle Management Program

Since 2006, when the first of two large in-flights of mountain pine beetle (*Dendroctonus ponderosae* Hopkins) occurred, Alberta has been actively managing MPB populations in the Province. Prior to the 2006 inflight, Alberta had a zero-tolerance for MPB-infested trees; every MPB-infested tree that was detected in the province was controlled. After the inflight, a zero-tolerance philosophy was not feasible due to the large number and wide spatial distribution of infested trees. In response to this change in operations, the Mountain Pine Beetle Management Program (MPBMP) was developed. Three documents (Mountain Pine Beetle Action Plan; Mountain Pine Beetle Management Strategy; Mountain Pine Beetle Infestation Management Responsibilities) were published that describe the MPBMP. This program is still implemented using the same principles and procedures, however, improvements have been made based on operational and scientific learnings.

Alberta's MPBMP has employed both a short-term, beetle-focused strategy and a long-term, pine-focused strategy. The short-term strategy consists of direct population management through control treatments. The long-term strategy focuses on the reduction of MPB habitat by changing the amount

and distribution of mature pine tree across the landscape. Both strategies contribute to the following MPBMP program objectives:

1. Minimize spread of MPB north and south along the eastern slopes of Alberta to minimize impacts to key watersheds;
2. Slow further eastward spread, and minimize impact of MPB in Canada's boreal forest lodgepole-jack pine hybrid and jack pine ecosystems;
3. Rehabilitate stands with significant tree mortality where natural regeneration will be slow and where desired ecological function is being impacted by the losses;
4. Protect *Endangered* tree species and critical habitat;
5. Participate and collaborate on interprovincial/territorial and national spread mitigation initiatives; and
6. Support Alberta-based research to inform management decisions.

The MPB Decision Support System (DSS) is a spatial tool that assists land managers to implement control activities in a manner that meets the Province's program objectives. Government of Alberta staff and Canadian Forest Service (CFS) scientists from the Pacific Forestry Centre jointly developed the tool. Dr.'s Les Safranyik and Allan Carroll contributed advice on the subject of beetle biology, ecology, and climatic suitability, while Dr.'s Terry Shore and Bill Riel were the leading experts on the role of host stand characteristics and host connectivity. The DSS only considers factors associated with beetle biology and risk of spread. Based on experiences in British Columbia and lessons learned through discussions with forestry managers in that Province, it was felt that taking a scientific approach to beetle management was the best option.

The DSS is under continuous review and changes have been made as new information has become available. For example, the original DSS included a climate suitability factor. It was soon realized that this factor consistently underestimated the realized beetle productivity throughout most of Alberta, and it was removed for that reason.

Three management zones are used to refine the MPBMP geographic boundaries. These zones are characterized by differing MPB-infested tree tolerances and management tactics. The boundaries of each zone are assessed annually and redrawn in October once all the pertinent data has been gathered and the annual budget has been allocated.

1. Leading Edge Zone
   The main objective in the Leading Edge Zone is to extinguish local populations or reduce outbreak populations to an endemic level and to reduce spread of infestations. This requires that the control of 80 per cent or more of the identified infested trees with surviving beetle brood.

   This zone has the highest management priority. It encompasses the region where beetle populations threaten to spread along the eastern slopes and eastward into the boreal forest. The Leading Edge Zone is characterized by large continuous, highly connected pine stands that are climactically and ecologically suitable for good MPB survival and reproduction. Infestations are controlled through aggressive Level 1 (single tree) treatment, and supplemented by Level 2 (forest industry harvest) treatment where applicable.

2. Active Holding Zone (formerly Holding Zone)
   The objective for this zone is the maintenance of static beetle populations. This goal is achieved through the removal (i.e. through harvest or prescribed burns) of 50 to 80 per cent of infested trees.

   The Active Holding Zone has significantly more infested trees over the forested landscape, with generally larger infested patches of trees than the Leading Edge Zone. On average stands in this zone contain less susceptible pine which are more disconnected. Additionally, female productivity and beetle survival is lower than in the Leading Edge Zone. Control of populations is achieved primarily through Level 2 treatment supplemented with Level 1 treatment.

3. Inactive Holding Zone (formerly Salvage Zone)
   Within the Inactive Holding Zone the main goal is to manage for other forest values. Watershed protection, ecosystem restoration, non-host species retention, mid-term timber supply protection and wildfire and fuel management are the main management objectives. In general, salvage harvest in beetle-killed stands does not reduce MPB populations or limit spread in any significant way and is not considered a control strategy.

   The Inactive Holding Zone is defined by stands or compartment where 50 per cent or more trees have been killed by MPB, or the proportion of trees that could be killed by MPB is likely to reach or exceed 50 per cent within one year. Beetle productivity in these stands range from very low or to relatively high. Susceptible pine stands are very disconnected which decreases the risk of population spread. Any action taken to suppress or maintain MPB populations and reduce subsequent damage will be ineffective in this zone.

The Mountain Pine Beetle Infestation Management Responsibilities document outlines who implements the short- and long-term strategies. Alberta forest industry is responsible for planning and implementing the long-term strategy through the Pine Strategy. The Government of Alberta (GOA) administers the short-term beetle-focused strategy. The forest industry and GOA coordinate their respective activities under each strategy.

MPB population management requires the treatment of currently infested trees to kill the developing brood. In order to treat the infested trees, they must first be detected. Aerial surveys are conducted from August 15 through September 15 each year. Surveyors mark the location and number of red pine trees from a helicopter. Red trees are those pine that were mass-attacked by MPB during the previous summer. During this time, ground surveyors conduct green-to-red ratio surveys. Ratios are calculated by site based on the number of green-attack trees (trees with current year attacks) compared to the number of red-attack trees. These surveys provide information on the potential for local population spread and can indicate if immigration into a given area occurred.

Throughout the fall and winter, ground surveyors perform concentric circle surveys around red-attacked trees detected during aerial surveys to find the new attacked trees. Control crews follow the ground surveyors and treat currently-attacked trees using either fall and burn or mechanical techniques. Quality inspections are conducted to ensure the accuracy and timeliness of survey and control activities and data.

Performance measures, which were developed during the early stages of the MPBMP, have been valuable for ensuring that management activities are effective and that procedures are adhered to. The measures themselves are reviewed annually as management tolerances, survey protocols, and

operational goals may change. Performance measure monitoring and reporting demonstrates fiscal accountability and identify areas for program improvement.

An important annual program review is completed where every aspect of the program is examined by provincial forest health staff and adjusted as necessary. This is a time to adjust and develop new monitoring and control protocols, evaluate what science was working, scan the scientific landscape for new insights or technologies that could help with the program, and improve administrative processes. When doing so it has been extremely valuable to solicit feedback from all levels of staff and contractors involved in all aspects of the program.

A1.2.1 Summary of Mountain Pine Beetle Management Activities

Management activities have been tracked each year since the beginning of the provincial MPBMP. The number of sites that were ground surveyed and trees controlled are summarized by year in Figure 11 below.

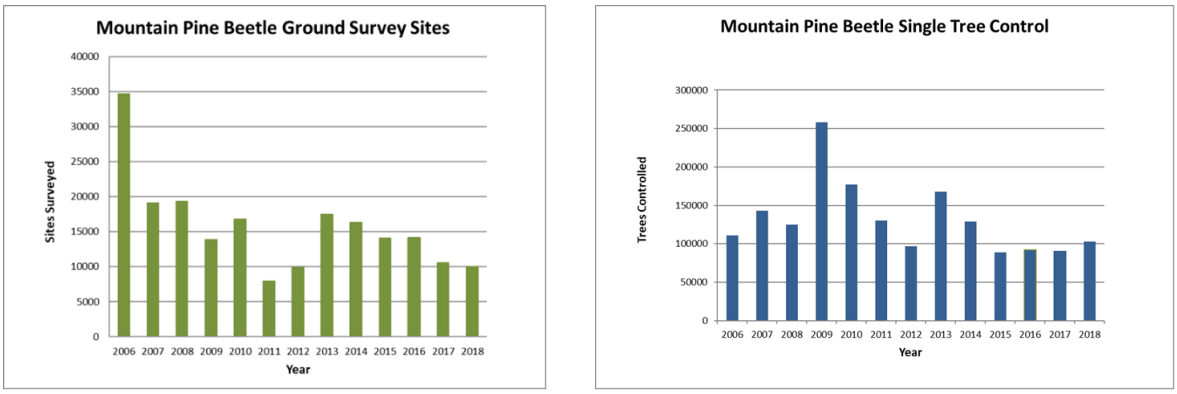

Figure 11. Summary of annual MPB management activities 2006 – 2018.

Alberta developed and implemented the Pine Strategy in 2007 as part of the MPB Management Strategy and Action Plan. The objective for this strategy is to reduce the risk of environmental, social and economic impacts posed by MPB. This is achieved by altering the age class structure (decreasing the number of large patches of old pine forest) thereby reducing the forest's susceptibility to current and future MPB outbreaks

Implementation of the Pine Strategy resulted in increased coniferous Annual Allowable Cuts (AAC) in 12 Forest Management Agreement areas and one Crown-managed Forest Management Unit for the 20-year implementation period of the Pine Strategy. The average increase in AAC was 44 per cent, but ranged from zero to 119 per cent increase. If the Pine Strategy is implemented for the full 20 years as planned, elevated harvest levels will be followed by reduced long-term coniferous AACs relative to pre-Pine Strategy levels. The average reduction in AAC will be 12 per cent but could reach up to 29 per cent in some Forest Management Agreement areas.

Results show that forestry companies that implemented the Pine Strategy have generally focused harvesting in stands highly susceptible to MPB. On average, companies harvested 80 per cent of their approved Pine Strategy coniferous AACs between 2010/2011 and 2014/2015.

A1.2.2 Efficacy of Current Mountain Pine Beetle Management Program

Alberta's single tree control (Level 1) program was designed to achieve high treatment rates, which is key to the success of the program. High efficacy rates are attained through the following principles:

1. Early detection of infested trees followed by aggressive and sustained action.
    - This approach is widely accepted as the most effective way to supress an outbreak. Alberta's over-arching MPB Strategy and Action Plan are driven by this principle.
2. Utilization of the DSS to prioritize treatment areas in order to meet the Province's prime objectives (See Section 1.1.).
    - The DSS considers factors associated with beetle biology and risk of spread (number of current attacked trees, stand susceptibility, and pine connectivity).
3. Ensuring that infested-tree removal rates exceed the MPB population growth rate.
    - Control is not implemented in areas where this objective cannot be achieved given fiscal or operational constraints.
4. Flexibility in program response to increase efficacy where desired.
    - More intensive detection and control activities are currently being used to increase efficacy in locations where population density and growth rates are low (Alberta-Saskatchewan Spread Management Action Collaborative).
5. Ensuring that operational program objectives are achieved by monitoring activities using performance measures. In relation to Level 1 control, performance measures have been established for:
    - Aerial survey - timing, coverage, tree count variance, point location accuracy.
    - Green-to-red ratio survey - survey timing, plot distribution, plot location and tree count accuracy, data entry and map production timing.
    - Ground survey and control - accuracy targets for the survey and subsequent control of high priority aerial survey sites and control trees.
    - Quality inspection - minimum 15 per cent of 3rd party checks on survey and control contractors.
    - Quality assessment - minimum 10 per cent internal checks on 3rd party quality inspection contractors.
6. Utilizing an adaptive management approach to examine the program and adjusted as necessary.
    - GOA annually assesses monitoring and control protocols and incorporates new insights and technologies.
    - Real-time monitoring the progress of operational activities and adjustment of activities if appropriate.

Measuring efficacy has been challenging from a provincial program perspective. This is due to fact that MPB are being aggressively managed over a significant portion of their range in Alberta. Since most of the infested are is actively managed, GOA can only predict what would have happened in a particular area if control tactics had not been employed. Beetle migration and long-distance movement compound these difficulties. The following case studies summarize a selection of efficacy assessments that have been completed on various aspects of Alberta's Level 1 survey and control program.

CASE STUDIES

Case Study 1 – Detection Efficacy

Recently, an in-depth analysis of Alberta's Level 1 control was completed by Carroll et al. (2017) in western Alberta. The authors evaluated detection and control efficacy based on a spread model. The authors estimate that the rate of green-attack detection via ground surveys ranged from 54-68 per cent in non-immigration years, and 38-44 per cent during years of high immigration.

It is important to note that the rates of detection estimated in this study were measured in relation to much larger search radius than what is actually used during MPBMP operational surveys. This analysis was based on a 750 metre search radius, conversely Alberta searches a 50 metre radius around a red tree. A 750 metre search radius equals 176 hectares while 50 metre concentric survey covers 0.78 hectares. Given this large discrepancy in theoretical versus operational search area size, it is not surprising that the analysis resulted in low detection rates. Even in light of this discrepancy the analysis shows that GOA is able to detect, on average, 60 per cent of the infested trees in 0.05 per cent of the assessed area.

A quality assessment on the efficacy of ground detection (2011-2016 surveys) for green-attack trees was conducted internally (pers. comm. Whitehouse 2018). In this analysis, Alberta averaged 98.5 per cent detection accuracy within the 50 metre radius concentric plot. The analysis was extended to consider what efficacy could be achieved by increasing plot size to 75 and 100-metre areas; detection efficacy was minimally increased by 3 and 11 per cent respectively. Given that this effectively doubles and quadruples the search area and the associated expense, the increase in detection may not be worth it in all situations. Greater detection efficacy will not be achieved through fixed radii surveys. This project, along with Carroll et al. (2017) identifies that the difficulty lies in finding green-attack trees that are at a distance greater than 100 meters from red-attack trees.

Carroll et al. (2017) estimated that the Province's current Level 1 program (slow-the-spread) reduced the overall area colonized by MPB to approximately 70 per cent of that predicted in the absence of management. Therefore by simply by expanding the ground survey area, potential MPB colonization could be further reduced. An expanded search area in priority locations could be employed, however, a different survey methodology would need to be used instead of concentric plots.

Case Study 2 – Grande Prairie Control vs. No Control

This 2010 case study illustrates the effectiveness of Alberta's Level 1 control program to help slow the spread of MPB across Alberta. Two similarly-sized forested areas in the Grande Prairie region were compared: the Lingrell area south of Grande Prairie, and the Saddle Hills north of Grande Prairie. Each of these areas received different mountain pine beetle treatments after the region experienced the massive in-flight from British Columbia in 2006 alone.

In the Saddle Hills, no infested trees were removed, as the area's pine stands were considered too fragmented to pose significant risks of spreading infestations elsewhere. In Lingrell, where pine stands are more connected to the rest of the Province's forests, an aggressive program was initiated to remove infested trees. Control work was conducted in Lingrell over a three year period. The infestation in the Saddle Hills, where no control work was undertaken, expanded 241 per cent while the infestation in

Lingrell expanded by just seven per cent (Table 4). It is clear that the control work conducted in Lingrell minimized the growth of the infestation.

Table 4. History of infestations in the each case study area, the control work performed, and the resulting number of red trees.

Area	Size (hectares)	Number of red trees in 2007	Number of trees controlled 2007 - 2009	Number of red trees in 2010
Saddle Hills	211,220	4,621	0	1,118,820
Lingrell	211,220	24,944	115,509	196,949

Case Study 3 – Central Region Model

Forest industry members, led by Millar Western and Alberta Newsprint, initiated a modelling exercise to examine the spread rate of MPB in central Alberta under a variety of control scenarios. The purpose of this modelling exercise was to develop an MPB strategy specifically for the central region of Alberta. The province supported this work by providing expertise on MPB population dynamics and spread rates. Experts from academia such as Dr. Allan Carroll also assisted with the initial calibration of the model. The model is re-run each year to incorporate actual Level 1 and harvesting actions completed during the year. In the absence of Level 1 and harvest activity, this model predicts that 13.9 million cubic metres of pine growing stock would be lost to MPB over the next 20 years (Fig. 12, Forcorp 2019). When actual harvest and Level 1 action is included in the model, losses to MPB were reduced by up to 51 per cent.

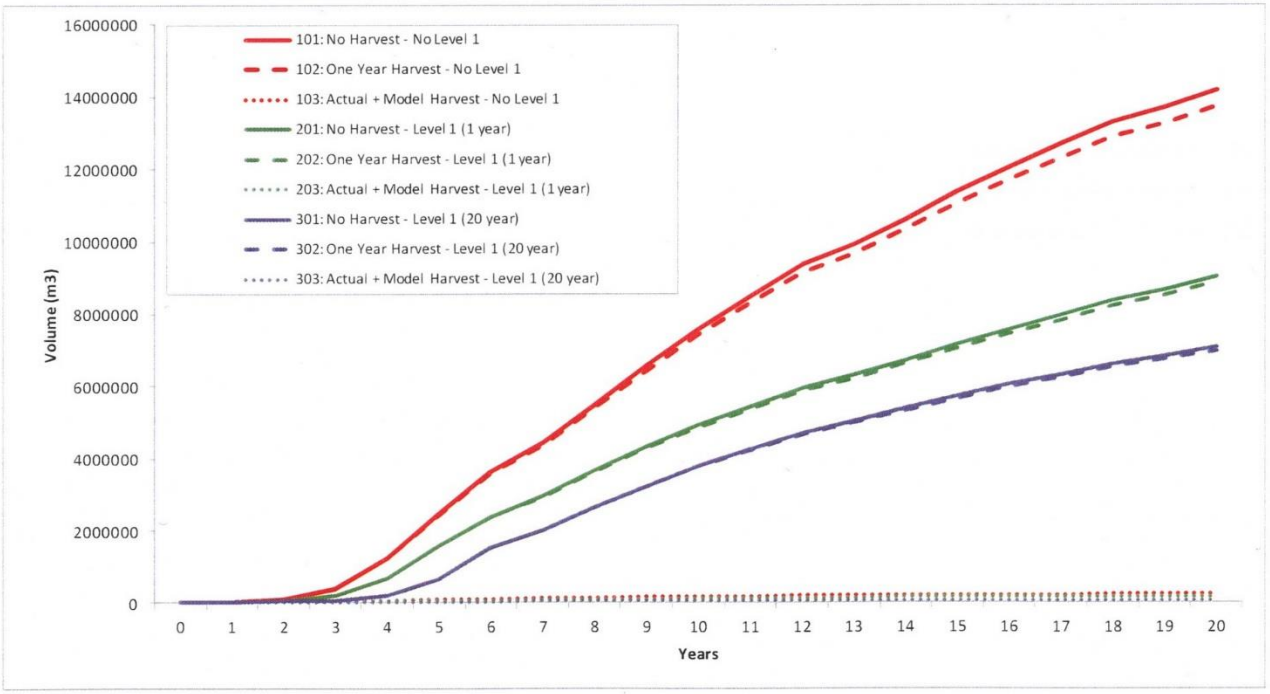

Figure 12. Forecasted pine growing stock lost to mountain pine beetle each year under various modelling scenarios (Forcorp 2019).

Case Study 4 – Hinton Region

The Hinton region has been within the Leading Edge Zone since MPB became established in Alberta in 2005, and infestations in the region have been aggressively managed over its entirety since that time. Note that in 2017 a portion of the region adjacent to Jasper National Park was not controlled due to a lack of funding for effective control requirements. Given the extensive control activity that occurred in this region, there is a unique opportunity to assess how infestations have changed over time in relation to control activities. Level 1 and 2 treatments in this region over an eight year period (2005-2012) stabilized the population (Fig. 13, Cooke 2015). This is despite large distance immigration events in 2006 and 2009 that resulted in pulses of red tree counts in 2007 and 2010 (five-fold increases).

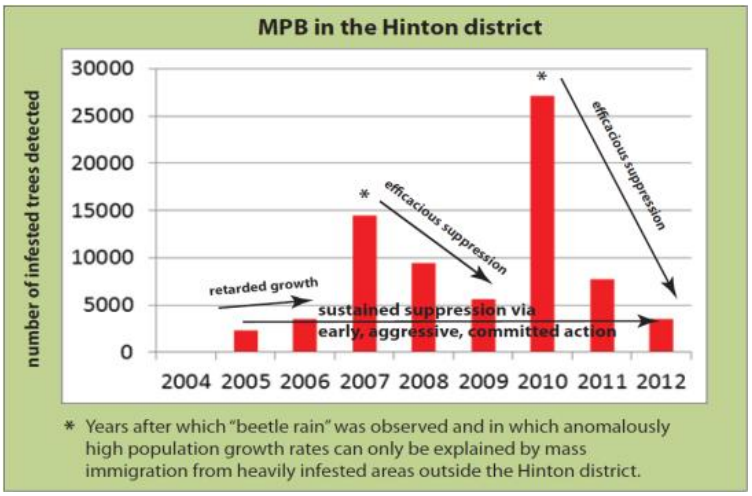

Figure 13. Red pine trees detected by aerial surveys in Hinton region (Cooke 2015).

In recent years this trend has not held; approximately 11,840 and 46,437 infested (red) trees were detected during aerial surveys in 2016 and 2017 respectively. The increase in the number of infested trees can be primarily attributed to outbreaking source populations in Jasper National Park. In Figure 14, the black linear line that originates in year 2005 represents a 2.5-fold growth in the number of trees detected in Hinton region between 2005 and 2010. By projecting this fitted line forward in time, it is estimated that there will be nearly 2 million MPB-infested trees on the landscape by 2024 if control activity in the Hinton region ceased.

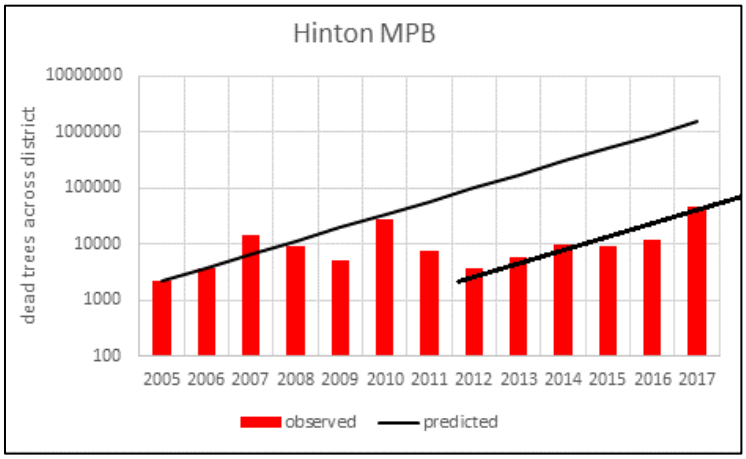

Figure 14. The number of observed to predicted number of MPB-infested pine trees for the period 2005-2017.

Case Study 5 – Green-to-red Beetle Growth Model

GOA undertook a modeling exercise to estimate, on a provincial scale, the effect of not controlling MPB-infested trees. While not specifically a case study in control efficacy, this exercise was aimed at calculating the cost/benefit of implementing the MPBMP over the past decade. Green-to-red tree ratio survey (G:R) results provide a realistic measure of beetle population growth at a specific location in a given year. GOA estimated the number of MPB-killed trees that would be present on the landscape if Level 1 treatments had not been conducted. To do this, infestations were "grown" based on the location of infested but controlled and the annual G:R ratio for that location.

Between 2006 and 2016 Alberta controlled just over 1.5 million infested trees. Based on the method described above, the number of infested trees may have actually been approximately 311 million

infested trees today in the absence of an aggressive control program. To estimate the impact to industry, 311 million MPB-killed trees is equivalent to between 207,204,075 and 211,313,907 cubic metres of merchantable volume. This volume translates to more than 11 years of total provincial coniferous harvest activity. Research is currently underway that will quantify the cost/benefit analysis of the Alberta MPBMP.

A1.2.3 Mountain Pine Beetle Population Trends

MPB populations throughout the province have fluctuated over the years (Figs. 1 and 15). However, general trends regionally can be seen since the last large long distance migration event in 2009 and a suspected, smaller in-flight in 2012. By and large, overwinter temperatures have not reached lows cold enough to suppress populations over large geographic areas. However, Alberta did experience two widespread cold snaps in 2019 that were predicted to cause higher-than-normal mortality (MacQuarrie et al. 2019). In recent years, summer conditions have been conducive to a one-year MPB lifecycle. The summer of 2019 was colder and wetter than average, and anecdotally, MPB experienced delayed flight, and slow and lower reproduction rates. At the time of writing, Alberta can not conclusively report green-attack tree numbers or reproductive rates as control work is ongoing. However, the effect that these two weather events could have on population growth may not scale up to a landscape level pattern or take multiple years to manifest.

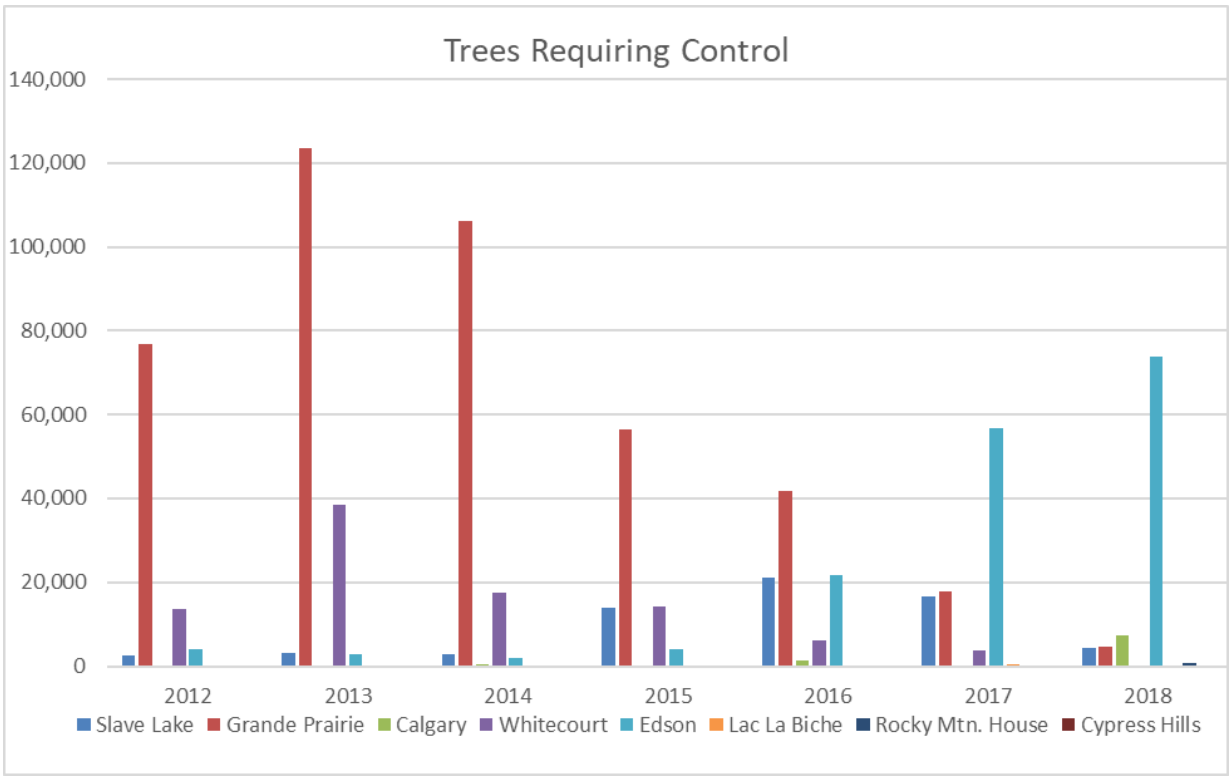

Figure 15. The number of trees requiring control between 2012 and 2018.

Grande Prairie Forest Area
Populations in the Grande Prairie have been decreasing due to sustained and aggressive control, a lack of in-flights and decreased reproductive success. Over the last seven years the average density of red-attack trees has decreased annually. In 2103, 36 red-attack trees per square kilometer were mapped during aerial surveys and this has dropped to nine red-attack trees. This decline in control and red-attack tree numbers suggest that the control program is suppressing these populations.

Slave Lake Forest Area
The population in the Slave Lake Forest Area remained relatively similar between 2012 to 2014 but began to increase in 2015. In the last couple of years, population growth appears to have slowed. It is difficult to determine the main cause of population dynamics in the Slave Lake Forest Area but it can be assumed that this population would erupt and spread without active management. Populations near Slave Lake pose the greatest risk to eastern spread further into the Canada's boreal forest.

Edson Forest Area
The Edson Forest Area (Hinton and surrounding area) experienced a considerable increase in the number of infested trees in 2016 due to immigration from Jasper National Park (JNP). MPB populations in JNP began to build in 2014, and the number of infested hectares close to doubled each year since. Approximately 229,176 hectares in JNP have been affected by MPB. It is predicted that the outbreak growth rate will subside due to weather conditions in 2019 and host depletion. . However, Alberta expects beetles to continue to immigrate onto Crown land for the next two to three years. Beetles were not present in significant numbers in the Edson Forest Area prior to the incursion of beetles from JNP. The number of red-attack trees rose from 8 trees per km^2 in 2016 to 41 trees in 2019. It is difficult to make assumptions about the establishment and growth potential of these new populations but there is a strong possibility that they will be successful given the abundance of mature pine and suitable climate. This population poses a large risk as a source of beetles that will spread south along the eastern slopes of the Rocky Mountains in Alberta.

Rocky Mountain House Forest Area
MPB populations are beginning to expand in the Rocky Mountain House Forest Area. The greatest increase in attacked tree densities are in the northern region of the forest area. This spatial pattern indicates that this is not local population growth but is the result of beetles migrating from large source populations in JNP and the Edson Forest Area. Stand characteristics in this region are likely to support MPB population growth and expansion; forests in the region are predominately comprised of mature, highly connected pine stands. Growing populations in the Rocky Mountain Forest Area present a considerable risk to the eastern slopes of the Rocky Mountains.

Calgary Forest Area
MPB populations significantly decreased in the Calgary Forest Area, specifically around Canmore, due to weather conditions in 2010. Since then population levels have remained very low. Populations on Crown land and in Banff National Park began have been building since 2016 and successfully attacked trees have been detected around Blairmore. Population densities are low but there is a high potential that populations will rapidly expand due to the highly conducive climate and large number of host trees present. Historically, this area has been affected by large outbreaks in the 1940s, 1980s and early 2000s. If populations continue to build, there is a high risk that they will expand along the eastern slopes of Alberta's Rocky Mountains.

Lac La Biche Forest Area

In the Lac La Biche Forest Area, populations have remained low since beetles were first detected in the region. The first control work in the region occurred in 2016 and in the years since, small numbers of trees have been treated. Population numbers remain low but have exhibited large growth potential. For example, in 2016, 86 trees were controlled and this number grew to 467 the following year. Stands in the region are predominately comprised of jack pine that are not highly connected which could inhibit population expansion. However, detection of MPB in this region is difficult because of the low population density and a lack of access to the Cold Lake Air Weapons range. Vigilance is required to mitigate the risk that these populations pose to Canada's boreal forest east of Alberta.

APPENDIX 2: PREVIOUS FUNDING REQUEST LETTERS

ALBERTA
SUSTAINABLE RESOURCE DEVELOPMENT

Office of the Minister
MLA, Grande Prairie - Smoky

AR26333

November 9, 2010

The Honourable Christian Paradis
Minister of Natural Resources Canada
House of Commons
Confederation Building
Ottawa, ON K1A 0A6

Dear Minister Paradis:

Further to our earlier discussion regarding federal funding contributions to Alberta for mountain pine beetle control, Alberta is requesting federal financial assistance for the province's mountain pine beetle control program.

As you are aware, Alberta's mountain pine beetle numbers exponentially increased in north-central Alberta in 2006 from a massive in-flight of beetles from British Columbia. We also experienced some more localized in-flights in 2007 and 2008. The in-flights from British Columbia are the only reason that beetle populations continue to increase in our province. In the areas that did not receive an influx of beetles in 2007 and 2008, our aggressive action was working. In many areas, we counted half of the number of infested trees compared to the 2006 levels.

There was another massive in-flight of beetles in 2009. The 2009 in-flight was so large that it resulted in significant levels of damage farther east than we had seen in previous years. We now have a large number of dead trees in the Slave Lake and Fox Creek areas. The mountain pine beetles that attacked the trees last year have now successfully reproduced and flown locally to infest more trees in the region.

.../2

Alberta

404 Legislature Building, 10800 - 97 Avenue, Edmonton, Alberta T5K 2B6 Canada Telephone 780-415-4815 Fax 780-415-4818
Constituency Office #105, 9804 - 100 Avenue, Grande Prairie, Alberta T8V 0T8 Canada Telephone 780-513-6233 Fax 780-513-6247
Web Address: mdknight.mla.com

As a result, there are a large number of newly-attacked trees in the region that pose a significant risk of spread further eastward toward Saskatchewan. A small number of baited jack pine trees were attacked east of Lac La Biche this summer, 110 kilometres to the west of the Alberta/Saskatchewan border. In comparison, five years ago, beetles were 630 km from the Saskatchewan border. We have been working with scientists from Natural Resources Canada, and they have indicated that a build-up in the highly-connected pine south of and around Slave Lake may result in a long-range in-flight of beetles from Alberta into Saskatchewan.

Sustainable Resource Development has completed its aerial surveys of this year's mountain pine beetle damage, and the department is awaiting the final results of these surveys and funding levels before finalizing its control plan for the coming fall and winter. It appears the southern half of Alberta has been spared much of the damage this year, thanks to no in-flights from British Columbia and Alberta's aggressive mountain pine beetle control program. However, there are still several significant "hot spots" in the north and central part of the province, in highly-connected areas of lodgepole pine threatening to move further east into the boreal forest.

This year, Alberta has a window of opportunity to make some real inroads in our control and help ensure mountain pine beetle never has the chance to cross into Saskatchewan or further east across Canada. Federal funding in the amount of $20 million over the next two years for beetle survey and control efforts will greatly reduce the risk of beetles spreading further east across the boreal forest. I look forward to your positive reply in the near future.

Sincerely,

Mel R. Knight
Minister

Alberta
Environment and Sustainable Resource Development

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11 Floor, South Petroleum Plaza
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Edmonton, Alberta T5K 2G8
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AR 54191

July 19, 2013

Mr. Bob Hamilton, Deputy Minister
Environment Canada
10 Wellington Street, 4th Floor
Gatineau, QC K1A 0H3

Dear Mr. Hamilton:

Canada contains approximately 30 per cent of the world's boreal forest, and the mountain pine beetle is a significant pest that threatens this ecosystem. The range of the mountain pine beetle is expanding, and these outbreaks are impacting natural biodiversity and forest fire patterns across western Canada.

In 2008, Natural Resources Canada published a report detailing the risk assessment of mountain pine beetle to Canada's boreal forest. The report concluded that Alberta's pine stands will allow for the further spread of beetle populations across the prairie region, and further east into susceptible pine forests. Wherever suitable conditions exist within this expanded range, there is the potential for damaging outbreaks and accelerated spread. The report also stated that if no action was taken to mitigate the incursion of mountain pine beetle, we will exceed the risk tolerance of stakeholders concerned about social, environmental, and economic impacts. These findings were reaffirmed in 2010.

Alberta's beetle infestations and the resulting damage to our pine forests across north-central Alberta are a result of massive influx of mountain pine beetles from British Columbia in 2006 and 2009. Without the influence of influxes from British Columbia, the number of infested trees continues to decrease each year in areas where the province and the forest industry are aggressively controlling beetles. Many areas show a 50 per cent decline in the number of infested trees compared to 2006 levels; and in southwest Alberta, infestations have been halted completely.

Despite our successes, infestations in Alberta continue to spread north and east, increasing the possibility of significant migrations of beetle populations beyond our province's borders into neighbouring provinces and territories. In 2010, the leading edge of beetle infestations was 110 kilometres west of the Alberta/Saskatchewan border. Today, that buffer has been cut in half. This past summer, beetles were detected within 50 kilometres of the Saskatchewan border. In the fall of 2012, beetle-attacked trees were detected in the Northwest Territories for the first time.

Alberta has been working closely with Saskatchewan to mitigate the spread of beetles eastward. Through a memorandum of agreement, Saskatchewan's Ministry of Environment is providing financial support to Alberta for mountain pine beetle management activities aimed at slowing the spread eastward. Our province has also been sharing expertise with the Yukon and the Northwest Territories.

Alberta has the proven expertise and experience to control beetle populations before they migrate beyond our borders. To accomplish this, assistance from the Government of Canada and at-risk provinces is essential. Specifically, Alberta is seeking a new funding model to implement beetle survey, control, and rehabilitation efforts.

Average expenditure on mountain pine beetle survey and control work in Alberta over the past eight years is just over $40 million per year. Since 2006, the federal government has contributed $18 million and the Government of Saskatchewan has provided $600,000. This is in addition to Alberta's contribution of $331 million.

Alberta proposes a joint-funding model where the province of Alberta and the Government of Canada each contribute one-third of the annual cost based on historical expenditures. The remaining one-third of required funding would be achieved from provinces and territories that face significant survey and control costs should the population move beyond Alberta's borders.

As well, our province requires the support and dedication of research scientists from the Canadian Forest Service to assist in studying the spread, risk, and effects of the mountain pine beetle.

Finally, in 2009 the federal budget was eliminated for mountain pine beetle single tree control work, communications, research, and detailed population monitoring in the national parks. Recent reports show that there is a high risk of spread from the parks to Alberta's public land.

Re-establishing funding to support strategic beetle planning and control work in Alberta's national parks would help mitigate this risk of spread.

I appreciate your assistance in securing federal funding to support our aggressive detection and control program in Alberta. I look forward to a strong and co-ordinated effort, and to working with you to develop a national response strategy.

Sincerely,

Dana Woodworth
Deputy Minister

Alberta
Environment and Sustainable Resource Development

Office of Deputy Minister
11 Floor, South Petroleum Plaza
9915 – 108 Street
Edmonton, Alberta T5K 2G8
Telephone: 780-427-1799
Fax: 780-415-9669
www.alberta.ca

AR 54370

July 19, 2013

Mr. Fred Meier, Deputy Minister
Conservation and Water Stewardship
Room 332 Legislative Building
450 Broadway
Winnipeg, MB R3C 0V8

Dear Mr. Meier:

Canada contains approximately 30 per cent of the world's boreal forest, and the mountain pine beetle is a significant pest that threatens this ecosystem. The range of the mountain pine beetle is expanding, and these outbreaks are impacting natural biodiversity and forest fire patterns across western Canada.

In 2008, Natural Resources Canada published a report detailing the risk assessment of mountain pine beetle to Canada's boreal forest. The report concluded that Alberta's pine stands will allow for the further spread of beetle populations across the prairie region, and further east into susceptible pine forests. Wherever suitable conditions exist within this expanded range, there is the potential for damaging outbreaks and accelerated spread. The report also stated that if no action was taken to mitigate the incursion of mountain pine beetle, we will exceed the risk tolerance of stakeholders concerned about social, environmental, and economic impacts. These findings were reaffirmed in 2010.

Alberta's beetle infestations and the resulting damage to our pine forests across north-central Alberta are a result of massive influx of mountain pine beetles from British Columbia in 2006 and 2009. Without the influence of influxes from British Columbia, the number of infested trees continues to decrease each year in areas where the province and the forest industry are aggressively controlling beetles. Many areas show a 50 per cent decline in the number of infested trees compared to 2006 levels; and in southwest Alberta, infestations have been halted completely.

Despite our successes, infestations in Alberta continue to spread north and east, increasing the possibility of significant migrations of beetle populations beyond our province's borders into neighbouring provinces and territories. In 2010, the leading edge of beetle infestations was 110 kilometres west of the Alberta/Saskatchewan border. Today, that buffer has been cut in half. This past summer, beetles were detected within 50 kilometres of the Saskatchewan border. In the fall of 2012, beetle-attacked trees were detected in the Northwest Territories for the first time.

Alberta has been working closely with Saskatchewan to mitigate the spread of beetles eastward. Through a memorandum of agreement, Saskatchewan's Ministry of Environment is providing financial support to Alberta for mountain pine beetle management activities aimed at slowing the spread eastward. Our province has also been sharing expertise with the Yukon and the Northwest Territories.

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Alberta proposes a joint-funding model where the province of Alberta and the Government of Canada each contribute one-third of the annual cost based on historical expenditures. The remaining one-third of required funding would be achieved from Northwest Territories and provinces, including Manitoba, that face significant survey and control costs should the population move beyond Alberta's borders.

I appreciate your assistance in helping to support our aggressive detection and control program in Alberta. I look forward to a strong and co-ordinated effort, and to working with you to develop a national response strategy.

Sincerely,

Dana Woodworth
Deputy Minister

Alberta
Environment and Sustainable Resource Development

Office of Deputy Minister
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9915 – 108 Street
Edmonton, Alberta T5K 2G8
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AR 54388

July 19, 2013

Mr. Serge P. Dupont
Deputy Minister
Natural Resources Canada
580 Booth Street
Ottawa, ON K1A 0E4

Dear Mr. Dupont:

Canada contains approximately 30 per cent of the world's boreal forest, and the mountain pine beetle is a significant pest that threatens this ecosystem. The range of the mountain pine beetle is expanding, and these outbreaks are impacting natural biodiversity and forest fire patterns across western Canada.

In 2008, Natural Resources Canada published a report detailing the risk assessment of mountain pine beetle to Canada's boreal forest. The report concluded that Alberta's pine stands will allow for the further spread of beetle populations across the prairie region, and further east into susceptible pine forests. Wherever suitable conditions exist within this expanded range, there is the potential for damaging outbreaks and accelerated spread. The report also stated that if no action was taken to mitigate the incursion of mountain pine beetle, we will exceed the risk tolerance of stakeholders concerned about social, environmental, and economic impacts. These findings were reaffirmed in 2010.

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Sincerely,

Dana Woodworth
Deputy Minister

Alberta
Environment and Sustainable Resource Development

Office of Deputy Minister
11 Floor, South Petroleum Plaza
9915 – 108 Street
Edmonton, Alberta T5K 2G8
Telephone: 780-427-1799
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www.alberta.ca

AR 54371

July 19, 2013

Mr. David O'Toole, Deputy Minister
Department of Natural Resources
Whitney Block
6th Floor, Room 6643
Toronto, ON M7A 1W3

Dear Mr. O'Toole:

Canada contains approximately 30 per cent of the world's boreal forest, and the mountain pine beetle is a significant pest that threatens this ecosystem. The range of the mountain pine beetle is expanding, and these outbreaks are impacting natural biodiversity and forest fire patterns across western Canada.

In 2008, Natural Resources Canada published a report detailing the risk assessment of mountain pine beetle to Canada's boreal forest. The report concluded that Alberta's pine stands will allow for the further spread of beetle populations across the prairie region, and further east into susceptible pine forests. Wherever suitable conditions exist within this expanded range, there is the potential for damaging outbreaks and accelerated spread. The report also stated that if no action was taken to mitigate the incursion of mountain pine beetle, we will exceed the risk tolerance of stakeholders concerned about social, environmental, and economic impacts. These findings were reaffirmed in 2010.

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Dana Woodworth
Deputy Minister

Alberta
Environment and Sustainable Resource Development

Office of Deputy Minister
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9915 – 108 Street
Edmonton, Alberta T5K 2G8
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AR 54369

July 19, 2013

Mr. Kent Campbell, Deputy Minister
Economy
300, 2103 – 11 Avenue
Regina, SK S4P 3Z8

Dear Mr. Campbell:

Canada contains approximately 30 per cent of the world's boreal forest, and the mountain pine beetle is a significant pest that threatens this ecosystem. The range of the mountain pine beetle is expanding, and these outbreaks are impacting natural biodiversity and forest fire patterns across western Canada.

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www.alberta.ca

AR 54372

July 19, 2013

Mr. Ernie Campbell
Deputy Minister
Environment and Natural Resources
PO Box 1320
Yellowknife, NT X1A 2L9

Dear Mr. Campbell:

Canada contains approximately 30 per cent of the world's boreal forest, and the mountain pine beetle is a significant pest that threatens this ecosystem. The range of the mountain pine beetle is expanding, and these outbreaks are impacting natural biodiversity and forest fire patterns across western Canada.

In 2008, Natural Resources Canada published a report detailing the risk assessment of mountain pine beetle to Canada's boreal forest. The report concluded that Alberta's pine stands will allow for the further spread of beetle populations across the prairie region, and further east into susceptible pine forests. Wherever suitable conditions exist within this expanded range, there is the potential for damaging outbreaks and accelerated spread. The report also stated that if no action was taken to mitigate the incursion of mountain pine beetle, we will exceed the risk tolerance of stakeholders concerned about social, environmental, and economic impacts. These findings were reaffirmed in 2010.

Alberta's beetle infestations and the resulting damage to our pine forests across north-central Alberta are a result of massive influx of mountain pine beetles from British Columbia in 2006 and 2009. Without the influence of influxes from British Columbia, the number of infested trees continues to decrease each year in areas where the province and the forest industry are aggressively controlling beetles. Many areas show a 50 per cent decline in the number of infested trees compared to 2006 levels; and in southwest Alberta, infestations have been halted completely.

Despite our successes, infestations in Alberta continue to spread north and east, increasing the possibility of significant migrations of beetle populations beyond our province's borders into neighbouring provinces and territories. In 2010, the leading edge of beetle infestations was 110 kilometres west of the Alberta/Saskatchewan border. Today, that buffer has been cut in half. This past summer, beetles were detected within 50 kilometres of the Saskatchewan border. In the fall of 2012, beetle-attacked trees were detected in the Northwest Territories for the first time.

Natural Resources Canada | Ressources naturelles Canada

Deputy Minister | Sous-ministre

Ottawa, Canada
K1A 0E4

AUG 15 2013

Ms. Dana Woodworth
Deputy Minister of Environment and
Sustainable Resource Development
Government of Alberta
South Petroleum Plaza, 11th Floor
9915–108 Street
Edmonton, Alberta T5K 2G8

Dear Ms. Woodworth:

Thank you for your letter of July 19, 2013, regarding support for mountain pine beetle mitigation efforts in Alberta and the development of a national response strategy.

The Government of Canada remains concerned about the potential impacts associated with the spread of the mountain pine beetle as well as those of other forest pests across the country, such as the spruce budworm and the emerald ash borer.

Canada's forests are of national and international importance; they contribute to the well-being of Canadians and provide important ecological and economic benefits nation-wide. I recognize the significant efforts made by the governments of Alberta, British Columbia and Saskatchewan, as well as the Yukon and the Northwest Territories, in attempting to mitigate the eastern and northern spread of the mountain pine beetle. Given the potential for ongoing range expansion, I also share your concern regarding the spread of this insect on federal lands, such as national parks or military ranges, and the influence that spread in these areas could have on Alberta's Crown lands.

Natural Resources Canada's Canadian Forest Service has recently renewed a memorandum of understanding with Parks Canada to work co-operatively regarding the field assessment of forest health within select national parks. As a result, forest health assessments will be conducted within parks jointly identified early in the fiscal year. It is my understanding that Revelstoke, Glacier, Banff, Yoho, Kootney, Wood Buffalo and possibly Waterton are scheduled for assessment in the fall of 2013.

Canada

Conducting mountain pine beetle research is one of the core priorities of the Canadian Forest Service. Between 2010 and 2012, close to $4.3 million was allocated for activities including mountain pine beetle biological and socio-economic research, risk assessments, and the development of adaptive options for affected communities, industry and ecological zones. These research efforts, collaborations with staff in your Ministry, as well as elsewhere, and the ongoing sharing of knowledge and information will continue.

Finally, under the auspices of the National Forest Pest Strategy, which is endorsed by the Canadian Council of Forest Ministers, I will ask my officials to continue to dialogue with you and our other provincial and territorial partners to determine a best course of action in relation to forest pests and the mountain pine beetle.

Yours sincerely,

Serge P. Dupont
Deputy Minister
Natural Resources Canada

ALBERTA
ENVIRONMENT AND SUSTAINABLE RESOURCE DEVELOPMENT
Office of the Minister
MLA, West Yellowhead

58841

June 2, 2014

Honourable Greg Rickford, Minister
Natural Resources Canada
580 Booth Street
Ottawa ON K1A 0E4

Dear Honourable Rickford:

Congratulations on your recent appointment as Minister to Natural Resources Canada. Alberta has a long history of positive collaboration with Natural Resources Canada and I look forward to working with you in the future.

I am seeking your assistance to secure federal funding to implement an aggressive detection and control program that will help mitigate the spread of mountain pine beetle here in Alberta. Mountain pine beetle infestations in Alberta continue to spread north and east increasing the possibility of significant migrations of beetle populations beyond our province's borders into neighbouring provinces and territories. Beetle-attacked trees have been detected in the Northwest Territories and adjacent to the Yukon border.

These infestations are a result of massive in-flights of mountain pine beetles from British Columbia in 2006, and again in 2009. Our aggressive action is working in the areas not directly affected by these in-flights. Many areas show a 50 per cent decline in the number of infested trees. In southwest Alberta infestations have been halted completely.

In 2008, Natural Resources Canada published a report confirming pine stands found in eastern and northern Alberta will allow for further spread of beetle populations and potentially spread across the prairie region into Ontario and further east. Wherever suitable conditions exist within this expanded range, there is the potential for damaging outbreaks and accelerated spread. The report also stated that not responding to the incursion of mountain pine beetle would exceed the risk tolerance of stakeholders in the regions under threat. These findings were upheld during a review of the report conducted in 2010.

Alberta has been working closely with Saskatchewan to mitigate the spread of beetles eastward. Through a memorandum of agreement, Saskatchewan's Ministry of Environment is providing financial support to Alberta for mountain pine beetle management activities aimed at slowing the spread eastward. Our province has also been sharing expertise with Yukon and the Northwest Territories.

323 Legislature Building, 10800 - 97 Avenue, Edmonton, Alberta T5K 2B6 Canada Telephone 780-427-2391 Fax 780-422-6259
6, 554 Carmichael Lane, Hinton, Alberta T7V 1S8 Canada Telephone 780-865-9796 Fax 780-865-9760

To continue mitigation efforts, assistance from the Government of Canada is essential. Natural Resources Canada has a long tradition of supporting forest health in Canada and I look forward building on that commitment through a strong, co-ordinated effort to address the threat posed by mountain pine beetle.

The support for research and program funding to control spruce budworm in New Brunswick is a positive example of what can be done when provinces and the federal government come together to address a significant threat to forest health.

Alberta has the proven expertise and experience to control beetle populations before infestations migrate beyond our borders. It is my hope that together we can find a way to take the lessons learned in New Brunswick and build a working arrangement to address the threat posed by the mountain pine beetle and contain any further spread.

I look forward to hearing from you on this matter and would welcome the opportunity to discuss next steps at your convenience.

Sincerely,

Robin Campbell
Minister

Minister
of Natural Resources

Ministre
des Ressources naturelles

Ottawa, Canada K1A 0E4

OFFICE OF THE MINISTER
ENVIRONMENT AND SUSTAINABLE
RESOURCE DEVELOPMENT
AUG - 5 2014
AR #:
Due Date:

JUL 30 2014

The Honourable Robin Campbell, M.L.A.
Minister of Environment and Sustainable Resource Development
Government of Alberta
323 Legislature Building
10800–97th Avenue
Edmonton, Alberta T5K 2B6

Dear Minister: Robin

Thank you for your letter of June 2, 2014, regarding federal funding to implement an aggressive detection and control program for mountain pine beetle in Alberta. As the federal Minister responsible for the Canadian Forest Service, I can assure you of my commitment to the health of forests and the communities that they support.

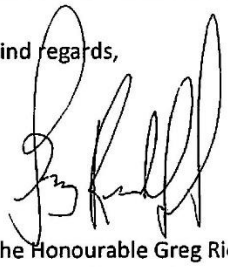
The Government of Canada has invested significantly in responding to mountain pine beetle outbreak and to the economic pressures the outbreak has placed on forestry and forestry-based communities in Canada. Our research activities have resulted in spread predictions, risk assessments, and an increase in value-recovery from beetle-killed trees. Our actions have also contributed to the development of tools and best practices that assist provincial and forest managers in their efforts to slow mountain pine beetle spread eastward. These activities will continue as a core activity for Natural Resources Canada, and we will continue to work with staff from your Ministry, other provinces and territories, and stakeholders to invest in research and provide scientific support to combat forest pest infestations and slow their geographic expansions.

The Government of Canada remains concerned about the spread of the mountain pine beetle through Canada's boreal forests and is continuing to conduct research that contributes to beetle control and spread mitigation. This research includes studying beetle biology to help develop control alternatives and providing recommendations to help slow and control expansion east and north. Additionally, through a Memorandum of Understanding with Parks Canada, researchers and field staff from my department conduct forest health surveys, which include mountain pine beetle in Canada's national mountain parks, such as Wood Buffalo and Nahanni.

Canada

I recognize the significant efforts by the Governments of Alberta and Saskatchewan, as well as the activities of the Governments of the Northwest Territories, the Yukon and British Columbia to mitigate the eastward spread of this insect. Hence, under the auspices of the National Forest Pest Strategy, which has been endorsed by the Canadian Council of Forest Ministers, I will ask my officials to continue to dialogue with you and our other provincial and territorial partners to determine a best course of action in relation to forest pest disturbances and the mountain pine beetle.

Kind regards,



The Honourable Greg Rickford, P.C., M.P.
Minister of Natural Resources and Minister for the
Federal Economic Development Initiative for
Northern Ontario

Alberta | Environment and Sustainable Resource Development

Office of Deputy Minister
11 Floor, South Petroleum Plaza
9915 - 108 Street
Edmonton AB T5K 2G8
Canada
Telephone 780-427-1799
Fax 780-415-9669

61812

January 19, 2015

Mr. Alan Latourelle, Chief Executive Officer
Parks Canada
30 Victoria Street
Gatineau QC J8X 0B3

Dear Mr. Latourelle:

I am writing to seek your assistance in the development, implementation, and funding of a mountain pine beetle program for Jasper National Park.

Increasing mountain pine beetle populations in this park are raising concerns with both the Government of Alberta and Alberta's forest industry. Improved co-operation and co-ordination with Parks Canada is required to further manage the mountain pine beetle in Alberta. This will mitigate the threat of an infestation spreading beyond Jasper National Park, which would compromise Alberta's efforts to control a beetle infestation.

The Government of Alberta has implemented an aggressive mountain pine beetle survey and control program since 2006, when the first beetle inflight occurred from British Columbia. Since then, we have seen significant reductions in beetle populations and tree mortality in areas with active management. From the British Columbia infestation, we have learned that early, aggressive action is the best strategy to contain beetle infestations.

In 2005-06, the federal government developed a Mountain Pine Beetle Management Strategy for Jasper National Park. This strategy described 17 management units and activities that would be employed in each unit. However, it is my understanding that the plan has not yet been implemented.

Alberta has spent more than $380 million on survey and control activities to control the spread of mountain pine beetle since 2004. Those efforts have largely been successful in containing the infestation within Alberta's borders. To continue to meet our mountain pine beetle objectives, we request that Parks Canada engage in co-operative management planning processes with us. As part of this process, funding is necessary to support these activities.

I appreciate your assistance in securing federal funding to support our aggressive detection and control program in Alberta. I look forward to a strong and co-ordinated effort to develop a response strategy. For further discussion regarding this matter, your staff can contact Mr. Darren Tapp, Executive Director of our Forest Management Branch. Mr. Tapp can be reached at 780-427-5324 (dial 310-0000 for a toll-free connection), or at darren.tapp@gov.ab.ca.

Sincerely,

Bill Werry
Deputy Minister

cc: Darren Tapp
Environment and Sustainable Resource Development

Premier of Alberta

Office of the Premier, 307 Legislature Building, Edmonton, Alberta, Canada, T5K 2B6

April 1, 2015

The Right Honourable Stephen Harper
Prime Minister of Canada
Langevin Block, 80 Wellington Street
Ottawa, Ontario K1A 0A2

Dear Prime Minister:

I was pleased to have the opportunity to meet with you on March 6 in Ottawa. During our discussion it was agreed that I would provide you some additional information on the issues I raised regarding mountain pine beetle.

At our meeting we discussed the importance of ongoing action to limit the spread of the mountain pine beetle, which could spread eastern across the country. The best opportunity to prevent the spread is to control infestations in Alberta.

The pressing concern at this time is the recent increase in the number of mountain pine beetle-killed trees in Jasper National Park. Aerial surveys completed by the Canadian Forest Service within Jasper National Park in 2014 identified a total of 6,250 hectares of Mountain Pine Beetle-killed pine – a very significant increase from the 122 hectares identified the previous year. This increase clearly demonstrates the need for continued support for the Canadian Forest Service.

Alberta is working closely with British Columbia and Saskatchewan to address this issue, and would welcome Parks Canada as an active partner in our fight against mountain pine beetle. Comprehensive and collaborative action is critical to success in this effort. To that end, I propose Alberta and Canada establish a joint working group of senior government officials to:

- Evaluate the breadth and scope of the detection and monitoring activities needed to execute effective plans for both Jasper and Banff National Parks.
- Determine the exact costs of implementing and maintaining those plans.
- Produce by June 30, a detailed report specifically for our review detailing the planning and funding needed to ensure the spread can be controlled.

Sincerely,

Jim Prentice
Premier of Alberta

cc: Honourable Kyle Fawcett
Minister of Environment and Sustainable Resource Development

Alberta

AR-62087

ALBERTA
AGRICULTURE AND FORESTRY

Office of the Minister
MLA, Whitecourt-St. Anne

NOV 2 3 2017

The Honourable James Carr, P.C., M.P.
Minister of Natural Resources
21st Floor, 580 Booth Street
Ottawa, Ontario K1A 0E4

The Honourable Ralph Goodale, P.C., M.P.
Minister of Public Safety and Emergency Preparedness
269 Laurier Avenue West
Ottawa, Ontario K1A 0P8

The Honourable Catherine McKenna, P.C., M.P.
Minister of Environment and Climate Change
200 Sacré-Coeur Boul., 2nd Floor
Gatineau, Quebec K1A 0H3

Dear Ministers Carr, Goodale, and McKenna:

Alberta has aggressively managed mountain pine beetle infestations in the province since 2006 when a massive influx of beetles came from British Columbia; a second influx occurred in 2009. Despite the influence of these two events, Alberta's effective and efficient management program has significantly reduced the beetle population and averted the economic and environmental disaster experienced in British Columbia.

Mountain pine beetle infestations threaten the forest industry that relies on healthy and sustainable forests. In Alberta, there are six million hectares of pine at risk, valued at more than $8 billion. Of the 25 major forest companies operating in Alberta, 14 rely on pine to continue operations. Community stability and economic prosperity will be negatively affected as 18,250 Albertans and 70 Alberta communities depend on the forest industry for their livelihood. The forest sector contributed $2.6 billion to the GDP in 2016 and generated $6.3 billion in revenue for 2015.

Since 2004/05, Alberta has invested more than $461 million on mountain pine beetle management. The Government of Saskatchewan has provided $4.35 million to Alberta to help slow the spread east into boreal forests of Saskatchewan. Between 2007 and 2011, the Federal Government contributed $18 million.

Due to the aggressive management actions taken by the province, the forest industry and other stakeholders, many of the areas infested in 2006 and 2009 show a greater than 50 per cent decline in the number of infested trees. However, over the past several years, an unmanaged population in Jasper National Park has been rapidly expanding. This year, that population

229 Legislature Building, 10800 - 97 Avenue, Edmonton, Alberta T5K 2B6 Canada Telephone 780-427-2137 Fax 780-422-6035

expanded significantly east of the park border into the provincial forest in the Hinton area. This new infestation in Alberta is too large to manage without additional funding support.

The newly and heavily infested area is a significant concern to Alberta given its proximity to the pure pine forests along the eastern slopes of the Rocky Mountains. The eastern slopes contain a number of important headwaters that supply water for habitat, drinking water, and irrigation. Analysis indicates thousands of hectares of watershed will be heavily impacted should a mountain pine beetle infestation cause significant mortality. The current infestation may also have significant negative impacts on federally listed Threatened and Endangered species such as caribou and whitebark pine.

Reducing the extent and severity of pine forest mortality is important for the forest sector, but also important in terms of wildfire risk to communities.

Mountain pine beetle-killed areas present a significant wildfire threat as the standing dead timber increases the wildfire's intensity and rate of spread, making it more difficult and dangerous for personnel charged with fighting wildfire. A further complication is the amount of downed timber which burns with greater intensity than a fire in a healthy forested area doing more damage and inhibiting future regeneration. Significant mortality of forests surrounding communities will increase the fire risk in the short and long term. Recent wildland/urban interface wildfires in Alberta and British Columbia have heightened awareness of these impacts.

It is important to conduct fuel management around and within the currently affected areas, as well as those that will be impacted going forward. To that end we are working with Jasper National Park and the town of Jasper, Alberta.

Our successful mountain pine beetle management program is not solely focused on detection and control. Research and development and support to stakeholders managing beetle within their jurisdictions is also important. Over the past 10 years, 68 per cent of the provincial mountain pine beetle budget has been spent on direct detection and control with the remaining 32 per cent supporting research and other stakeholders including the forest industry and communities.

In 2008, Natural Resources Canada published a report about the risks of mountain pine beetle to Canada's boreal forest. The report concluded that Alberta's pine stands will allow for the further spread of beetle populations across the prairie region, and further east into susceptible pine forests. These findings were reaffirmed in 2010. The Canadian Council of Forest Ministers publication *Risk assessment of the threat of mountain pine beetle to Canada's boreal and eastern pine forests.* 2014. Nealis, V.G.; Cooke, B.J. Canadian Council of Forest Ministers, Ottawa, Ontario.

MPB is a threat to Alberta and the rest of the boreal forest of Canada, and Federal investment is needed to control the spread of mountain pine beetle in Alberta. During the height of the infestation in British Columbia, federal contributions reached $340 million. In May 2014, the Federal Government committed $18 million over four years to control spruce budworm in Quebec and eastern Canada in order to support the sustainability of the forest sector and the health of Canadian forests. This latest mountain pine beetle infestation carries similar but potentially more widespread risks.

Premier Rachel Notley has contacted Prime Minister Trudeau to express Alberta's concerns and my intent to communicate directly with you. Alberta is requesting $20 million each year for the next five years to support the mountain pine beetle management program and $5 million per year for the next five years to support the FireSmart program for communities affected by this latest infestation.

I look forward to further communications with you and to developing a strong and coordinated effort in dealing with this national issue.

Sincerely,

Oneil Carlier
Minister

Premier of Alberta

Office of the Premier, 307 Legislature Building, Edmonton, Alberta T5K 2B6 Canada

November 23, 2017

The Right Honourable Justin Trudeau, P.C., M.P.
Prime Minister of Canada
Office of the Prime Minister and Privy Council
80 Wellington Street
Ottawa ON K1A 0A2

Dear Prime Minister:

Over the past several years, an unmanaged population of mountain pine beetles in Jasper National Park has been rapidly expanding. This year, that population expanded significantly east of the park border into the provincial forest in the Hinton area. This new infestation in Alberta is too large to manage without additional funding support, and threatens the economic livelihood of more than 70 Alberta communities that rely on healthy forests to create 18,250 jobs.

Alberta has been aggressively managing mountain pine beetle (MPB) infestations in the province for over a decade when a massive influx of beetles came from British Columbia. Since 2004/05, Alberta has invested more than $461 million on mountain pine beetle management. Between 2007 and 2011, the federal government contributed $18 million. These investments have not only allowed Alberta to avoid the economic and environmental disaster experienced in British Columbia, but our aggressive management has also stemmed the spread of the beetle to forests in provinces to our east.

To put it simply: Alberta has invested heavily in the management of pine beetle and the rest of the country has benefited from these investments.

If Alberta is unable to address this most recent infestation in a timely and effective manner, the pine beetle may spread further eastward, as a 2008 risk assessment by Natural Resources Canada indicated that Alberta's pine stands would allow further spread through the prairie region and further east into susceptible pine forests.

The further spread of pine beetle beyond the Eastern Slopes would present unacceptably high risks for Alberta's and Canada's forest communities. It would threaten the economic viability of our communities, as the forest sector added $2.6 billion to the Alberta's GDP alone in 2016. It would have significant impacts on threatened and endangered species such as the caribou and whitebark pine. And, most viscerally to western Canadians who have been experiencing increasingly frightening wildfire seasons—pine beetle-killed forests substantially increase the intensity and rate of spread for wildfires.

.../2

Alberta has long been a leader on mountain pine beetle, and we will continue to do our part. However, we will need the help of the federal government in this endeavour, just as British Columbia has needed it in the past, receiving $340 million in federal contributions. Simply put, we need assistance and we need it immediately. Alberta is requesting $20 million each year for the next five years to support existing mountain pine beetle management program as well as $5 million per year for the next five years to support the FireSmart program for communities affected by this latest infestation.

I look forward to a strong and coordinated effort in dealing with this national issue.

Sincerely yours,

Rachel Notley
Premier of Alberta

cc: Honourable Oneil Carlier, Minister of Agriculture and Forestry
Honourable James Carr, Minister of Natural Resources
Honourable Ralph Goodale, Minister of Public Safety and Emergency Preparedness
Honourable Catherine McKenna, Minister of Environment and Climate Change

JUL 0 5 2019

ALBERTA
AGRICULTURE AND FORESTRY

Office of the Minister
MLA, Innisfail-Sylvan Lake

The Honourable Amarjeet Sohi
Minister of Natural Resources
Natural Resources Canada
580 Booth Street
21st Floor, Room C7-1
Ottawa, ON K1A 0E4

The Honourable Catherine McKenna
Minister of Environment
and Climate Change
200 Sacré-Coeur-Boul., 2nd Floor
Gatineau, QC K1A 0H3

The Honourable Ralph Goodale
Minister of Public Safety and Emergency
Preparedness
269 Laurier Avenue West
Ottawa, ON K1A 0P8

Dear Minister Sohi, Minister McKenna, and Minister Goodale:

Alberta has been aggressively managing Mountain Pine Beetle (MPB) infestations in the province since 2006 when a massive influx of beetles came from British Columbia. Alberta has almost six million hectares of susceptible pine forest and, to date, over two million hectares have been affected by MPB. Infestations of MPB threaten economic, social, and environmental values, such as the province's forest industry, community sustainability, watershed health, and species-at-risk habitat.

The unmanaged outbreak in Jasper National Park has rapidly expanded and significantly affected our provincial forest. This newly infested area along the eastern slopes is of critical concern to Alberta, as many of the rivers that supply water for habitat, drinking, and irrigation are located in this area. Federally listed Threatened and Endangered species, such as caribou and whitebark pine, are also present in the affected areas. In 2008, Natural Resources Canada published a report about the risks of MPB to Canada's boreal forest. The report concluded that Alberta's pine stands will allow for the further spread of beetle populations across the prairie region, and further east into susceptible pine forests. These findings were reaffirmed in 2010 and again in 2018. In his June 11, 2019, letter, Minister Sohi mentioned pest infestations as a critical forest sector competitiveness issue in Canada that is especially important in the transition to a low-carbon economy.

Two years of extreme wildfire behaviour in British Columbia were exacerbated by dead forests damaged by MPB. Combined, these events are adding significant pressures to the forest industry in British Columbia and are compounding challenges affecting their fibre supply. As Alberta continues to manage the seasonal impacts of wildfire, it is of increasing importance that Alberta continues to focus on MPB management to protect its forest industry.

The Government of Alberta has invested over $530 million on MPB management since 2006. The Government of Saskatchewan has provided $6.15 million to Alberta to help slow the spread east into boreal forests of Saskatchewan. Between 2007 and 2011, the federal government contributed $18 million. It is estimated that these investments in effective, efficient, and long-term MPB management activities returns a benefit ratio of 8:1. In 2018, Alberta submitted a funding request that outlined objectives and deliverables of a jointly federal-provincial funded

229 Legislature Building, 10800 - 97 Avenue, Edmonton, Alberta T5K 2B6 Canada Telephone 780-427-2137 Fax 780-422-6035

program. A total of $20 million per year over five years was requested to support an expanded Mountain Pine Beetle management program in Alberta and Saskatchewan. Unfortunately, no federal funding was identified for MPB management in Budget 2019.

Given the demonstrated benefits of MPB management in Alberta, and the importance of protecting Alberta's and British Columbia's forest resources, Alberta is renewing its request from the federal government to help support this fight. Alberta is requesting $20 million each year for the next five years to support the province's MPB management program and $5 million per year for the next five years to support the FireSmart program for communities affected by this latest infestation. Alberta's 2019 wildfire situation is extreme—we can only imagine what it would have been like had the wildfires burned MPB-killed forests.

MPB is a threat to Alberta and the rest of the boreal forest of Canada, and the federal government needs to invest in controlling its spread. During the height of the infestation in British Columbia, federal contributions reached $340 million. In 2014, the federal government committed $18 million over four years, and an additional $74.75 million in 2018 over five years to control spruce budworm in eastern Canada and support the sustainability of the forest sector and the health of Canadian forests. MPB infestation carries similar but potentially more widespread risks.

The economic, social, environmental, and wildfire risks are too great for Alberta. Alberta's MPB program has proven multiple times to be effective at meeting its objectives of reducing spread and mitigating damage to the forest resource. The effectiveness of the program has been evident in the reduction in MPB populations and has been supported by research. There is still the opportunity for Canada to step up and jointly fund the MPB management program in Alberta to mitigate losses to its provincial forest resource and slow the spread into the boreal forest.

Alberta expects equitable recognition for forest health disasters, and asks the federal government to reconsider our request for funding. Our provincial specialists are available to provide more information and discuss options if needed. I look forward to further communications with the Government of Canada on this matter.

Sincerely,

Honourable Devin Dreeshen
Minister, Alberta Agriculture and Forestry

Premier of Alberta

Office of the Premier, 307 Legislature Building, Edmonton, Alberta T5K 2B6 Canada

July 29, 2019

The Right Honourable Justin Trudeau, PC, MP
Prime Minister of Canada
Office of the Prime Minister and Privy Council
80 Wellington Street
Ottawa ON K1A 0A2

Dear Prime Minister Trudeau:

An unmanaged outbreak of Mountain Pine Beetle (MPB) in Jasper National Park has rapidly expanded and significantly affected Alberta's provincial forest. This infestation is threatening ecosystems in our province that support threatened and endangered species, such as caribou and whitebark pine. Recent infestations along the eastern slopes are posing serious risks to rivers that supply drinking water. If Alberta is unable to address this most recent expansion, federal government research confirms that MPB will spread through the prairie region and expand further east into susceptible pine forests. This is clearly a matter of critical concern for both Alberta and Canada.

Alberta has been aggressively managing MPB infestations since 2006, when a massive influx of beetles came from British Columbia. The Government of Alberta has invested over $530 million to fight the spread of MPB to protect its own forests and stem the spread east to help protect the forests of our provincial neighbours. Between 2007 and 2011, the federal government contributed $18 million to support this fight. Unfortunately, no federal funding was identified for MPB management in Budget 2019.

The fight against MPB is one Alberta must continue to face in order to avoid economic and environmental disaster. We need immediate assistance from the federal government to avoid the economic disaster British Columbia faces from the MPB.

Alberta is requesting $20 million each year for the next five years to support the province's MPB management program and $5 million per year for the next five years to support the FireSmart program for communities affected by recent infestations. Alberta's 2019 wildfire situation is extreme—we can only imagine what it would have been like had the wildfires burned MPB-killed forests. Two years of extreme wildfire behaviour in British Columbia were exacerbated by dead forests damaged by MPB. Combined, MPB and wildfire are adding significant pressures to Canada's forest industry, especially in British Columbia and now Alberta. As Alberta continues to manage the seasonal impacts of wildfire, it is of increasing importance that Alberta also continues to manage MPB to protect the strength of its forest industry.

.../2

Alberta will continue to be a leader in the fight against MPB and continue to do our part to protect the forests to the east. It is time for the federal government to show leadership in the face of this serious challenge. I look forward to a strong and coordinated effort in dealing with this pest as a national issue.

Sincerely yours,

Hon Jason Kenney PC
Premier of Alberta

cc: The Honourable Amarjeet Sohi
Minister of Natural Resources

The Honourable Catherine McKenna
Minister of Environment and Climate Change

The Honourable Ralph Goodale
Minister of Public Safety and Emergency Preparedness

The Honourable Devin Dreeshen
Minister of Agriculture and Forestry

APPENDIX 3. DESCRIPTION OF THE ALBERTA AND SASKATCHEWAN FORESTRY SECTORS

A3.1 Alberta Forestry Sector

Forestry is the third-largest resource-based industry in Alberta and forests cover 38 million hectares, of which an estimated 60 per cent are available for timber harvest. Of the annual allowable cut, approximately 57 per cent of the AAC is comprised of conifer, with some of the largest per cent volumes found in the central region of Alberta and along the eastern slopes of the Rocky Mountains (Fig. 16). Key issues facing the forest industry include market access, commodity market swings, species-at-risk requirements, and secure access to fibre. The November 2017, imposition of the final countervailing and anti-dumping duties by the United States on Canadian softwood lumber created uncertain market access. Additionally, wildfire and MPB continue to threaten communities, forest health and long-term wood fibre access.

Alberta strives to be a leader in forest resource management. The Ministry supports the innovative development of and sustainably produced forest products that are the economic, social, and cultural foundation for at least 70 rural and Indigenous communities. These communities include approximately 30 municipalities where the forest sector is directly responsible for at least 20 per cent of employment income.

A complement to Alberta's rigorous and comprehensive forest management standards and regulations is the fact that 82 per cent of managed forested lands in Alberta have been granted third-party international certification. This is a significant achievement when only 11 per cent of forests around the globe are internationally certified.

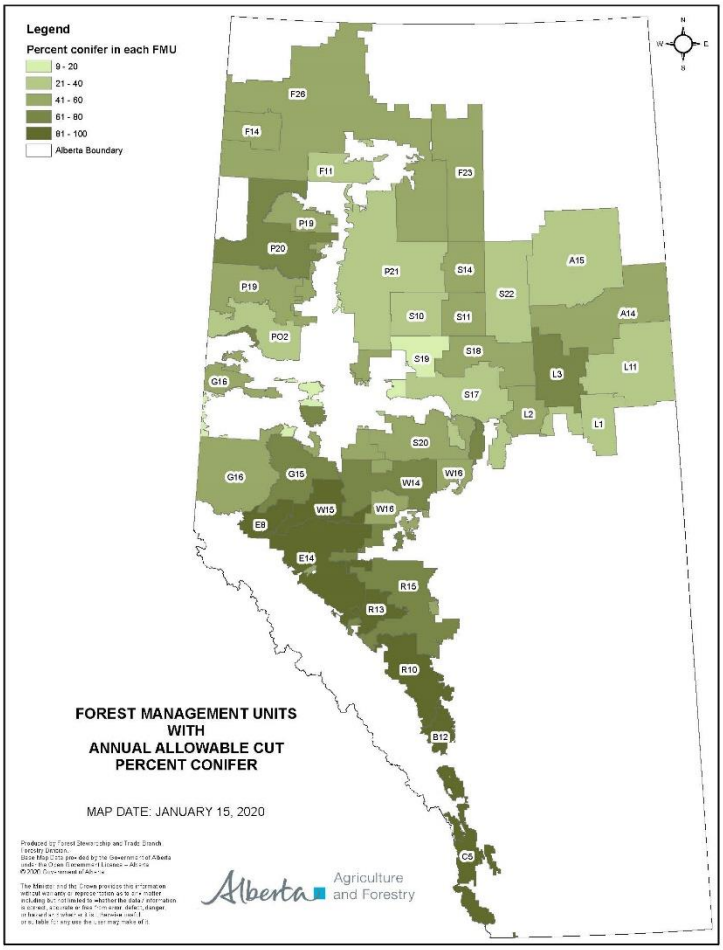


Figure 16. Per cent conifer annual allowable cut by forest management unit in Alberta.

The primary driver for capital investment in Alberta's forest sector is secure access to wood fibre. Between 1986 and 1996, the province attracted $5 billion worth of domestic and international greenfield investment in pulp mills, panel plants and sawmills, by offering companies long-term tenure agreements.

In 2018, the forest sector directly employed 18,700 people, contributed $2.24 billion to the provincial gross domestic product, and paid over $1.6 billion in wages and salaries. Indigenous peoples hold 7.9 per cent of jobs directly related to Alberta's forest industry. Alberta has 820 primary and secondary firms in the forest sector, 52 per cent of which employ less than five people. The forest sector also generated $8.05 billion in revenue from harvesting operations and the sale of lumber, pulp, newsprint, wood panels, engineered wood products, bio-products, and ecosystem services. In the same year, buyers from the United States, China, Japan, South Korea, Taiwan, the European Union, and other export markets purchased over $4.12 billion of Alberta wood products.

The successful incorporation of mass timber tall buildings in Alberta building design may substantially increase domestic softwood lumber consumption (and potentially structural hardwood products). There are opportunities for made-in Alberta secondary wood product manufacturing in both Indigenous peoples and Metis communities. The ten largest companies operating in Alberta's forest sector produce lumber, oriented strand board, softwood pulp, hardwood pulp, bleached chemi-thermal mechanical pulp, plywood, veneer, medium-density fibreboard, laminated-veneer lumber, wood pellets, and renewable electricity (Fig. 17).

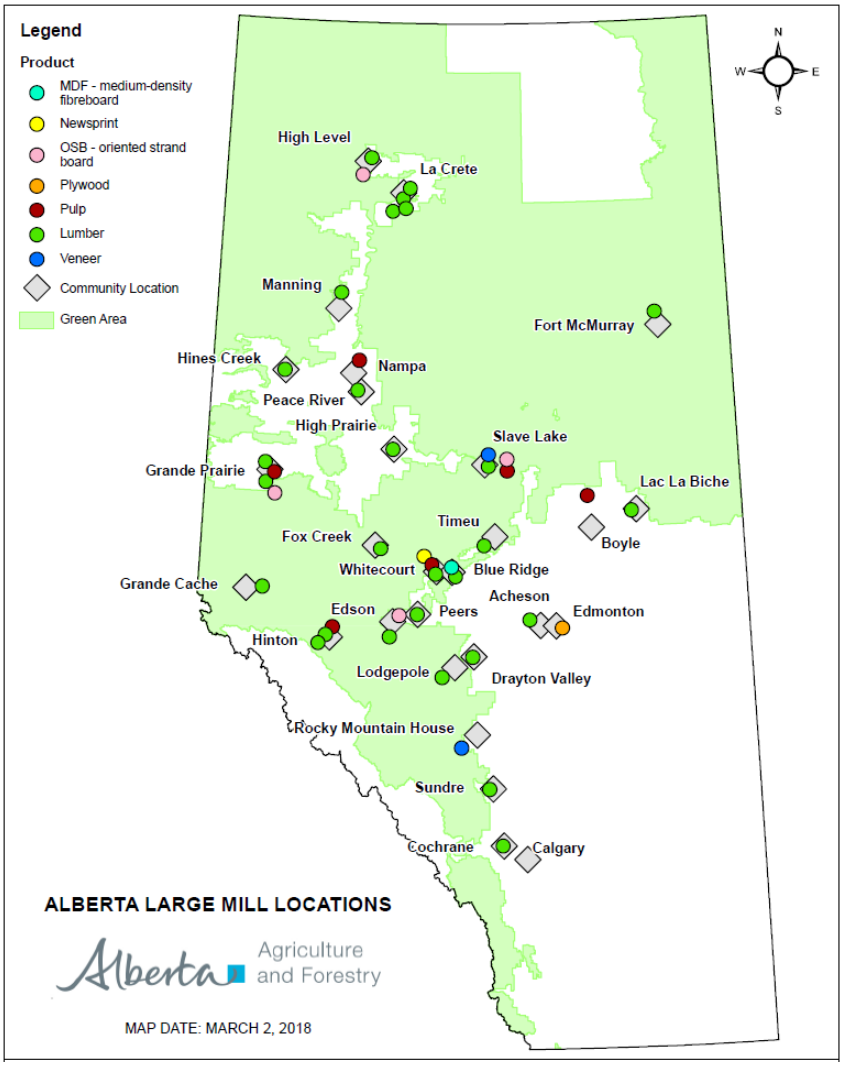


Figure 17. Locations and products produced by large mills in Alberta.

A3.2 Saskatchewan Forestry Sector

While other eastern provincial forest sectors will be affected by continued spread of MPB through the boreal forest, Saskatchewan will be the first Province negatively impacted. Saskatchewan is the only jurisdiction that currently contributes to Alberta's MBPMP, as described in Section 3.2.1

As the Saskatchewan Ministry of Environment is committed to environmental stewardship, conservation must be considered in the sustainable management of natural renewable resources to increase economic benefits. The overall goal of the Ministry is to ensure productive resilient and biologically diverse landscapes while maintaining a commercially viable forest industry (Government of Saskatchewan 2018a).

Saskatchewan's forestland covers just over 29.5 million hectares and represents half of the province's land base (Government of Saskatchewan 2018b). Forestry is the second largest industry (after mining) in northern Saskatchewan. The commercial forest zone is 11.7 million hectares with 5.3 million hectares of productive forestland available for commercial development. Sustainable timber harvest level is 8.3 million cubic metres of timber annually. Forest products produced by Saskatchewan's forest sector include lumber, oriented strand board, softwood pulp, hardwood pulp, treated posts and timbers, and log homes.

There are ten large primary forest products manufacturing facilities including two pulp mills, two oriented strand board (OSB) mills, one plywood mill, and five saw mills (Fig. 18). In 2017, seven of the ten major mills were in operation, with forest products sales of nearly $1.2 billion and supported over 8,400 jobs (direct and indirect). At full working capacity, the industry could generate around $2 billion in annual forest products sales and support a workforce of over 13,000 direct jobs. The Saskatchewan forest industry has attained Environmental Certification on 62 per cent of the commercial forest zone.

Approximately 50 per cent of the mean merchantable growing stock is softwood of which pine comprises approximately 46 per cent (Fig. 19). Softwood lumber harvest in Saskatchewan is managed under four major Forest Management Areas (FMA's), which accounts for approximately 70 per cent of Saskatchewan's productive forest:

- Prince Albert FMA,
- Pasquia Porcupine FMA,
- Mistik Management FMA, and
- Northwest Term Supply License.

Indigenous Peoples in Saskatchewan significantly contribute to the forest industry and benefit economically from this participation. First Nations and Métis people make up over 30 per cent of the work force, which is by far the largest proportion of indigenous forestry employees in any of the Canadian provinces. The NorSask sawmill In Meadow Lake is the largest 100 per cent First Nations owned and operated facility in Canada.

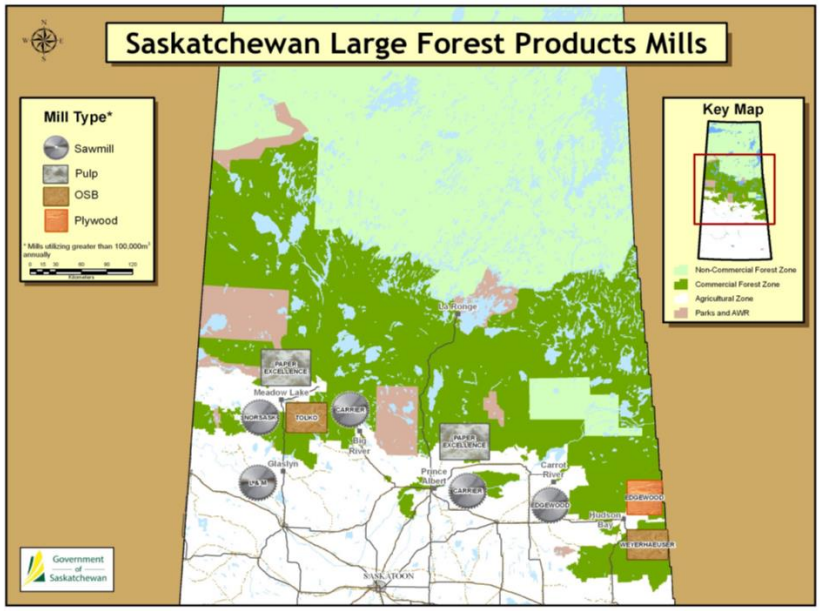


Figure 18. Distribution of the ten major forest product-manufacturing facilities in Saskatchewan.

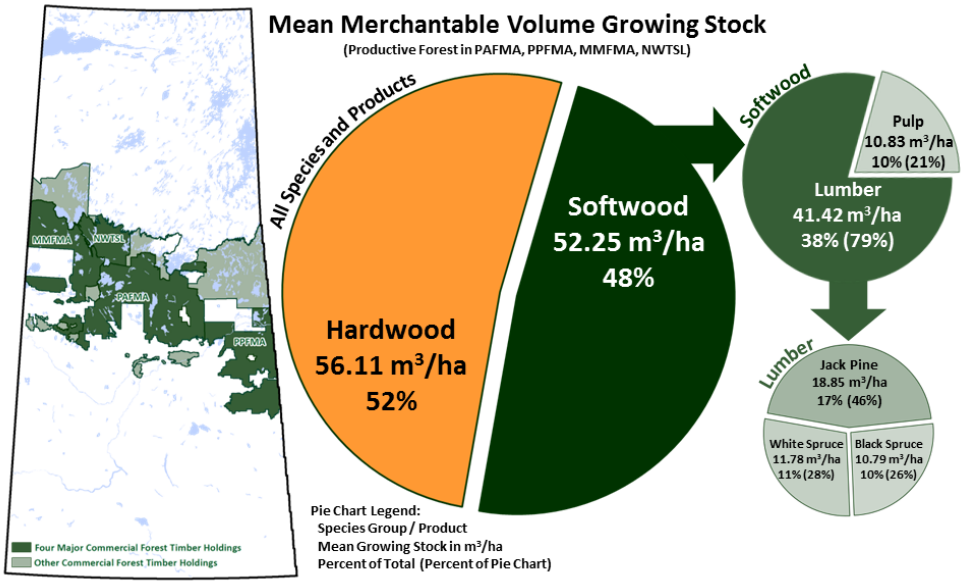


Figure 19. Breakdown of mean productive forest merchantable volume growing stock for Saskatchewan's four major commercial forest timber supply areas.

APPENDIX 4: GANTT CHART