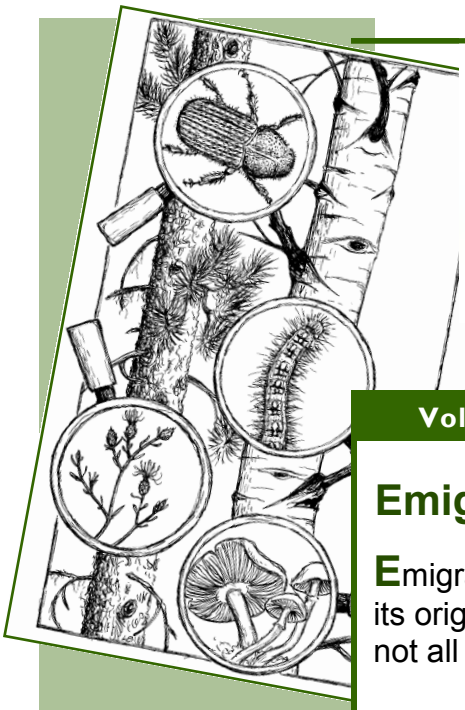


# Bugs & Diseases

Vol. 28 No. 3 December 2017

*Alberta's eye on forest health*

**Issue highlights:**




Alberta Government

## Emigration, Immigration and Metamorphosis

Emigration is the movement of individuals from one population away from its original area to a new area. Emigration is common in the insect world but not all that common to the Forest Health and Adaptation Section (FH&A).

This summer Aaron McGill, Information Management Technologist for FH&A, emigrated. He, his wife and two daughters moved to Dartmouth, Nova Scotia and have settled in nicely to life on the east coast. Aaron was with the Section for over 12 years with the responsibility of data management and analysis, data distribution, mobile data collection hardware and software, mapping, and other GIS tasks that supported the team in making management decisions. The impact of Aaron's emigration to the remaining population isn't exactly certain yet. Thankfully Aaron was willing and able to answer questions and provide a bit of direction on a couple of projects to get us through. Hopefully by the next edition we will have a new individual to introduce to the remaining population. FH&A will miss Aaron's skills and abilities as a co-worker and also his friendly and outgoing nature as a friend. We wish him and his family all the best!

Some insects undergo metamorphosis: a change in the shape, form or habits of an individual as they develop. We have had several metamorphoses within FH&A. First, Allison Brown, former FHT in the Whitecourt Forest Area has taken on the role of FHO. For a full introduction to Allison, please see Get to Know an FHO. Another development in the team is that Bart McAnally, former FHT in the Calgary Forest Area, assumed the role of FHO this fall. Bart is a long time Forestry staff member who joined the Forest Health team in 2005. In the Grande Prairie Forest Area, Clint McCrea has assumed the role of FHT. Clint has been with the Forest Health and specifically the mountain pine beetle program since 2009 as the Forest Health Assistant. Clint is a skilled aerial surveyor and has excellent supervisory and field work skills.

From a programming point of view, it is rewarding to see staff develop skills and experience that enables them to develop and progress within the Department. Congratulations to these three morphed staff members.

*Erica Samis, Director, FH&A - Edmonton*

# Spruce Beetle Outbreak in Omineca Region of Northern BC

**Outbreak overview:** The spruce beetle is an insect commonly found in spruce forests throughout Canada; but recently, higher-than-normal populations of spruce beetles have been detected primarily in the Omineca Natural Resource Region of north-central BC. Warm winters, dry summers, and windstorms resulting in windthrown host trees have contributed to this population increase. Approximately 341,000 hectares of forest in the Omineca Region (data is from the 2017 Aerial Overview Survey) are currently infested (intensity of attack varies from trace attack to severe), primarily around the southern half of Williston Lake in the Mackenzie Timber Supply Area and the northern portion of the Prince George Natural Resource District, in the Prince George Timber Supply Area. Sporadic attack was detected in 2017 in the Robson Valley Timber supply area and in the Northeast Region, primarily in the pine pass area east of Mackenzie. An outbreak was declared in the fall of 2015 due to size and rate of spread of infested trees; this infestation area now represents the largest recorded spruce beetle outbreak in the Omineca Region. An interactive map of the current infestation can be found here.

**Government of BC response:** The BC Ministry of Forests, Lands, Natural Resource Operations, and Rural Development (FLNRORD) is closely monitoring the situation in order to minimize impacts on timber supply, ecosystem function, as well as the forest industry and forestry jobs. The overarching aim of the BC government's approach is to balance the maintenance of ecosystem integrity with the need to maintain the mid-term timber supply. In addition, a public advisory committee is in place to provide input into the development and implementation of control actions focused in three main areas: detection and outreach, operation working groups, and training.

**Detection and outreach:** FLNRORD has dedicated resources each year since the outbreak was declared in 2015. An Omineca Spruce Beetle Project Manager was appointed to coordinate efforts within the Omineca with a budget of $850,000 in 2015-2016, $1,000,000 in 2016/17. Over $1,300,000 was allocated in 2017/18 for flights to identify areas impacted, ground surveys to identify priority operational areas and to deploy trap trees, as well as to support timber decay "shelf life" research. FLNRORD is also focused on continuing to update and engage with First Nations, the public, local governments, and forest industry professionals. A free, public Spruce Beetle Summit was hosted in the fall of 2016 and again in October 2017 to review the rate of spread, current and best research, actions to date, and to assist in the development of future action with speakers from across Canada and the Western United States. A extension document was produced in 2016: "Working Together BC's Spruce Beetle Mitigation Strategy".


**Operational working groups:** FLNRORD staff facilitate joint government-licensee spruce beetle working groups for each affected timber supply area. Each working group develops and implements locally feasible management activities and a joint government-licensee spruce beetle action plan that lists and prioritizes harvesting activities and the use of trap

trees. In conjunction with the working groups, FLNRORD developed a series of guidelines and District Manager "letters of expectations" to guide mitigation activities. Guidelines include beneficial management practices for spruce beetle management, hauling and milling guidelines for spruce beetle infested wood, and most recently, the Chief Forester's guidelines for retention. All guidance documents to date can be found here.

**Training:** An integral part of monitoring is developing the capacity to accurately recognize and record infested stands. A spruce beetle probing course is offered by the University of Northern British Columbia continuing studies in Prince George (see: http://www.unbc.ca/continuing-studies/courses-workshops). This practical course is designed for forest consulting personnel conducting ground detection surveys for spruce beetle. Trained and experienced beetle-probing professionals are a key resource for timely and effective monitoring of infestations. FLNRORD is strongly encouraging consulting professionals, licensees, and government employees involved in on-the-ground spruce beetle management to complete the training course.

**Low risk to Alberta:** We are in open communication with Alberta government and actively sharing relevant information. Although spruce beetle killed trees are sprinkled throughout the Northeast Region of BC, there have not yet been any reports of rapidly increasing spruce beetle populations in Alberta. The Alberta government and FLNRORD will continue to actively monitor the populations and mitigate population growth through 2018. For more information, please feel free to contact Jeanne Robert, FLNRORD Regional Entomologist Omineca and Northeast Regions (Jeanne.Robert@gov.bc.ca)

*Jeanne Robert — BC FLNRORD*

## MPB Update

The 2017-18 mountain pine beetle (MPB) control program is now in full swing. Last year the Department controlled just under 92,000 infested trees, which is similar to the control target for this year's program. Although program size has remained relatively constant over the past few years, MPB population levels have changed significantly from a geographic perspective.

Most notably is the increase in the number of MPB-killed (red) pine trees detected during aerial surveys this past fall in the Edson Forest Area—just over 46,000 red trees were detected. This is approximately a 3-fold increase from the 11,853 red trees detected in 2016. The sharp increase doesn't come as a complete surprise as we have watched the MPB outbreak expand eastward from the Mount Robson region in British Columbia into Jasper over the past few years. In 2013 only a few hundred hectares of MPB-impacted area was detected within Jasper; the outbreak now covers approximately 93,000 hectares in the park. As we have learned from previous MPB outbreaks adjacent to Provincial land, MPB immigration is inevitable.

With in-flights or MPB immigration events, MPB reproductive success is not always guaranteed in their newly-found home. Unlike MPB movement within a pine stand where emerging individuals most often have the benefit of being in a location where suitable hosts are availa-

ble, when MPB drop from the sky during an immigration event not all of them will land in climatically suitable locations with susceptible host material. These sub-par pine stands can act as beetle sinks where low reproductive ability results in declining populations. An example of this occurred in the Edson Forest Area following an unprecedented province-wide inflight of 2009 that resulted in 27,131 MPB-killed (red) trees detected by aerial surveys in that area in 2010. Following 2 years of aggressive control, red tree counts were reduced to 3,472.

Although the situation seems to be getting worse in one specific part of the Province, some other parts are seeing the benefits of aggressive and sustained action. In the Whitecourt Forest Area 2,601 red trees were detected in 2017, down from 22,011 in 2015. This is similar to the situation south of Grande Prairie where red tree numbers declined from 66,009 to 25,369 from 2015-2017.

The ground survey results to date in some areas are very positive - ground crews are finding fewer trees than predicted. Within the Edson Forest Area alone, we predicted there would be over 500,000 current attack trees. As this amount of control work was out of reach from an operational perspective, some of the hardest hit areas around the Hinton region and west to Jasper were designated as Inactive Zone; and infestation locations at elevations above 1200 meters where climate is generally less suitable for MPB were removed from the control priority list. The significantly lower than expected control tree numbers discovered to date in the Edson Forest Area have allowed us to reduce the size of the Inactive Zone by expanding control work west towards the Town of Hinton, and possibly into higher elevations elsewhere.

Even with the MPB situation constantly changing in the Province, we continue to gain knowledge through research and observations that assists in making difficult management decisions. Keeping focussed on beetle biology, host susceptibility and detection/control efficacy through an adaptive management lens will continue to be the key to success.

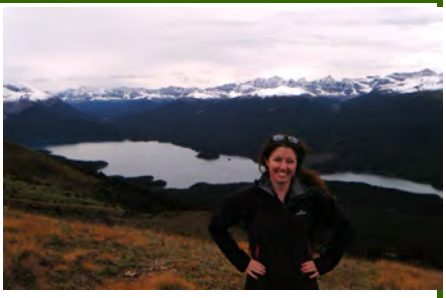
*Mike Undershultz- Edmonton*

## Get to Know an FHO – Allison Brown

With some recent changes to the forest health team roster, it is time once again to get to know an FHO (Forest Health Officer). This time I travelled to the lovely town of Whitecourt to chat with Allison Brown, one of the more recently appointed FHOs. Allison is no stranger to many of us as she has very aptly filled the position of Forest Health Technician in Whitecourt over the past 3 years. She accepted the Whitecourt FHO position this past November.

Mike: Thanks for taking time out of your busy day to meet with me Allison. For the benefit of those who have not had the pleasure of meeting you, can you tell us where you were born and raised, and what brought you to AB?

Allison: *I was born and raised in Island View, New Brunswick. A few years ago, two old friends from UNB returned home to get married, at that time they told me about a forest health job opportunity in Whitecourt, where they lived at the time. As I disliked my current job, I applied, got a job offer, and then hopped on a plane heading northwest.*



Mike: Well I am happy you decided to come to Alberta. You mentioned the University of New Brunswick; what was your focus of study?

Allison: *I obtained a Bachelor's of Science in Forestry, and a Master's in Environmental Engineering.*

Mike: Can you tell me a bit about your past work experience?

Allison: *I spent a few summers in Prince George working as a silviculture assistant and then spent a few years in New Brunswick as a silviculture supervisor. Both jobs were with a forest company. I've spent the last 3 years here in Whitecourt as a Forest Health Technician, so I'm quite excited about this step up to FHO!*

Mike: Congratulations! As a child, I am betting that being a Forest Health Officer was always your dream?

Allison: *No, not really. At one point as a kid I wanted to work in a chocolate factory. When I got a bit older I figured out that working in the environmental field was where I was meant to be. Not as sweet, but maybe more satisfying.*

Mike: What type of things keep you busy on weekends?

Allison: *On weekends I enjoy skiing or hiking. Luckily Jasper is close enough to Whitecourt for a weekend trip. I've also been known to head into Edmonton, or to stay home with books and movies. I love skating in the winter, and have started shooting archery in the summer.*

Mike: Any nicknames? Allison: *Ally Cat*

Mike: Can you tell me which forest health damaging agent is most interesting to you, and why?

Allison: *I'd have to say mountain pine beetle, as they keep me the busiest throughout the year.*

Mike: In your opinion, what is the biggest challenge facing the health of Alberta's forests now and into the future?

Allison: *The biggest threat to Alberta's forest now is climate change and how drought and other climate related stress weaken tree defenses to diseases and insects. I've heard Allan Carrol say something to the effect that the biggest threat to our forest in the future is the 'unknown'. For example, an invasive pest could appear and catch us off guard. We may not have any management plan for them or extensive knowledge on how they operate.*

Mike: Thanks for sharing some things about yourself for our readers.

Allison: *You are welcome Mike. My pleasure.*

*Mike Undershultz- Edmonton*

# A Bird's Eye View of Alberta's Forests in 2017

Every summer the Forest Health area staff conduct aerial overview surveys (AOS) to map forest disturbances that are visible from the air. Historically these surveys were limited to the assessment of defoliating pests (e.g. forest tent caterpillar and spruce budworm), but the scope of the surveys has been broadened to include a wide variety of damage agents. Symptoms of these disturbances include tree defoliation, dieback, mortality, and damage caused by climate/weather (e.g. blowdown, hail, drought stress). AOS are timed to capture the activity of as many damage agents as possible and are performed between mid-June to the end of July.

Aerial overview surveys are one of the most important activities that Forest Health undertakes for a number of reasons. The data provides a baseline from which we can gauge when disturbances exceed the natural range of variation. The data can be used as an early warning system to identify disturbances at an early stage. Quick detection is important from not only an invasive species perspective but also when considering native pests that undergo eruptive population dynamics. Aerial overview survey data has been used to identify situations that subsequently influenced forest management plans/harvest sequences. Ultimately, our goal is for the Forestry Division to be recognized as a national leader in forest disturbance management in the prevention, detection, and management of high risk forest disturbance events.

In 2017, an impressive 286 hours were spent surveying Alberta's forests and 212 hours of ground-truthing were performed. An estimated 1.79 million ha of disturbance were mapped in 2017 (Table 1). Aspen defoliators were responsible for 48 per cent of the damage observed during the surveys. Almost half of the defoliation was attributed to forest tent caterpillar even though populations have been decreasing since 2015. Large aspen tortrix populations have been on the rise in southern Alberta since 2015, while aspen two-leaf tier defoliation dropped from 18,786 ha in 2016 to zero in 2017. Willow leafblotch miner activity has been observed in the northern reaches of the province since 2013, although 2017 was the first year that defoliation was formally reported. Spruce budworm represented 2% of provincial defoliation and decreased slightly between 2016 and 2017.

Much of the observed dieback occurred in aspen stands. Dieback has become easier to detect as the defoliation by forest tent caterpillar has decreased. Much of the dieback is a result of the additive effects of drought combined with repeated defoliation events. Note that we map tree mortality but only when evidence suggest that the mortality is due to something other than natural tree senescence. In 2018, we may continue to see an increase in the area affected large aspen tortrix as outbreaks tend to last 2-3 years. It is likely that forest tent caterpillar infestations will continue to decrease but localized populations may overlap with large aspen tortrix as the presence of former tends to follow the latter.

Spruce beetle activity remained at levels expected from an endemic population. Note that there was a substantial increase in the area affected by spruce beetle between 2015 and 2016 which is primarily due to differing mapping practices between the years. In 2016 we mapped cumulative spruce mortality in order to create a baseline from which to track population expansion.

The prevalence of pine needle cast increased dramatically in 2017, which can be expected in the years following moist summer weather. It is difficult to predict what level of pine needle cast we can expect next year as summer moisture conditions across the province were quite variable. There is a large amount of inoculum present in the forests which may support overall higher-than-normal infection rates given local moisture levels. Rest assured that whatever happens out there, our Forest Health staff will be ready to map it!

Table 1. Summary (in hectares) of Alberta forest disturbance agents mapped during aerial overview surveys.

| | 2015 | 2016 | 2017 |
|---|---|---|---|
| **Bark beetles** | | | |
| Eastern Larch Beetle | 918 | 6,583 | 2,927 |
| Spruce beetle | 1,405 | 10,465 | 3,139 |
| **Total bark beetles** | **2,323** | **17,048** | **6,066** |
| **Defoliators** | | | |
| Aspen serpentine leafminer | --* | --* | 1,277 |
| Aspen two-leaf tier | 536 | 18,786 | -- |
| Bruce spanworm | 3,564 | -- | -- |
| Forest tent caterpillar | 1,586,486 | 525,135 | 394,286 |
| Large aspen tortrix | 54,444 | 213,316 | 294,123 |
| Linden looper | -- | -- | 25,504 |
| Spearmarked black moth | -- | -- | 710 |
| Spruce budworm | 51,750 | 19,265 | 17,337 |
| Unknown | -- | 859 | 8,321 |
| Willow leafblotch miner | --* | --* | 118,539 |
| **Total Defoliators** | **1,696,780** | **777,361** | **860,097** |
| **Diseases** | | | |
| *Armillaria* root disease | --* | --* | 11,665 |
| Lodgepole pine dwarf mistletoe | --* | --* | 7,195 |
| Pine needle cast | 20 | 36,097 | 354,898 |
| Other | -- | -- | 3,224 |
| **Total diseases** | **20** | **36,097** | **376,982** |
| **Other** | | | |
| Dieback | 23,657 | 115,728 | 350,158 |
| Flooding | 5,457 | 2,415 | 9,075 |
| Foliar damage | --* | 34,000 | 38,640 |
| Hail | 1,419 | 1,050 | 11,416 |
| Mechanical - unknown | -- | -- | 1,869 |
| Mortality | --* | 144,693 | 130,631 |
| Windthrow/blowdown | 1,204 | 1,338 | 2,376 |
| Winter desiccation | 15,341 | 7,766 | -- |
| **Total Other** | **47,078** | **306,990** | **544,165** |
| **Total Disturbance** | **1,746,201** | **1,137,496** | **1,787,310** |

*Observed on the ground but not formally assessed from the air.

*Caroline Whitehouse—Edmonton*

# Aspen Decline in Alberta

Aspen mortality appears to have increased over the past two decades in many areas of North America. Mortality of aspen forest, often called aspen dieback, has occurred in central and western Canada as well as in the western United States. In western Canada, dieback and reduced growth of aspen forest was first noted during the 1990s in the St. Walburg region of Saskatchewan and the Grand Prairie region of Alberta. The impacts of these mortality events prompted the Canadian Forest Service to establish an aspen monitoring program consisting of a network of aspen study sites across the prairie provinces and Ontario in the year 2000. The purpose of the Climate Impacts on the Productivity and Health of Aspen (CIPHA) program is to assess the health of Canada's aspen forests and to determine the factors that lead to decreased health and productivity. Alberta Agriculture and Forestry has been a collaborator in the CIPHA project since its inception and has actively participated in site monitoring since 2009.

Since the beginning of the CIPHA program, there have been two major episodes of aspen mortality. The first occurred in the mid 2000s in the area between Edmonton and Saskatoon along the boreal forest/aspen parkland ecozone transition. The second episode, which peaked in 2016, saw a return of mortality to the area north of Grande Prairie. A common factor underlying these mortality events is drought.

The region between Edmonton and Saskatoon experienced an exceptionally severe drought in 2001-2002. Moisture levels, as measured by the Climate Moisture Index (precipitation minus potential evapotranspiration), were the lowest recorded in over 50 years. Aspen mortality began to increase across the affected CIPHA sites immediately following the drought and peaked four years later. Delayed mortality is common following drought because although drought itself can kill trees it more often leads to stressed and weakened trees. Secondary diseases and pests such as cankers and boring insects then kill these stressed trees over a number of years.

The second major episode of aspen dieback, north of Grande Prairie, was preceded by over a decade of lower than normal moisture levels that have existed in much of Alberta. The peak of drought occurred in 2015 and extended well into the boreal forest of northern Alberta (Figure 1). Defoliation is another factor strongly related to mortality. Unlike the first dieback episode, severity of the second major episode was compounded by severe defoliation. A forest tent caterpillar (*Malacosoma disstira*) infestation began in 2011 and ended in 2016.

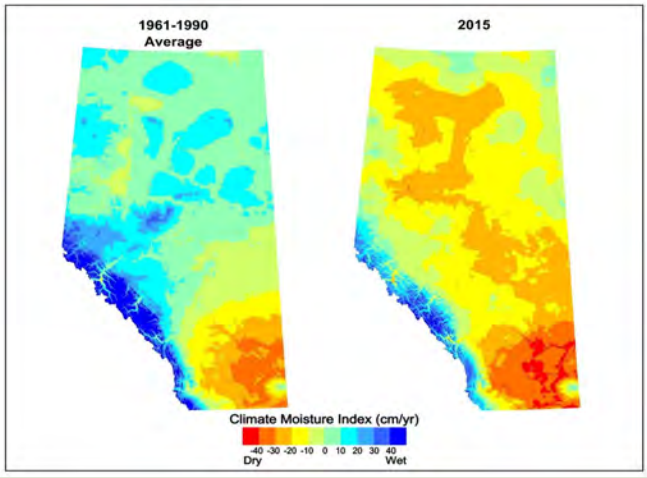



Figure 1. Comparison of the 2015 climate moisture index with the average 1961 to 1990 climate moisture index.

The combination of severe drought and severe defoliation led to widespread and relatively rapid aspen dieback (Figure 2). Dieback was most severe near the Dunvegan region but increased mortality was noted well in the neighbouring regions of BC and NWT.

Moisture levels in 2016 and 2017 returned closer to the 1961-1990 average however aspen mortality is expected to remain relatively high at least for the next few years. The long-term viability of Alberta's aspen forests is at risk given the increased drying and drought expected with a changing climate. These findings are consistent with globally observed increases in drought-induced forest decline.

Figure 2. Aspen dieback in the Grande Prairie Forest Area. Photos: D. Letourneau

***"The second episode peaked in 2016...north of Grande Prairie."***

*Mike Michaelian—Canadian Forest Service*

# Tweaking the Use of Pheromones for MPB Monitoring in Alberta

Mountain pine beetle (*Dendroctonus ponderosae*, MPB) has recently spread into northeastern Alberta. In this expansion zone, low densities of MPB are establishing in a new host jack pine (*Pinus banksiana*), along with hybrids with lodgepole pine (*P. contorta*). Accurately detecting and monitoring these low-density populations is important for controlling these tree-killing bark beetles. Important tools for managing beetle populations are chemical lures that mimic and exploit how beetles naturally communicate through pheromones.

Mountain pine beetles use pheromones to find mates during the colonization phase of their life history. An arriving female MPB initiates an attack, and releases the aggregation pheromone trans-verbenol that attracts both sexes. Males then produce exo-brevicomin that attracts mainly females. Together, these pheromones act as a powerful attractant, whose effects are improved with monoterpene chemicals released from the tree during attack to attract large numbers of MPB (Borden et al. 2008). This can trigger a mass attack, where large numbers of MPB overwhelm the defenses of a tree. When the number of infesting beetles gets too high, aggregation pheromone release is reduced and anti-aggregation pheromones (frontalin and verbenone) are emitted.

The use of commercially available beetle pheromones and tree compounds as trap lures is a common management strategy for several important bark beetles. However, beetle response to these lures can depend on many factors, such as geography and population density (Miller et al. 2005). This puts Alberta in the unique position where the efficacy of commercially available lures for MPB is unknown because the lures were developed in a different region and pest population.

Recently, the laboratory of Nadir Erbilgin at the University of Alberta has tested different formulations of pheromones and tree chemicals to determine which is most effective for Alberta. Commercially available standard lures – aggregation pheromones alone or in combination with the tree chemical terpinolene – attached to plastic traps were tested against other tree chemicals that could be important for MPB attraction in the Swan Hills area (Klutsch et al. 2017). While this lure was effective, we caught nearly 200% more beetles with a mixture of aggregation pheromones plus the tree chemicals terpinolene and myrcene.

Trees can be baited with these lures to create trap trees in order to monitor beetle populations and concentrate beetles in trees destined for removal. In Alberta, low populations of MPB dispersing in the Leading-edge Zone are detected using a grid of baited trees, arranged in groups of three trees and spaced 45 km apart with approximately one group per township (Alberta Agriculture and Forestry 2016). The efficacy of such systems for detecting low populations of MPB, especially in novel habitats, is unknown.

A recent two-year study tested different numbers of baited trees and distances between groups of baited trees in the Swan Hills and Whitecourt areas. Groups of four trap-trees were

most effective at attracting beetles to mass attack with less spillover onto non-baited trees than groups of three or six trees. This shows that trap-trees can be effective at concentrating MPB into a small area. Furthermore, the number of attacked trees spillover were the same for trap-tree groups spaced at 8 km and 12 km, suggesting that trap-trees can be set up to 12 km away from one another to monitor MPB activities (Klutsch et al. 2017).

Together the most effective lure and efficient trap-tree system can be important tools in operational control programs for MPB, especially while MPB is still at low population levels in north-eastern Alberta. However, there remains a risk of unintentionally increasing MPB populations in these areas if attacked trees are not removed prior to emergence of the next generation of beetles. Therefore, a sustained effort to remove attacked trees is very important.

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Miller DR, Lindgren SL, Borden JH. 2005. Dose-dependent pheromone responses of mountain pine beetle in stands of lodgepole pine. Environmental Entomology 34: 1019-1027.

*Jennifer Klutsch, Jonathan Cale, and Nadir Erbilgin - University of Alberta*
*Department of Renewable Resources*

## Dwarf Mistletoe as Biocontrol?

New Zealand has a problem with 'wilding conifers' such as lodgepole pine (*Pinus contorta*) as a result of past plantings for shelterbelts and forestry. It is such a problem that a previous government awarded $16 million to a Wilding Conifer Management group to tackle the problem. *P. contorta* was declared an unwanted organism under the Biosecurity Act in 2001. This move paves the way for consideration of biocontrol agents to manage the unwanted trees.

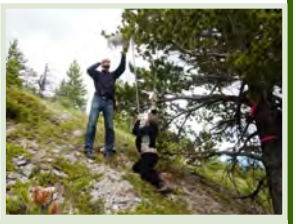
Dwarf mistletoes (*Arcuethobium* spp.) are a potentially ideal biocontrol agent because of their impacts and their host-specificity is well documented—and very specific for some species. Any potential for non-target impacts is considered low due to the slow rate of dispersal—*A. americanum's* slow generation time limits spread in its native range to 30-60 cm per year.

A researcher at NZ Landcare Research has linked with University of Oregon researchers who work on dwarf mistletoes and weed biocontrol. This collaboration, as well as expert opinion from USA/Canada, is intended to potentially determine which dwarf mistletoe species or combination of species might be the best choice.

*Marian Jones—Rocky Mountain House Forest Area*

# Five-needle pine 2017 season update

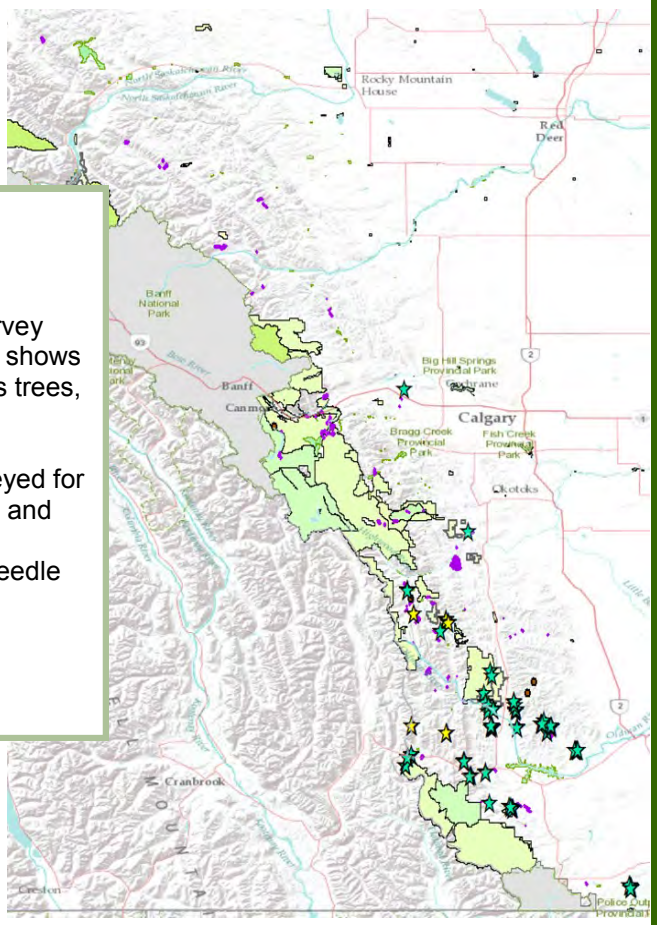
Did you bet on how many new plus trees the 2017 field crew selected? Twelve whitebark pine and 96 limber pine. 24 (both species) merit follow-up during a better cone crop. To date there are 213 limber pine and 59 whitebark pine plus trees, but we don't have seeds from them all.



Caging cones.

Twelve limber pines had a collectible cone crop this year. Fifteen whitebark pine and 112 limber pine plus trees have been sent for disease resistance testing. It takes about 7 years to get final results. These trees grow slowly, and some resistance mechanisms take years to manifest. For durable long term recovery, we need a diversity of ways to tolerate or resist this pathogen over the long term since it's here to stay, like many exotic invasive species. Trees we select in the field aren't all "winners" so continued selection and testing is needed to meet recovery targets.

177 polygons had 5-needle pine (5NP) presence, absence, density, and/or ecological data collected to improve habitat models and support prioritization of recovery work. Confirming absence is important to ensure resources aren't wasted revisiting areas with no 5NP that look promising on imagery.




South 2017 survey area: turquoise shows limber pine plus trees, yellow shows whitebark pine. Polygons surveyed for density, health, and abundance or absence of 5 needle pine in purple.

Crews did a lot of work this year with permission on private lands, including conservation properties held by agencies like Nature Conservancy of Canada; First Nations lands were also assessed with permission. Most were very supportive and interested in limber pine once they learned of its plight and status. Junior Forest Rangers, Forest Area staff, and other volunteers also joined the field crew.

Following up 2016 work, trees in Willmore Wilderness Area with seed in the seed bank were assessed to see if they should be included in the recovery program. Unfortunately so many tags were lost, staff re-measured 5 monitoring transects instead – rust noticeably increased from the last assessment but was still well under 50%, too low to reliably select plus trees. Five transects were re-measured in the David Thompson corridor with scientists from the USDA Forest Service following the access closure in the south. Thanks to Devin, Megan, Clint, Brittany, Matt, and to Wildfire for heli and accommodation. 2019 is planned to re-measure all transects throughout Alberta. We will be looking for support with logistics, access, and field work.

Humidity and temperature controlled inoculation chamber with leaves ready to drop spores onto tree seedlings .

Family rows of screened seedlings from prior years – all selections were plus trees, but not all plus trees have heritable resistance .

Jodie assisted with blister rust inoculations to screen some of our whitebark pine seedlings at Kalamalka Forestry Centre in BC, where regional pathology and genetics staff have set up a pilot program that has accepted Alberta material at no cost and can test 40 parent trees a year. The inoculations were successful and results will be monitored.

A whitebark pine provenance trial was donated and planted by the BC Government next to the limber pine provenance trial that was donated last year. This is the only Alberta site in a series of 10 range-wide large and 8 small whitebark pine provenance trials. Data from these long term trials is used to delineate seed zones and seed transfer guidelines. The limber pine trial had just under 95% survival after the first growing season.

The citizen science app “Save the Pine” using ESRI’s Survey123 for recreational users was little used but there was a slight increase after the September Whitebark Pine Ecosystem Foundation workshop in Jasper. A whitebark pine ESRI Story Map *Living on the Edge* has been published highlighting GoA recovery work.

With advice from Tim Juhlin (Blairmore Area Forester) and other GoA staff, a controlled replicated silviculture restoration trial was established north of Coleman. The objective is to determine what treatment may be most beneficial and cost-effective for releasing whitebark pine saplings, while maintaining a stocked stand of crop species. This is the first operational restoration trial of its kind in Canada; several exist in the USA. All trials were established using Provincial Growth and Yield Initiative standards and will be included in the PSP program for long term documentation.

Alberta Environment and Parks, Fish & Wildlife Policy Branch, Species At Risk provided funding to produce plus tree seedlings for restoration. This activity is an urgent priority in the provincial recovery plan for limber pine. Approximately 16,000 seeds from a diverse selection of limber pine trees, that are all being screened, are being stratified and will be grown in a commercial nursery with a planned planting date of fall 2019. Seed transfer rules for 5NP are also being revised to facilitate restoration.

This work can’t happen without partners. Forest Management Branch works with Alberta Fish & Wildlife Species At Risk program, and also receives support from Wildfire, Forest Area operational staff, Alberta Parks, Nature Conservancy of Canada (Alberta sections) BC Ministry of Forests, Lands and Natural Resource Operations, USDA Forest Service, many supportive landowners, Piikani Nation and Stoney Nation, Whitebark Pine Ecosystem Foundation, and other volunteers.

**Field work in 2018 will focus on cone collecting. To join us, or for training on identifying plus trees in your area or for extension materials, contact** Jodie.krakowski@gov.ab.ca

*Jodie Krakowski—ATISC*

# Whitebark Pine Ecosystem Foundation Workshop in Jasper

Canada's 150th included a huge variety of events from coast to coast to coast. But what was going on in the mountains? Parks Canada admission was free – and to help celebrate the anniversary Jasper National Park hosted the Whitebark Pine Ecosystem Foundation's (WPEF) annual Science and Management Workshop, a joint event with US and Canadian members.

The long standing format of a Directors' meeting the day before; a full day of presentations highlighting new research, policy, and recovery actions; and two days of field trips. Organizers handily rearranged initial field trip plans to still get attendees out to demonstrations, sites of interest, and engaged discussions in spite of over 30 cm of snow preventing access to the first planned trip.

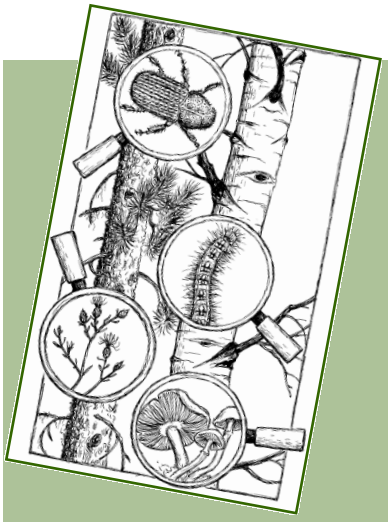
Altogether, 91 registrants from nearly every state and province across the species' ranges showed up. These enthusiasts were from federal, provincial, state, Aboriginal, academic, industrial and non-profit agencies. There were also many unaffiliated but passionate attendees. One highlight was hosting an entire keen class and two instructors from Lakeland College. Highlights included talks on grizzly bear use of whitebark pine seed in Canada; new work looking at interactions between climate change, northern range limits, whitebark pine and Clark's Nutcracker; progress on operational recovery and resistance screening range-wide; and launching of a US range-wide recovery program with support from numerous agencies.

The silent auction raised enough funds to support the annual WPEF student scholarship, and the social and field trips were buzzing with networking to forge new connections or visit with friends and colleagues. The first (rearranged) field trip featured an equipment climbing demonstration with Parks Canada staff using their adapted ultralight gear, and a hike and discussion of monitoring. The second field day headed south to look at limber pine restoration projects, monitoring plots, and a research trial.

**A thank you to all the organizers for a terrific meeting. The 2018 workshop is in scenic, historic Stanley, Idaho.**

Forest Health and Adaptation

*Jodie Krakowski—ATISC*





# Fungi Gone Astray

## *to the tune of Jingle Bells*

*Drifting through the air…On a gentle spring-time breeze*
*Or wafting in the mist…Landing on the trees*
*Tons and tons of spores…Catch a little ride*
*Find a good substrate…And snuggle down inside*

*Oh, Dothistroma, needlecasts…Fungi gone astray*
*Cronartium stalactiform…Will wreck a poor pine's day – hey!*
*Dothistroma, needlecasts…Fungi gone astray*
*Rusts and brooms…Wilts and blights…Diseases here to stay*

*Many years ago…Some Europeans said*
*"Almost all the pines…We brought home here are dead!"*
*So they took them back…To whence they once came from,*
*A decision that we all can say…In hindsight, was quite dumb!*

*Oh, Dothistroma, needlecasts…Fungi gone astray*
*Cronartium stalactiform…Will wreck a poor pine's day – hey!*
*Dothistroma, needlecasts…Fungi gone astray*
*Now with white pine blister rust…Some pines are in dismay*

*Out in Smoky Lake…A mycologist did say*
*If you want to save your pines…You'd better get some spray – hey, hey, hey!*
*So the trees were sprayed…It was a messy fight*
*But the gooey bluey fungicide…Helped to ease their plight*

*Oh, Dothistroma, needlecasts…Fungi gone astray*
*Cronartium stalactiform…Will wreck a poor pine's day – hey!*
*Dothistroma, needlecasts…Fungi gone astray*

*Climate change may make things worse…*
*More wave years on the way*
*Climate change may make things worse…*
*We're gonna have to pray*
*If climate change does make things worse…*
*There'll be a pine doomsday!*

**Listen here**
Performed by *Telio Tom & the Basidiospores*

*Tom Hutchison—Edmonton*

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