Bugs and Diseases

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FH 100 - 2021 - The long awaited sequel

This spring saw the return of many things – flowers, birds, mosquitoes, and (from June 15 to 17) Forest Health 100 (FH 100). FH 100 is an introductory course aimed at promoting a basic understanding of forest health issues and current forest health best practices. Until 2017, FH 100 occurred biennially at the Hinton Training Centre (HTC). However, HTC had to cancel the last two offerings due to fires and COVID-19. This year, in conjunction with the HTC, the course moved entirely online. The new delivery method posed many challenges, and the transition was somewhat difficult. However, the team of instructors (Mike Undershultz, Caroline Whitehouse, Pam Melnick, Fraser McKee, Ryan Hermanutz, Devin Letourneau, and myself) produced something quite good – at least according to my personal bias. As well, the HTC (and in particular Sr. Forestry Management Specialist – Chris Gosman) did a great job of hosting the virtual course, putting together binder content, etc.

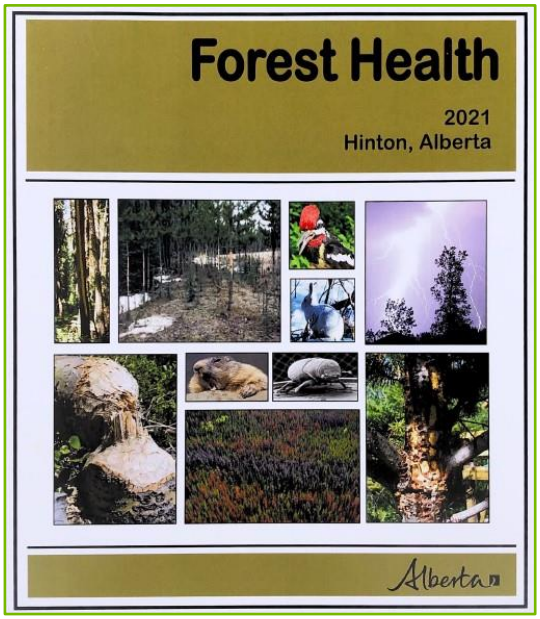

Photo credit: Tom Hutchison

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Alberta

The feedback we have received was generally positive. Of the 18 responses to the post-course survey, only one felt FH 100 did not meet personal expectations. This person felt the course was too broad and should have focused on a few damaging agents of concern in Alberta. Feedback is helpful and could be the basis for other, future FH courses. FH 101 anyone? Many positively commented on the high level of interactivity for a virtual course. This is something we were striving for, so it was good to hear appreciation. Other responses cited creative aspects (songs, poems) as things they enjoyed about the course. I am going out on a limb to suggest FH 100 is the only course HTC has ever put on that included a “live off the floor” rendition of a weed picking song.

We tried our best to make the online FH 100 enjoyable as well as informative. Still, in-person instruction is preferable to virtual instruction, and the field sessions were the thing most people enjoyed in previous FH 100 courses. Moving to an online format should provide some certainty the course will happen again in the future. Still, I hope when it does, it will include some face-to-face component. Perhaps next time, a hybrid model could offer the best of both. The next FH 100 is scheduled for 2023. We hope to see many new faces there.

Tom Hutchison - Edmonton

New answers to old questions? A collaborative approach to assessing SBW impacts in northwest Alberta

In the summer of 2021, Alberta Agriculture and Forestry and Tolko engaged in a partnership to gain an understanding of how repeated annual defoliation from eastern spruce budworm (*Choristoneura fumiferana* (Clem.)) is affecting the health of spruce forests in northwest Alberta. The project, referred to as *Spruce Budworm Impact Assessment 2021*, will provide a snapshot of current conditions as represented by four indicators of tree health: defoliation of current-year growth, cumulative or total canopy defoliation, dieback (i.e. top-kill) and tree mortality. Observers performed ocular assessments over the upper 40 per cent of live Crown to estimate defoliation in stands with variable histories of consecutive annual defoliation. To capture mortality levels, a tree health code (i.e. alive, alive with significant health issues, and dead) was assigned over a variable-length and four metre-wide transect plot. In this manner, nearly 1,800 trees were assessed over a two-week period after budworm feeding was complete.

Photo credit: Ryan Hermanutz

However, with a long and well-documented history of outbreaks in northwest Alberta, this is not the first opportunity or attempt to assess impacts from spruce budworm. Top research scientists with the Canadian Forest Service have probed northwest forests during highpoints of budworm populations since the 1960’s with similar goals. Their learnings have been important to not only determine biological factors affecting populations, such as the importance of understanding phenology and synchronicity of bud development and larval feeding, but also to estimate growth losses, canopy dieback levels and mortality rates. After demonstrating wide variability in these rates, findings

remain only broadly applicable and specific to conditions at the time. Ever-changing climate, pest and forest conditions (e.g. age, composition) force a requirement to re-assess the static relationship between forest insects and forest health.

The support of the Forest Resources Improvement Association of Alberta (FRIAA), and funds administered through the Forest Resources Improvement Program (FRIP), were essential to completing the data collection portion of the project. With companies such as Tolko contributing directly, the *Spruce Budworm Impact Assessment 2021* is an excellent way to utilize funds appropriately, and demonstrates the shared responsibility of pest management and integrated management practices.

Although results were not available at the time of publishing, it's hoped these assessment techniques can be used repeatedly, as needed, to gain accurate, real-time information. This technique offers the ability to investigate areas of potential high impact or to target areas where management strategies could be implemented. Since no permanent sample plots are established, this assessment does not provide for long-term monitoring. In the case that spruce budworm defoliation persists in northwest Alberta, and poses a risk to forest health in the coming years, forest management objectives will be more appropriately informed.

Federal – Provincial MPB Research Partnership

Alberta continues to face an ongoing threat from the mountain pine beetle. Since the turn of the century, forests lost entirely or variably damaged by this invasive insect have expanded significantly. Alberta has implemented effective control and management policies resulting in an encouraging curtailment of the beetle in the provinces' pine forests.

From 2007-2021, Alberta has invested nearly $5 million in research covering the broad themes of beetle biology and management; hydrological impacts of the mountain pine beetle; landscape and stand dynamics following MPB; and social and economic implications of a changing landscape. During this period of intensive research, nearly 40 projects were undertaken and provided numerous scientific papers, technical reports, Quick Notes and presentations (the reader is invited to download a recently completed Annotated Bibliography[1]). Operational strategies are supported by research that addresses critical information needs.

Despite the broad nature of past research and its advancement of science essential for managing the spread of the beetle, many questions remain unanswered. Moreover, Alberta faces impacts from source areas from the Banff area and Jasper National Park. The expected funding level dedicated to beetle management was deemed insufficient to protect Alberta's pine forests and to limit the eastward spread of the beetle. It was imperative that a partnership with the federal government was necessary to mount continued operational and research efforts. A proposal accepted by the federal government resulted in a joint Federal-Provincial Partnership to achieve the following outcomes:

1. Limit the spread of the mountain pine beetle into the eastern boreal forest,
2. Limit the mountain pine beetle along the eastern slopes of Alberta,

[1] Rubuliak, N, Odsen, S, and Pyper, M. 2021. Annotated Bibliography for the Mountain Pine Beetle Ecology Program. fRI *Research*. 61p. MPB Annotated Bibliography.

3. Mitigate damage to Alberta's pine resources in locations in areas where mountain pine beetle is already established, and
4. Generate knowledge and innovative management techniques through research focused on mountain pine beetle.

The partnership is providing $56 million for operations and $4 million for research. While operational activities address outcomes 1-3 above, new knowledge offers support for these activities. Specific research themes, nationally and provincially based, were selected and provided the essence of a request for proposals administered by fRI Research. The research themes were reasoned to encompass critical information needs to be satisfied to achieve the desired outcomes noted above.

The process initiating the request for proposals began with the selection of a Research Advisory Committee (RAC) comprising of members from government, industry and the Canadian Interagency Forest Fire Centre. Members provided valuable input to develop the rationale for the research themes as listed and described below:

Strategic research theme #1: Beetle biology

Unlike in British Columbia, where lodgepole pine co-evolved with mountain pine beetle, Alberta pine is more vulnerable to mortality due to its lack of co-evolution. As the beetle spreads eastward through novel habitats of lodgepole pine, lodgepole pine X hybrid jack pine, and jack pine, one can expect to witness unique population dynamics and a range of biological interactions with new hosts, fungal associates, natural enemies and competitors. Refining our knowledge on beetle biology in eastern habitats will enhance risk assessments in eastern pine forests. Moreover, climatic variations will broadly shift our current understanding requiring reassessment of existing science to guide future management decisions.

Strategic research theme #2: MPB dispersal

The mountain pine beetle expands its range by spreading through the landscape in short and long-distance dispersal flights. MPB populations face challenges in their extended range with more heterogeneous pine forests of lodgepole pine and hybrid lodgepole X jack pine. These forests exhibit various degrees of resistance and, regionally, exhibit a vastly different climate than experienced in the beetle's historical range. These factors, and others, affect their dispersal capability and impact population expansion.

Strategic research theme #3: Detection of MPB

Tools to confidently detect the presence of MPB at varying densities are critical for managing beetle populations successfully. Control efficacy is partially limited by effectively detecting green-attack trees and responding within a given timeframe. Historically, provincial detection efficacy for green attack trees ranged between 54-68 per cent. Improving detection methodologies is paramount to limit the spread of the beetle.

Strategic research theme #4: Ecological and social impact

MPB outbreaks cause broad-scale ecological changes in pine forests, leading to socio-economic impacts on the community well-being and security of the forest industry. Understanding their impact is necessary to develop preparedness plans and to increase community resiliency. Research on the effects of MPB in new novel habitats is required. Moreover, understanding is needed on the response of endangered species to changes in habitat due to MPB, hydrologically induced changes across the landscape and stand regeneration. Research carried out by fRI Research through its Mountain Pine Beetle Ecology Program has provided essential insights to these questions, but more needs to be done.

Strategic Research Theme 5: Wildfire Behaviour after MPB

Studies have shown that tree mortality resulting from MPB infestations affects the susceptibility of stands to fire through changes in fuel loading, fuel structure and microclimates. Changes in fuel chemistry, e.g. the release of highly flammable terpenoids by dying trees and the availability of standing dead trees, can potentially and dramatically impact fire behaviour. Federal scientists have noted that MPB-killed trees may increase the frequency and intensity of wildfires and contribute to a more rapid spread and a greater likelihood of Crown fires. However, many knowledge gaps remain, particularly in light of climate change and forest compositions in novel habitats.

Current research

The Strategic Research Themes were central to the request for proposals, which was issued in March 2021. Twenty-four proposals were received and subsequently reviewed by the Research Advisory Committee. Fifteen proposals were recommended for funding and are listed below by Strategic Research Theme:

Theme	Principal Investigator	Project Title
1	Dr. Catherine Cullingham Carleton University	Modelling eastern spread risk of mountain pine beetle using host genetic ancestry
1	Dr. Heath MacMillan Carleton University	The physiological costs and consequences of overwintering in Mountain Pine Beetle
1	Dr. Nadir Erbilgin University of Alberta	Improving monitoring tools to detect mountain pine beetle at low densities in novel habitats: incorporating host-tree stress and fungal volatiles in beetle attraction
2	Dr. Maya Evenden University of Alberta	Assessment of eastern spread risk of Mountain Pine Beetle through studies on beetle dispersal and host colonization
2	Dr. Allan Carroll University of British Columbia	Dynamic species distribution modelling to predict mountain pine beetle boreal invasion
3	Dr. Nadir Erbilgin University of Alberta	Efficient monitoring of mountain pine beetle outbreak spots using artificial intelligence applied to drone thermal imagery
3	Dr. Allan Carroll University of British Columbia	Toward preemptive management of future outbreaks: predicting the distribution of post-epidemic mountain pine beetle populations in the western boreal forest
4	Jodi Krakowski Whitebark Pine Ecosystem Foundation of Canada	Gene conservation to mitigate impacts of mountain pine beetle on endangered whitebark pine at its northern limit in Alberta
4	Dr. Nicholas Coops University of British Columbia	Development of fine spatial resolution tree species information for MPB-impacted ecosystems for Species-at-Risk habitat assessment
4	Dr. Eric Higgs University of Victoria	Using innovative techniques to understand how mountain pine beetle is shifting ecosystem composition and configuration in Jasper National Park.

Theme	Principal Investigator	Project Title
4	Dr. Justine Karst University of Alberta	Soil carbon stocks in forests recovering from mountain pine beetle outbreak: a possible C sink?
5	Dr. Nicholas Coops University of British Columbia	Generation of Tree level Fire Fuel Information across MPB Infestation Mosaics
5	Dr. Christopher Bone University of Victoria	Assessment of Risk Factors Influencing Landscape Level Fire in MPB Forests
5	Dr. Laura Chasmer University of Lethbridge	Quantifying spatio-temporal variability in post-mountain pine beetle outbreak fuels, in Jasper National Park, using terrestrial laser scanning, and bi-temporal multi-spectral airborne LIDAR
5	Dr. Patrick James University of Toronto	How do the spatial legacies of mountain pine beetle outbreaks affect fire severity in Canadian lodgepole pine forests?

An Introductory Quick Note posted on the fRI Research website will give readers an overview of respective projects. As regular progress updates are received from principal investigators, they will be added to the website. Readers are invited to visit this website to obtain detailed information on each project or contact Keith McClain, Research Program Manager (kmcclain@friresearch.ca) or Caroline Whitehouse, Research Program Chair (carolinewhitehouse@gov.ab.ca).

Keith McClain, Ph.D., RPF
Program Lead, MPBEP, fRI

Bugs & Diseases Flashback!

The other day, I pulled down a thick binder from my office shelf labeled “Bugs & Diseases”. Flipping to the back, I was amazed to see that the first edition of the newsletter was published in June 1989. Bugs & Diseases was the brainchild of two pioneers of forest health in Alberta: Hideji Ono and Sunil Ranasinghe of Alberta Forest Service’s Forest Protection Branch. The names have changed, but the song remains the same; this newsletter has been Alberta’s eye on forest health for 32 years! To celebrate the longevity of this publication, I want to take some space in the next few issues to look back at some articles that are interesting (and entertaining) from a historical perspective.

The following article was from Vol. 9 No. 2 (published in August 1998), where Erica Samis reported on the initial trickle of mountain pine beetle into the Willmore Wilderness Park. Erica recalls that the infested trees were located near the Jackpine Pass, adjacent to a growing MPB population in the Holmes River valley of British Columbia. In relation to Alberta’s current outbreak, this was only the second year that MPB was detected. Twenty-three years have passed, and these 23 infested trees represent some of the very first of the 1.88 million trees controlled to date.

Mike Undershultz - Edmonton

Flashback!

Bugs & Diseases info note
August 1998

MPB bugging Willmore

The Willmore Wilderness Park is becoming an area of concern for insect infestations. Each year 16 mountain pine beetle and 10 spruce budworm pheromone plots are set up. In the 1997 survey year, nine mountain pine beetle plots had successful attacks with a maximum of 60 hits per tree. Early in June, Land and Forest Service, Natural Resource Service, and Weldwood of Canada Ltd. employees worked co-operatively on a pine beetle control program in the Willmore. During the three days seven trees were felled and debarked, seven trees were left standing and debarked, and nine trees were cut and burned.

The controlled sites were checked later in June and new hits were noticed on five of the sites where the trees had been debarked. An aerial survey and plot check is planned for the first week in September. Once the sites are assessed, a control program for the end of September will be planned.

Jasper National Park is in the process of developing a Forest Insect and Disease Management Plan. Information will be shared between JNP, Land and Forest Service, and the B.C. Forest Service to determine the extent of the existing problem, potential risks, and develop a long term program if needed. ◘

Erica Lee
NES Forest Health Officer

Find the hidden scientific names for the species listed below

Y H U D G S U I X N A S U L I R G A U X J D K
J P W L H N Q R T A Y U N R B K G J R I B C O
D E N D R O C T O N U S P O N D E R O S A E Y
X B A I R T S S I D A M O S O C A L A M G S V
W V C A F D A T Q Q G X B K I N L B Q A Z T J
R K W Z X F Y X U H I R L H E M V F S G Y C R
G S B G S I C I L A S A M O C U E L N Q N Y D
L Y M A N T R I A D I S P A R D I S P A R L O
F X E L P M I S S U N O T C O R D N E D W O H
P E K B M U C S U F M U I P O R T E T Z S Q E
U R G P A M W B S Y W Y C P Z Z R U E T N T A
G H R C P M A H S W V U Q C U J N B G Y N Z R
U R Y K A T A E C U R B A R E T H P O R E P O
P I K O N E M A A L A S K E N S I S O V L G H
U P B H R O L O C E D A I G R A N E Y M X F N
L H A C I N N E F A I B E T C A Q Z R G S U W

ASIAN LONGHORNED BEETLE
ASPEN TWOLEAF TIER
BLACK ARMY CUTWORM
BRONZE BIRCH BORER
BROWN SPRUCE LONGHORN BEETLE
BRUCE SPANWORM
EASTERN LARCH BEETLE
EASTERN SPRUCE BUDWORM
FOREST TENT CATERPILLAR
GYPSY MOTH
LARGE ASPEN TORTRIX
MOUNTAIN PINE BEETLE
PALE-HEADED ASPEN LEAF ROLLER
SATIN MOTH
YELLOWHEADED SPRUCE SAWFLY

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Bugs & Diseases informs forestry-related personnel about current forest health issues.
Articles and photos are welcome.

Heat Dome

So hot, what hath thou wrought?

Heat stress, as you might guess
Is hard on vegetation
Wilting, scorching foliage, pushing trees toward the edge
Of further degradation

This year's summer may be a bummer
For the health of many trees, I mean
The effects of the heat, that had records beat
Is, no doubt, still to be seen

The heat dome may have made your home
Uncomfortable and hot
Still, think of a tree, with no AC
Its health prognosis fraught

Tom Hutchison - Edmonton

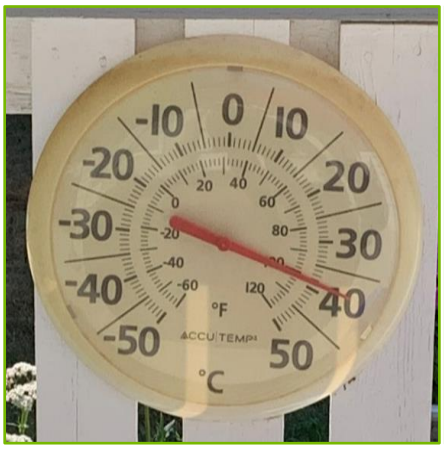

Photo credit: Tom Hutchison

Photos submitted by readers

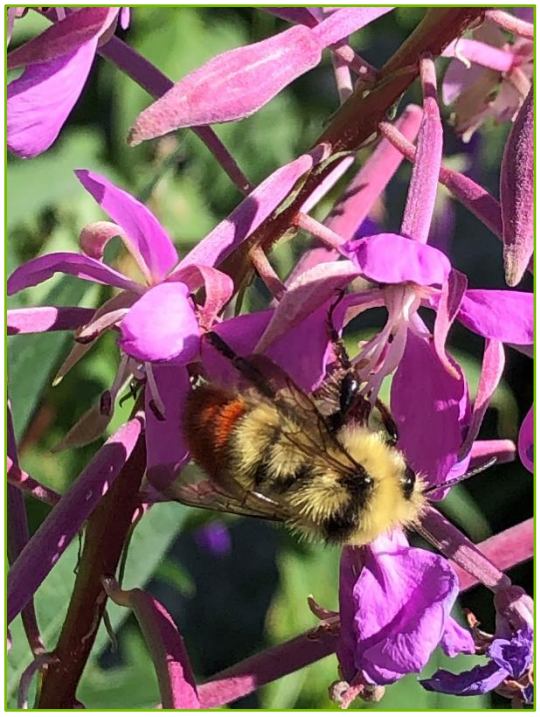

Photo credit: Iain Johnston

Orange-belted bumblebee (*Bombus ternarius)* on Fireweed (*Chamaenerion angustifolium)*

Reproduction of fireweed

This perennial species flowers in summer. Each flower lasts about 48 hours. On the first day, the male organs reach maturity and the pollen is transferred to other flowers by insects. On the second day, the female organs on the same flower reach maturity and receive pollen from younger flowers. This phenomenon prevents the flowers from self-fertilizing. Bumblebees are the main pollinators of fireweed, often sleeping on the flowers at nighttime.

Space for Life. Fireweed. https://espacepourlavie.ca/en/biodome-flora/fireweed