Mountain Pine Beetle Information Exchange Forum

April 22 and 23, 2015 | Edmonton, Alberta

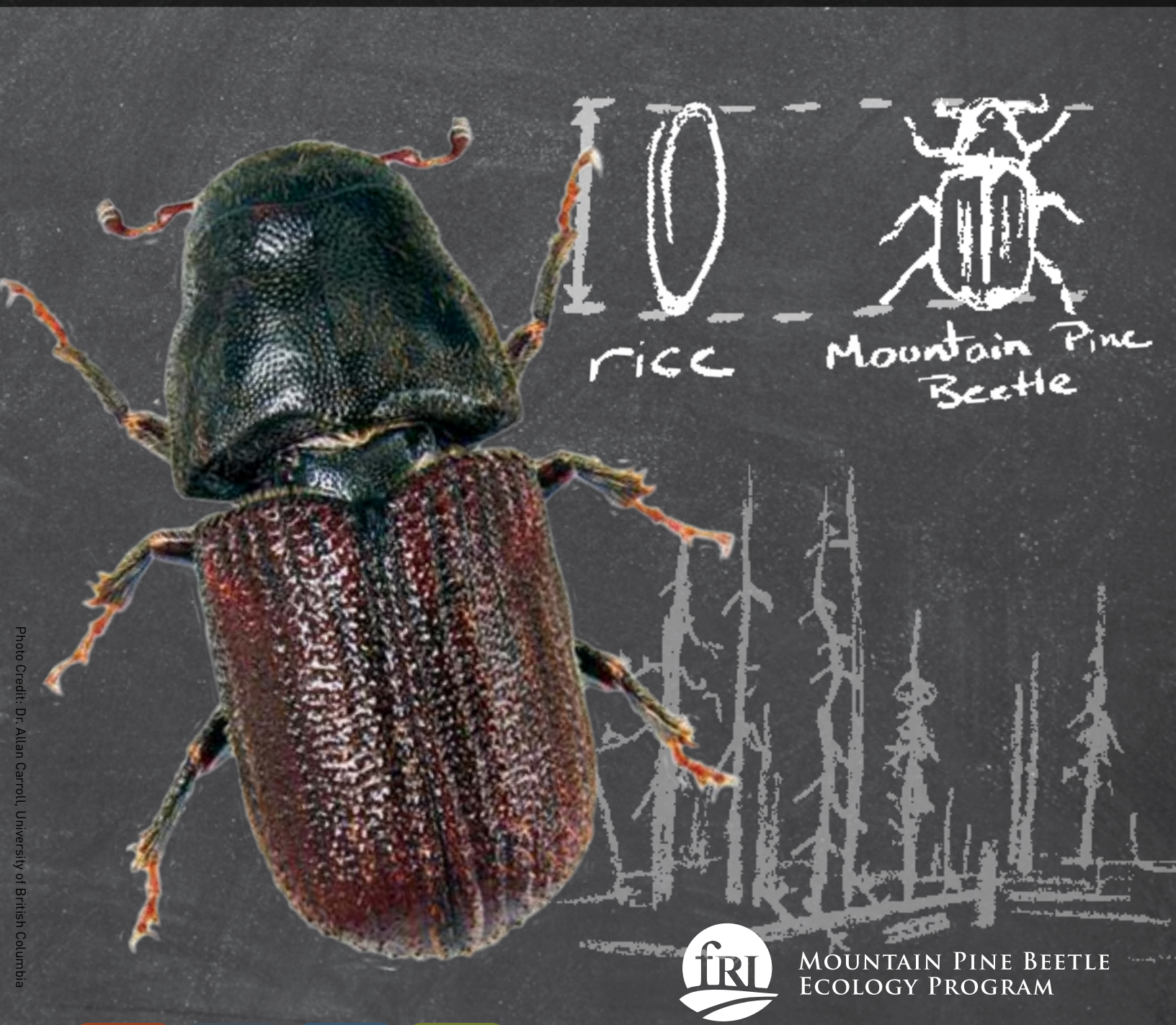

Photo Credit: Dr. Allan Carroll, University of British Columbia

FRI Mountain Pine Beetle Ecology Program

Keith McClain, Ph.D., R.P.F.

Keith is a registered professional forester and has worked in forest science for the past 40 years. After spending 17 years as a research scientist and manager for the Ontario Ministry of Natural Resources he moved to Prince George, British Columbia to work with the Canadian Forest Service as research manager in applied research and technology transfer. In 2003, he was appointed to the position of Director, Science Policy and Strategy with Alberta Sustainable Resource Development where he promoted the acquisition and application of science for informed decision-making and policy development. Since April 2012 Keith has provided leadership for the Mountain Pine Beetle Ecology and Socio-Economics Programs at the Foothills Research Institute. Keith has B.Sc.F. and M.Sc.F. degrees from the University of Toronto and a Ph.D. from Oregon State University.

WELCOME TO fRI'S ANNUAL MPB ECOLOGY PROGRAM INFORMATION EXCHANGE FORUM.

It has been a year since fRI hosted the last Information Exchange Forum. I have often pondered about the frequency of these meetings, but I am quickly brought to my senses when I consider the enormity of the challenges that still face Alberta in managing the mountain pine beetle and preserving its pine resource.

As the beetle continues to move northward and eastward into novel habitats, we realize that we cannot confidently rely on all of our past science-based information to guide operational decisions. Moreover, other factors such as changing climate, environmental conditions and a new host pine species suggest that modification of current management strategies will be required.

The extent of these changes is a question that research sponsored by the Mountain Pine Ecology Program (MPBEP) intends to answer. In 2013, the program refined its priorities to address these new unknowns. For nearly a year and a half research projects have been underway and are providing new insights on beetle biology and population dynamics, factors affecting the rate of spread, cold tolerance in novel environments, beetle and forest interactions, and low-beetle-density detection strategies. We are also supporting the development of models to assess the effectiveness of current management strategies that will allow for the determination of success as the range of the beetle increases northward and eastward.

We remain optimistic that through collaboration with the scientific community, industry, provincial and federal governments and forest practitioners, damage caused by the beetle will be held to tolerable levels. However, our optimism for the future has to be balanced against unparalleled damage to Alberta's pine resource, which serves to remind us of the immense task ahead to restore affected landscapes.

From a social and economic standpoint, the impact of the decline in the pine resource will be felt for many years to come: the forest industry will see disruption in wood supply, forest-dependent communities will see declines in employment, hydrological changes may result in alterations to aquatic ecosystems and declines in water quality, wildlife habitats will suffer variable effects, recreational opportunities may decline and, most worrisome, there may be increasing threats of fire, destruction of infrastructure and loss of life.

These potential scenarios have provided the impetus for the MPBEP to embark upon a regimen of research that will support the rehabilitation of damaged pine landscapes. We have to accept the fact that not all pine sites will be actively rehabilitated for reasons such as productivity, current re-vegetation status, and accessibility. At the 2014 Information Exchange Forum, guest speaker Dr. Dave Coates, BC Forest Ecologist, warned that we have to be prepared to walk away from some sites. This has been a common experience in British Columbia. As we renew our forests it will be a challenge for us to understand the complexities of forest site / vegetation interactions and potential vegetation trajectories so that forest practitioners make best decisions as to where to allocate scarce resources.

During the two days of this Forum, you will hear about new research findings and their importance from a social and economic stand point, and be encouraged to contribute your thoughts as to their operational application. Especially important for the successful outcome of this Forum will be your active participation in Day 2 that will require consideration of landscape – forest scenarios and development of silviculture prescriptions to return them to future productive forest ecosystems. This is where your expertise will come into play. Enjoy the Forum.

Photo Credit: Dr. Allan Carroll, University of British Columbia

LOCATION AND PARKING

University of Alberta

Maple Leaf Room, Lister Centre

87 avenue and 116 street

Pay parking is available at the University of Alberta lots shown below

Lister Centre is located west of the Jubilee Auditorium

Event location

Parking

SPONSORSHIP

fRI's Mountain Pine Beetle Ecology Program is proud to have Alberta Innovates - Bio Solutions (AI Bio) as a co-sponsor of the 2015 Information Exchange Forum.

AI Bio is a board-governed agency of the Government of Alberta that works with partners to identify, coordinate and fund research projects to grow prosperity in Alberta's agriculture, food and forestry sectors. They help to solve industry challenges with solutions that deliver economic, environmental and social benefits. AI Bio has the benefit of working with agriculture and forestry, the province's leading renewable industries that currently contribute more than $25 billion every year into the Alberta economy.

Alberta Innovates Bio Solutions

AGENDA

Day 1 Wednesday APRIL 22, 2015
Maple Leaf Room, Lister Conference Centre, University of Alberta

Time	Presentation	Presenter
7:45 – 8:30	CONTINENTAL BREAKFAST	
8:30 – 8:45	Welcome, Forum objectives and the day ahead	**Dr. Keith McClain**, Program Lead, fRI – MPBEP, Edmonton, AB
8:45 – 9:30	Forests of today – taking a step back to look forward	**Dr. Bruce Larson**, Professor and FRBC Chair of Silviculture, Faculty of Forestry, University of British Columbia, Vancouver, BC
9:30 – 10:00	Impacts of MPB at the community level	**Mr. Richard Harpe**, Councillor, Division 8, County of Grande Prairie No. 1, Grande Prairie, AB
10:00 – 10:30	HEALTH BREAK	
10:30 – 11:50	MPB Status Report: British Columbia	**Dr. Art Stock**, RPF, Regional Entomologist, BC Ministry of Forests, Lands, and Natural Resource Operations, Nelson, BC
	MPB Status Report: Alberta	**Erica Samis**, Senior Manager, Forest Health and Adaptation Section, Environment and Sustainable Resource Development, Edmonton, AB
	MPB Status Report: Saskatchewan	**Dr. Rory McIntosh**, Provincial Forest Entomologist and Pathologist, Forest Service Branch, Ministry of Environment, Government of Saskatchewan, Prince Albert, SK
	The Risk of Mountain Pine Beetle spread to eastern pine forests: *What can we predict?*	**Dr. Barry Cooke**, Research Scientist, Spatial Dynamics of Insect Populations, Northern Forestry Centre, Canadian Forest Service, Natural Resources Canada, Edmonton, AB and Dr. Allan Carroll, Associate Professor and Director, Forest Sciences Program, Department of Forest & Conservation Sciences, University of British Columbia, Vancouver, BC
11:50 – 12:15	Cold tolerance of MPB: *Implications for population dynamics and spread*	**Dr. Katherine Bleiker**, Research Scientist, Bark Beetle Ecology, Pacific Forestry Centre, Canadian Forest Service, Natural Resources Canada, Victoria, BC
12:15 – 1:15	LUNCH	
1:15 – 1:40	Development of monitoring tools to detect mountain pine beetle at low densities on the eastern and northern edge of beetle expansion into Saskatchewan and Northwest Territories	Dr. Nadir Erbilgin, Canada Research Chair & Associate Professor and **Jennifer Klutsch** Ph.D. Candidate, Department of Renewable Resources, University of Alberta, Edmonton, AB
1:40 – 2:05	Dynamics of endemic mountain pine beetle populations in novel pine habitats	**Dr. Allan Carroll**, Associate Professor and Director, Forest Sciences Program and Stanley Pokorny, Ph.D. Candidate, Department of Forest & Conservation Sciences, University of British Columbia, Vancouver, BC

Day 1 Wednesday APRIL 22, 2015

Maple Leaf Room, Lister Conference Centre, University of Alberta

Time	Presentation	Presenter
2:05 – 2:30	Assessing the effectiveness of Alberta's forest management strategies against the mountain pine beetle	**Drs. Allan Carroll**, Brad Seely, Clive Welham, and Harry Nelson, Professors, Department of Forest & Conservation Sciences, University of British Columbia, Vancouver, BC
2:30 – 2:45	HEALTH BREAK	
MOVING INTO THE REHABILITATION REALM		
2:45 – 3:05	Impacts of MPB on hydrology and vegetative redevelopment in lodgepole pine forests	**Drs. Ellen Macdonald** and Uldis Silins, Professors, Department of Renewable Resources, Faculty of Agricultural, Life & Environmental Sciences, University of Alberta, Edmonton, AB and Axel Anderson, fRI Water Program Lead, Edmonton, AB
3:05 – 3:25	Beyond the beetle: *Natural and Facilitated Pine Regeneration After MPB Attack*	**Drs. Ellen Macdonald**, Victor Lieffers, Nadir Erbilgin, and Mike Flannigan, Professors, Department. of Renewable Resources, Faculty of Agricultural, Life & Environmental Sciences, University of Alberta, Edmonton, AB
3:25 – 3:45	Innovative stand enhancement and regeneration systems to recover value, reduce risk and rehabilitate mountain pine beetle affected stands in the Alberta boreal plains ecozone	**Derek Sidders**, Regional Coordinator and Program Manager, and Tim Keddy, Wood Fibre Development Specialist, Canadian Wood Fibre Centre, Natural Resources Canada, Northern Forestry Centre, Edmonton, AB
3:45 – 4:05	Dynamics of lodgepole pine regeneration and implications for forest management following MPB attack	Dr. W.R. (Dick) Dempster, Research and Development Associate and **Sharon Meredith, RPF**, Director, Forest Growth Organization of Western Canada, Hinton, AB
4:05 – 4:30	Potential impacts of mountain pine beetle and management actions on grizzly bear and caribou populations in West Central Alberta	**Dr. Laura Finnegan**, fRI Lead, Caribou Program, Gord Stenhouse, fRI Lead, Grizzly Bear Program and Terry Larsen, Biologist, fRI Grizzly Bear Program, Hinton, AB
5:00 – 6:30	CIF AGM and Awards Reception: Cash Bar and Hors d'oeuvres	Join the **Canadian Institute of Forestry, Rocky Mountain Section** for its AGM and celebration of member achievements by the Section and nationally by the Institute.

AGENDA

Day 2 Thursday April 23, 2015

Maple Leaf Room, Lister Conference Centre, University of Alberta

Time	Title	Presenter
7:45 – 8:30	CONTINENTAL BREAKFAST	
8:30 – 8:45	The day ahead	**Dr. Keith McClain**, Program Lead, fRI MPBEP
8:45 – 9:30	Is it a disaster or merely a catastrophe? Living with disturbance	**Dr. Bruce Larson**, Professor and FRBC Chair of Silviculture, Faculty of Forestry, University of British Columbia, Vancouver, BC
9:30 – 10:00	How ecosystem services thinking can be used to guide rehabilitation of affected landscapes	**Gillian Kerr**, Manager, Biodiversity and Ecosystem Services, Environment and Sustainable Resource Development, Edmonton, AB
10:00 – 10:20	**HEALTH BREAK**	
10:20 – 11:00	Planning for successful rehabilitation of Alberta's MPB damaged landscapes	**Dr. Keith McClain**, Program Lead, fRI MPBEP
	Working towards successful outcomes on post beetle landscapes within Alberta	**Brooks Horne**, RPF, Senior Forester-Forest Rehabilitation, Environment and Sustainable Resource Development, Edmonton, AB
	The silviculture prescription and an exercise in mountain pine beetle damage rehabilitation decisions	**Marty O'Byrne**, RPF, Senior Forester Silviculture Practice, Environment and Sustainable Resource Development, Peace River, AB
	The scenario/ silviculture planning exercise: goals and objectives	**Dr. Keith McClain**, Program Lead, fRI MPBEP
11:00 – 12:15	**Stand level scenarios and development of responsive strategies.** Forum participants are encouraged to lend their expertise, opinions and professional experience to develop brief, but effective rehabilitation options for different scenarios of MPB-damaged landscapes. The challenge and fun of this exercise lies in the collective application of creative thought and insight to propose and justify opportunities for replacing, maintaining or enhancing ecosystem services following MPB damage. This exercise is also intended to consolidate the elements of the presentations delivered during the workshop, moulding them into practical, justified strategies on the ground. Participants can also look forward to the plenary session where each group will present their proposals to elicit further discussion and insights from the group as a whole.	
12:15 – 1:00	LUNCH	
1:00 – 1:20	Scenario 1 – Critique of strategies	Table Lead
1:20 – 1:40	Scenario 2 - Critique of strategies	Table Lead
1:40 – 2:00	Scenario 3 - Critique of strategies	Table Lead
2:00 – 2:20	Scenario 4 - Critique of strategies	Table Lead
2:20 – 2:40	Scenario 5 - Critique of strategies	Table Lead
2:40 – 3:00	HEALTH BREAK	
3:00 – 3:20	Scenario 6 - Critique of strategies	Table Lead
3:20 – 3:40	Scenario 7 - Critique of strategies	Table Lead
3:40 – 4:00	Scenario 8 - Critique of strategies	Table Lead
4:00 – 4:15	Parting and collective thoughts; Adjournment	**Dr. Keith McClain**, Program Lead, fRI MPBEP

fRI's Mountain Pine Beetle Ecology Program

	Research Theme 1: MPB Biology and Management
1.	What is the efficacy of current control measures applied to MPB in Alberta?
2.	What drives local and long distance beetle dispersal, establishment and population dynamics of MPB in novel host environments?
3.	What critical establishment thresholds can be defined to guide operational management of MPB infestations in novel habitats?
	Research Theme 2: Hydrological Impacts of Mountain Pine Beetle
1.	What are the specific thresholds in MPB affected watersheds that are indicative of pending negative conditions such as, changes in water quality and quantity, deterioration in aquatic habitat, flood potential?
2.	What is the range of hydrological impact at stand and watershed levels from variable MPB attack; can hydrological recovery be effectively determined?
	Research Theme 3: Dynamics of Natural and Managed Lodgepole Pine Stands Following MPB
1.	What are the vegetation dynamics in managed and natural pine dominated stands across Alberta's ecosites following variable MPB caused mortality?
2.	What site parameters (e.g. ecosystem services, stand dynamics) ought to be evaluated to determine candidacy for treatment (including salvage) versus those that ought to be left for natural succession? What are the thresholds of these parameters by ecosite that suggest treatment success?
3.	What operational measures can be taken to restore landscapes severely altered by MPB to ensure the flow of ecosystem services?
4.	How is wildlife habitat for grizzly bear and caribou affected by landscape change due to MPB, and what rehabilitative measures can be taken to restore their critical habitat?
5.	How does fire risk and fire behaviour change following MPB?
6.	How will the anticipated increase in soil water affect choice of rehabilitative options and what are the potential implications to the flow of ecosystem services?
	Research Theme 4: Social and Economic Implications of a Changing Landscape
1.	What are the characteristics of resilient communities that are able to ensure their social and economic stability in the midst of a landscape changing due to MPB, and what steps can be taken to enhance resilient capacity of communities?
2.	How is fibre quality related to shelf life of MPB killed trees across ecosites across Alberta and what are the subsequent implications for manufacturing?

Photo Credit: Brad Hawkes, Canadian Forest Service.

Kevin Buxton, BC Ministry of Forests, Lands, and Natural Resource Operations

Forests of today – taking a step back to look forward

Dr. Bruce Larson, Professor and FRBC Chair of Silviculture, Faculty of Forestry, University of British Columbia, Vancouver, BC

Abstract

In order to understand where our forests are going it is sometimes useful to consider how our current forests got here. We often get so caught up with our immediate issues we fail to consider the long run. Throughout the world temperate forests have been shaped by a number of common driving factors. These include large scale geologic forces such as plate tectonics and climatic processes such as ice ages which drive our basic soil groupings and plant genera separation. Large scale weather processes such as ocean currents and the interaction of prevailing winds and topography shape our general forest types. Much of the temperate forest area has been heavily influenced by human process such as agricultural land abandonment. Forests also endure catastrophic disturbances such as fire, wind, clearcutting and even volcanic eruptions. Our attention is usually focused on episodic disturbances such as droughts and insect outbreaks, but we miss many chronic variables such as pollutant depositions. In an environment of these constant external factors the basic autogenic processes such as inter-tree competition are expressed through the gene-environment interaction. Our forests are on a basic trajectory that spans millennia, but as foresters we must react to the processes that shape the next few decades.

Biographical Sketch

Dr. Bruce Larson is Professor and FRBC Chair of Silviculture in the Forest Resources Management Department at the Faculty of Forestry at the University of British Columbia (UBC). He received degrees from Harvard and Yale before earning his PhD at the University of Washington. Prior coming to UBC he was on the faculty at Yale for 17 years; the last 10 of those years he was also Director of School Forests. He came to UBC 14 years ago and served as head of the department from 2006-2011. Among other books and papers he is co-author of the books *Forest Stand Dynamics*, and *The Practice of Silviculture: applied forest ecology*. In 2007 he was made a Honourary member of the Association of BC Forest Professionals (ASBCFP).

SPEAKERS

Impacts of MPB at the community level

Mr. Richard Harpe, Councillor, Division 8, County of Grande Prairie No. 1, Grande Prairie, AB

Abstract

The impact of the pine beetle infestation is far reaching and affects communities in numerous ways, both economically and socially. What the norm was yesterday does not apply today, especially in rural Alberta. The consequences of the infestations did not become a reality for quite a few years as the shift in wildlife habitat to more settled areas became evident. Impacts resulting from this along with other negative effects slowly became evident as the ecosystem took on a new structure. The infestation also changed the way municipalities prepared for fire threats resulting from dried stands of pine. Even the railways had to assess the way in which they operated on lines traversing stands of dead pine. There is no doubt that the shift to a new balance resulting from this infestation will take many more years to stabilize and will be prolonged by society and governments who are trying to mitigate the impact.

Biographical Sketch

Richard Harpe is a long time farmer in the Valhalla Community, a business man, and an elected councillor for Division 8 of the County of Grande Prairie No. 1. He has lived in the area for close to 29 years and remains active in various community organizations. Richard has a Diploma in Agriculture, a Certificate in local Government, along with a Master's designation in Electrical Installations. Richard has significant experience in dealing with community impacts of all kinds and mitigating these impacts and was federally recognized for being involved in stopping the use of potable water by industry to recover crude.

Mountain Pine Beetle Status Report: British Columbia

Dr. Art Stock, Regional Entomologist, BC. Ministry of Forests, Lands, and Natural Resource Operations, Nelson, BC

Abstract

This presentation will provide an update on the current status of the MPB populations in BC based on the results of the 2014 Provincial Aerial Overview Survey program. It will include a summary of current management activities in the SE part of the province as well as provincial initiatives designed to lessen the impacts of the catastrophic outbreak in the central interior.

Biographical Sketch

Art Stock is the Regional Entomologist, Kootenay-Boundary Region, BC Ministry of Forests, Lands and Natural Resource Operations in Nelson. He administers the regional air and ground components of the provincial aerial overview survey program ("inherited" from CFS in 1996), as well as providing operational expertise for specific programs managing defoliators, bark beetles, and other insects. Art has a BSc in Forestry from the University of New Brunswick, and was fortunate to do an MSc and PhD in John Borden`s lab at Simon Fraser University. Art started his career in 1981 as the first Regional Insect and Disease Biologist in Smithers in northwestern BC. His primary function was to implement the MPB suppression program for the region. Like many others, Art has been involved with mountain pine beetle for his entire career. Some highlights are:

- Participating in the early trials of the MPB pheromone tree bait with Dr. John Borden;
- Lighting up Bristol Mountain to burn out a MPB infestation;
- Involvement in the development of a rational approach to allocation of provincial bark beetle funding; and,
- Current work on efficacy and benefit: cost analysis of mountain pine beetle management.

SPEAKERS

MPB Status Report: Alberta

Erica Samis, Senior Manager, Forest Health and Adaptation Section, Environment and Sustainable Resource Development, Edmonton, AB

Abstract

While the current mountain pine beetle infestation in Alberta is the largest in the province's recorded history, two other outbreaks with management actions taken were initiated in the early 40's and mid 70s – mid 80s. The infestation in Banff National Park grew to 4,000 ha in 1940. A cut and burn program was initiated which resulted in 27,000 trees being cut over two winter seasons. The second infestation began in 1975 in southern Alberta. A control program was initiated in 1980, treated over 100,000 trees and cost $6 million. Both infestations declined after severe winters. Beetle activity in the province began to increase in the late 1990s, but the current infestation began with the large inflight in 2006. Over 1 million trees have been controlled since.

Biographical Sketch

Erica Samis began working seasonally for ESRD in 1997. She became permanent in 1998 as the Forest Health Officer for the then Northern East Slopes Region which is approximately the Upper Athabasca Region now. In 2006 she moved to Provincial Headquarters in Edmonton to work on developing the Provincial MPB Program. She became the Manager of the Forest Health and Adaptation Section in fall of 2014.

Photo Credit: Environment and Sustainable Resource Development

SPEAKERS

MPB Status Report: Saskatchewan

Dr. Rory McIntosh, Provincial Forest Entomologist and Pathologist, Forest Service Branch, Ministry of Environment, Government of Saskatchewan, Prince Albert, SK

Abstract

The mountain pine beetle (*Dendroctonus ponderosae*) continues to pose a significant threat to Saskatchewan's recovering forest industry and the health of boreal pine forests in Saskatchewan, and across Canada. This presentation will describe the strategic approach Saskatchewan has taken to regulate the human spread of the beetle as well as to accelerate early detection and rapid response capacity to reduce the risk of spread into the province and mitigate the threat to the boreal forest. Saskatchewan continues to invest in leading research to better understand ecology and epidemiology in leading edge novel environments, supporting fundamental discovery science through SERG-International and the multi-partner research conducted through the TRIA-Network. Since 2011, the Governments of Saskatchewan and Alberta have formally joined forces through a Memorandum of Agreement to implement a collaborative approach to slow the spread on the leading edge in Alberta. This agreement was renewed in 2014 for an additional 3 year term.

Biographical Sketch

Rory McIntosh has been involved in forest entomology since 1978. Rory has worked in entomology research across Canada, graduating from the University of New Brunswick and completing graduate work at the University of British Columbia and post-doctoral research at Simon Fraser University. Currently, Rory is the Provincial Forest Entomologist and Pathologist in Saskatchewan Ministry of Environment's Forest Service. Based in Prince Albert, he leads the provincial insect and disease program. In addition to his work for Saskatchewan Ministry of Environment, Rory serves as an adjunct professor in the Department of Entomology at the University of Manitoba.

The Risk of Mountain Pine Beetle spread to eastern pine forests: What can we predict?

Dr. Barry Cooke, Research Scientist, Spatial Dynamics of Insect Populations, Northern Forestry Centre, Canadian Forest Service, Natural Resources Canada, Edmonton, AB, and Dr. Allan Carroll, Associate Professor and Director, Forest Sciences Program, Department of Forest & Conservation Sciences, University of British Columbia, Vancouver, BC

Abstract

Over the period 2006-2011 the mountain pine beetle spread eastward across Alberta at an average rate of 80km/year. This spread rate is expected to slow as the invasion front moves from population sources in the dense pine of the Rocky Mountains into scattered pine of the cooler boreal plains region. However the rate of spread will depend on whether the system transitions from an epidemic state to an endemic state in response to environmental factors governing beetle-host tree interactions. Because of the inherent uncertainty here, forest management should explore ways of coping with unpredictable disturbances, including the development of adaptive capacity to adjust to transformational ecosystem change.

Biographical Sketch

Dr. Cooke is a Research Scientist with NRCan, Canadian Forest Service at the Northern Forestry Centre, Edmonton, Alberta. Barry specializes in important topics related to pest management especially mountain pine beetle and spruce budworm. His research contributes to the understanding of population dynamics, forest insect disturbance ecology and its links to ecosystem function, modeling insect outbreak processes and patterns, pest management decision support modeling, comparative dynamics of boreal forest insects, risk analysis, field validation of model predictions, and quantitative analysis. Barry has a BScF from University of Toronto, a MSc in Entomology from University of Laval and a PhD in Ecology and Evolution from the University of Alberta.

SPEAKERS

Cold tolerance of MPB: Implications for population dynamics and spread

Dr. Katherine Bleiker, Research Scientist, Bark Beetle Ecology, Pacific Forestry Centre, Canadian Forest Service, Natural Resources Canada, Victoria, BC

Abstract

Given the presence of a suitable food source, temperature likely has the largest overall impact on mountain pine beetle's (MPB) distribution and population dynamics. Winter is usually the largest single source of mortality even in benign climates like southern British Columbia. Growing season temperatures affect insect development and MPB's ability to maintain an adaptive seasonality – a synchronous one-year life cycle with the most hardy life stage entering winter. Here, we report on progress made in the first two years of a four-year study on MPB cold tolerance. The results of this work are ultimately expected to improve predictions of annual population trends and refine climatic suitability indexes that identify MPB's potential for continued range expansion and areas at risk to invasion and outbreaks.

Biographical Sketch

After earning a BSc from the University of Victoria, Kathy worked with the BC Forest Service and then as a forest health consultant for a number of years before returning to school to earn a MSc in Natural Resource Management from the University of Northern British Columbia and a PhD in Forestry from the University of Montana. Kathy is also a Registered Professional Forester in BC. She has been a Research Scientist in Bark Beetle Biology and Ecology with the Canadian Forest Service, Pacific Forestry Centre, Victoria, BC since 2010.

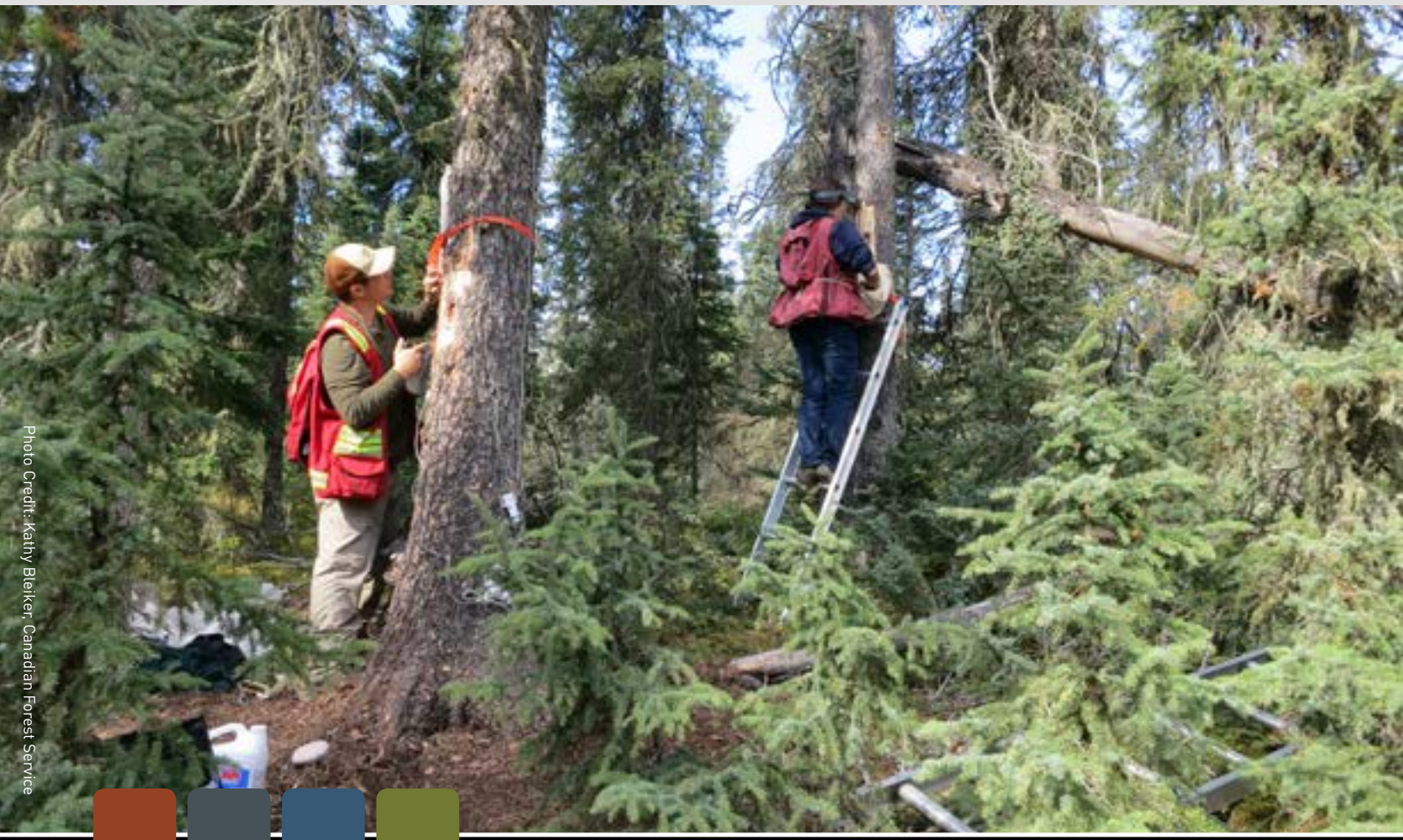

Photo Credit: Kathy Bleiker, Canadian Forest Service

SPEAKERS

Development of monitoring tools to detect mountain pine beetle at low densities on the eastern and northern edge of beetle expansion into Saskatchewan and Northwest Territories

Dr. Nadir Erbilgin, Canada Research Chair & Associate Professor and **Jennifer Klutsch** Ph.D. Candidate, Department of Renewable Resources, University of Alberta, Edmonton, AB

Abstract

We investigated whether the current commercially available lures for the mountain pine beetle (MPB) (*Dendroctonus ponderosae*) can be improved in Alberta. We were particularly interested in whether a host tree chemical can improve attraction of MPB to its pheromones. We used several host tree chemicals that can be potentially important for improving the attractiveness of MPB pheromones. Selection of these tree chemicals was based on the results of several reported studies in the literature. We conducted two separate experiments. In one experiment, we tested aggregation pheromone of MPB alone (trans-verbenol and exo-brevicomin), or combinations with various host tree chemicals. In the second experiment, we tested the standard MPB commercial lure alone or with combinations with various host tree chemicals. Our results from the first experiment indicated that standard MPB lure, consisting of two component beetle pheromones plus one host chemical (terpinolene), caught more beetles than two component beetle pheromones alone, or combined with other host chemicals. Numbers of beetles were similar between two component beetle pheromones plus myrcene and two component beetle pheromones plus terpinolene, suggesting that myrcene can replace terpinolene in the future studies. In the second experiment, traps baited with the standard lure plus myrcene caught three times more beetles than any other treatment. Currently, we are in the process of developing a field protocol for deployment of these new lures on trap trees to monitor and detect mountain pine populations in novel habitats and to determine whether trap trees can be used to evaluate annual trends of relative beetle abundance as part of the direct control strategy of beetle population manipulation and/or reduction. The resulting information will be invaluable for the development of monitoring tools to detect beetles at low densities on the eastern and northern edge of beetle expansion into Alberta and beyond.

Biographical Sketches

Dr. Erbilgin is the Canada Research Chair and Associate Professor in Forest Entomology and Chemical Ecology in the Department of Renewable Resources at the University of Alberta. His research focuses on identification of mechanisms (chemical and behavioural) that facilitate host and range expansion of invasive forest insects in novel habitats. Currently, Dr. Erbilgin has one PDF and 10 graduate students who are working on mountain pine beetle (either in the novel or historical host plant systems) or on other important forest/urban insect and diseases that are affecting western forests.

Jennifer Klutsch is a PhD Candidate working with Dr. Nadir Erbilgin at the University of Alberta. Her current research involves investigating the role of a forest pathogen in impacting tree defenses and the performance of mountain pine beetle in jack pine forests. She came to Edmonton having worked for the US Forest Service and completing her master's degree from Colorado State University, where she researched the influence of mountain pine beetle and forest pathogens on fuels and potential fire behaviour.

SPEAKERS

Dynamics of endemic mountain pine beetle populations in novel pine habitats

Dr. Allan Carroll, Associate Professor and Director, Forest Sciences Program and Stanley Pokorny, Ph.D. Candidate, Department of Forest & Conservation Sciences, University of British Columbia, Vancouver, BC

Abstract

For the mountain pine beetle (MPB) to persist in a new habitat, and thereby expand its range, an endemic niche must be available. Similarly, for MPB to exhibit predictable eruptive dynamics in a new habitat, an epidemic niche, and the means by which to surpass the endemic-epidemic threshold, must be available. Continued eastward expansion by MPB into the boreal forest is a significant probability even without additional climate change; however, lack of knowledge regarding altered trophic interactions in novel habitats precludes the capacity to predict the rate of spread and subsequent impacts. In 2014, we initiated a 4-year project to assess the ability of MPB to persist in naïve lodgepole, lodgepole × jack hybrid, and jack pine forests, quantify the potential for endemic populations to erupt in these novel habitats, and ultimately determine the capacity for MPB to spread and occupy pine forests east of the Rocky Mountains. Preliminary results of the first year of the investigation will be presented, and their implications to the potential for MPB to persist in Alberta will be discussed.

Biographical Sketch

Allan received his PhD from the University of New Brunswick in 1993. That same year, he joined the Canadian Forest Service as a Research Scientist. In 2009, he accepted a position within the Department of Forest & Conservation Sciences at the University of British Columbia, and in 2012 he became the Director of the Forest Sciences Program within UBC's Faculty of Forestry. His research efforts focus primarily on the influence of climate on the dynamics and impacts of eruptive forest insect populations. He has authored or coauthored over 70 peer reviewed publications and delivered numerous invited presentations to international audiences. In 2008, he was granted the Award of Excellence for Executive Leadership by the Government of Canada. In addition to his roles at the University of British Columbia, Allan has held appointments as Adjunct Professor at Memorial University of Newfoundland, University of Alberta, University of Victoria and the University of Northern British Columbia, and has been Visiting Scientist with the Canadian Forest Service and the Commonwealth Science and Industrial Research Organization. He has also served as an advisor to the Canadian Government and the European Union on issues pertaining to climate change and forest insects.

Photo Credit: Ellen MacDonald, University of Alberta

SPEAKERS

Assessing the effectiveness of Alberta's forest management strategies against the mountain pine beetle

Drs. Allan Carroll, Brad Seely, Clive Welham, and Harry Nelson, Professors, Department of Forest & Conservation Sciences, University of British Columbia, Vancouver, BC

Abstract

Following the breach of the Rocky Mountain geo-climatic barrier, Alberta Environment and Sustainable Resources Development staff have annually collected detailed data on the status of the invading mountain pine beetle (MPB) population by way of its impacts on tree mortality and in numbers of infested trees destroyed (an index of potential control). These data also include direct measures of MPB productivity known as 'r-values', which represent the ratio of surviving offspring to parent attacks. Using this information, we have begun to evaluate the efficacy of direct control efforts at slowing the spread of MPB in Alberta. We have developed an initial model that accurately predicts r-values from tree, site and climatic conditions. This model will be used to project baseline scenarios of MPB spread in the absence of control efforts. Furthermore, using a "parent – offspring" analysis informed by a detailed spatial analysis of MPB populations in Alberta, we have begun to assess the efficacy of focused direct control efforts (i.e. "level 1" treatments; the removal and destruction of individual infested trees). Preliminary results suggest that efforts to slow the spread of MPB within the leading edge of the invasion front have achieved some success. Efforts to quantify MPB spread at broad spatial scales in relation to control versus no control scenarios are still underway. Implications of our findings to future eastward spread of MPB will be discussed.

Biographical Sketch

See biographical sketch on previous page

Photo Credit: Kathy Bleiker, Canadian Forest Service

SPEAKERS

Impacts of MPB on hydrology and vegetative redevelopment in lodgepole pine forests

Drs. Ellen Macdonald and Uldis Silins, Professors, Department of Renewable Resources, Faculty of Agricultural, Life & Environmental Sciences, University of Alberta, Edmonton, AB and Axel Anderson, fRI Water Program Lead, Edmonton, AB

Abstract

In 2008 we established an experiment in pure lodgepole pine stands near Robb, AB at which we collected data on vegetation and hydrology for one year after which we simulated Mountain Pine Beetle attack by use of stem injection of glyphosate at two levels: heavy kill (100% of stems injected), moderate kill (30% of stems were injected). These treatments are being compared to untreated control forest and to an area harvested to mimic post-MPB salvage harvesting. In 2014 (fifth growing season post-treatment) the majority of treated trees had transitioned to a "grey attack" condition but were still standing. Canopy cover averaged 49%, 54% and 58% in the heavy kill, moderate kill, and control, respectively. There were very low levels of natural regeneration of pine in these sites: 50/ha, 37/ha and 34/ha for heavy kill, moderate kill, and control, respectively; in comparison, pine densities in the harvested areas averaged 4800/ha. The substrates supporting the most regeneration were: rotten wood, dead feather moss, and organic layers < 3 cm depth. Cover of herbaceous understory vegetation was higher in the heavy kill treatment, as compared to the moderate kill and untreated control. The harvested area had very different cover and composition of understory vegetation than the control and either of the simulated MPB treated stands. Intensive monitoring of hydrology of these sites is beginning again this spring.

Biographical Sketch

Ellen Macdonald is a professor at the University of Alberta whose research interests lie in forest ecology and plant biodiversity and the influences of natural and human caused disturbances on ecological systems. Dr. Macdonald is keenly interested in how these disturbances affect plant biodiversity, forest regeneration processes, and successional dynamics of boreal mixedwood forests. Through her research she aims to contribute to improved approaches for management and restoration of forest ecosystem. Dr. Macdonald has a BSc and PhD from the University of Calgary and has been the recipient of numerous teaching and academic awards including most recently, the Canadian Institute of Forestry Scientific Achievement Award (2014).

Dr. Uldis Silins is Professor of Forest Hydrology and Watershed Management in the Department of Renewable Resources, University of Alberta. In the past decade, his research has primarily focused on impacts of natural disturbance by wildfire and mountain pine beetle on hydrology of Alberta's eastern slopes forests. Apart from receiving recognition for teaching, the Southern Rockies Watershed Project for which Dr. Silins is a lead investigator won a 2014 Emerald Award.

Dr. Axel Anderson is a senior scientist with Environment and Sustainable Resource Development and as a forester and engineer he provides unique perspectives to resource problem solving and management. Axel's hydrology expertise is runoff generation, field and modelling work on the fate of water through hillslopes and catchments. However, his professional work involves many aspects of watershed management as it relates to natural environments. Dr. Anderson is on secondment from the ESRD to the fRI and as an Adjunct Professor with the Department of Renewable Resources at the University of Alberta he lends his expertise to graduate students and to special projects such as developing watershed assessment procedures and assessing hydrological impacts of MPB and wildfire at the landscape scale. Axel has a BSc in Forest Operations, a MScF and a PhD in Forest Hydrology from the University of British Columbia and is a registered Professional Forester and Engineer.

SPEAKERS

Beyond the beetle: Natural and Facilitated Pine Regeneration After MPB Attack

Drs. Ellen Macdonald, Victor Lieffers, Nadir Erbilgin, and Mike Flannigan, Professors, Department of Renewable Resources, Faculty of Agricultural, Life & Environmental Sciences, University of Alberta, Edmonton, A

Abstract

In this first year of this project we focused on surveying a wide variety of forest types in west-central Alberta, and a few sites in British Columbia, to assess the amount of natural regeneration of lodgepole pine in stands following attack by Mountain Pine Beetle. In total 127 sites were visited in a 125,000 km2 area. Although we focused on surveying sites that were likely first attacked by MPB in 2006 to 2008, we discovered that a very large proportion of sites had less than 50% mortality of lodgepole pine. Several sites were also rejected because they were < 70% pine or because they had > 400 stems/ha of advance regeneration. A total of 30 sites, representing eight different ecosite types in the lower foothills, boreal mixedwood, and boreal highlands ecoregions, were intensively surveyed for lodgepole pine regeneration. Pine seedlings were only found at 12 of the 30 intensively surveyed sites. The ecosite types most likely to have seedlings were the drier and poorer "c" and "b" ecosites. The richer ecosite types had no or very few seedlings; these sites were dominated by heavy understory herbaceous vegetation cover. Estimated seedling densities varied from 25/ha to a maximum of 500/ha found at one of the sites in British Columbia. In terms of cone serotiny, 75% of sites had> 30% open cones while the remainder mostly had < 20% open cones. In the areas with the highest MPB mortality most cones were closed. Some sites also had spruce regeneration.

Biographical Sketch

See Ellen Macdonald's biographical sketch on the previous page. For biographical information on Drs Victor Lieffers, Nadir Erbilgin and Mike Flannigan please visit the University of Alberta website at http://www.rr.ualberta.ca/en/StaffProfiles/AcademicStaff.aspx.

SPEAKERS

Innovative stand enhancement and regeneration systems to recover value, reduce risk and rehabilitate mountain pine beetle affected stands in the Alberta boreal plains ecozone

Derek Sidders, Regional Coordinator and Program Manager, and Tim Keddy, Wood Fibre Development Specialist, Canadian Wood Fibre Centre, Change order to: Northern Forestry Centre, Natural Resources Canada, Edmonton, AB

Abstract

The Canadian Wood Fibre Centre (CWFC) has partnered with CanFor and the University of Alberta in the establishment of a demonstration site and long-term research study to assess the impact of innovative partial harvest and regeneration systems on value recovery, risk reduction, and stand rehabilitation of Mountain Pine Beetle (MPB) affected stands. This project began in 2014 with the harvesting of 350 hectares of mixed MPB affected stands that had greater than 50% lodgepole pine crown composition and are greater than 15 m in height. The stands were comprised of a mixture of green (active attack and not affected), red and grey lodgepole pine as well as white spruce and aspen. The harvest system selectively removed active attack trees, green lodgepole greater than 20cm DBH and spaced small dense green lodgepole. This presentation will describe the completed harvest operations and values recovered, and present the reforestation strategy and related research studies being installed by the University of Alberta and CWFC.

Biographical Sketches

Derek Sidders is the Program Manager and Regional Coordinator of the Canadian Wood Fibre Centre for the Prairie Provinces and Northwest Territories. Derek graduated from Lakehead University in 1977 before beginning his career in Northwestern Ontario with the Ministry of Natural Resources. He has thirty-eight years of experience in forest management and afforestation operational development, applied research and technology transfer in Boreal Plains and Boreal Shield ecoregions of Canada. Derek has worked for the Canadian Forest Service since 1985 and for the Canadian Wood Fibre Centre since its inception in 2006.

Derek has spent the last 15 years developing, testing and demonstrating novel mixedwood forest partial harvesting and regeneration systems for the Boreal Plains and leads a national group that develops woody biomass feedstock options for an evolving Bioenergy industry in Canada.

With over 30 years of experience in the forest industry Tim Keddy has acquired a broad range of forest management and applied research skills working across Canada for private forest industry and various government agencies. He presently works for the Government of Canada with the Canadian Wood Fibre Centre (CWFC) as a Wood Fibre Development Specialist. His responsibilities include the operational coordination of the National SRWC Program and the National Innovative Woody Biomass Systems Development Program.

Photo Credit: Rene Alfaro, Canadian Forest Service

SPEAKERS

Dynamics of lodgepole pine regeneration and implications for forest management following MPB attack

Dr. W.R. (Dick) Dempster, Research and Development Associate and **Sharon Meredith**, RPF, Director, Forest Growth Organization of Western Canada, Hinton, AB

Abstract

Two ongoing projects are gathering information relevant to the management of Foothills forests following MPB attack. The first (the *Regenerated Lodgepole Pine Trial*) is primarily applicable to the management of salvaged stands. Experimentally controlled sequential data collected over the full regeneration phase for lodgepole pine have been analysed and incorporated into decision-support tools forecasting regeneration performance as a function of site and stand factors and silvicultural treatments. The second project (*Monitoring Stand Dynamics after MPB Attack*) is assessing stand development following MPB attack on permanent sample plots, in the absence of timber salvage or other management interventions. It has so far provided sequential data on initial rates of tree mortality in attacked stands, but by 2016 a fuller analysis will be possible of tree mortality and vegetative responses to 7+ years after initial attack. What has been learned to date from the two projects is discussed in the context of implications for post-disturbance management.

Biographical Sketches

Dick Dempster graduated in forestry at the University of Wales in 1968 and obtained a PhD there in 1972. He spent two years as a forester in Jamaica before immigrating to Canada in 1974, where he worked in forest management, industry, university teaching and government, before establishing his own consulting business in Alberta in 1981. He subsequently moved to British Columbia to work for a major international consulting firm, where his focus was providing technical leadership and advancing domestic and offshore business development. In 1999 he returned to Alberta to direct and undertake projects in forest growth and yield, planning, research and development. In 2007 he returned to live in the U.K., from where he continues to be involved in Alberta lodgepole pine growth and yield research.

Sharon Meredith attended the University of New Brunswick, completing a BScF in 1996 and an MScF in 1999. She moved to Alberta in 2000, where she gained a variety of forestry experience, including work in industry, consulting and government. Since 2012 Sharon's work has focussed on management of growth and yield research programs. She is currently the Director of the newly formed Forest Growth Organization of Western Canada.

SPEAKERS

Potential impacts of mountain pine beetle and management actions on grizzly bear and caribou populations in West Central Alberta

Dr. Laura Finnegan, fRI Lead, Caribou Program, Gord Stenhouse, fRI Lead, Grizzly Bear Program and Terry Larsen, Biologist, fRI Grizzly Bear Program, Hinton, AB

Abstract

Mountain pine beetle (MPB) management activities such as single tree cut and burn and forest harvesting (surge cut) has been ongoing in Alberta to mitigate the risk of MPB spread at the provincial level and across the Boreal forest. Caribou and grizzly bear are both listed as threatened species in Alberta and co-occur in areas deemed to be at a high risk of MPB infestation where MPB management actions are taking place. Managing MPB risk and maintaining important habitat for caribou and grizzly bear represents a unique challenge since disturbances such as forest harvesting may enhance grizzly habitat, but not habitat for caribou. We provide a synthesis of research to date focused on caribou and grizzly bear habitat management that has implications for forestry practices more generally and managing the MPB problem. We then introduce a new project that aims to fill some of the data and knowledge gaps regarding the concurrent management of caribou and grizzly bear habitat in the face of MPB infestations and current management strategies.

Biographical Sketches

Dr. Laura Finnegan is a research biologist with 11 years of combined experience in wildlife research, management and conservation. Laura has been the Caribou Program lead for the fRI Caribou Program (fRICP) since 2013. She has a PhD, Dip.Stats and BA in Zoology from Trinity College Dublin, Ireland where her research focused on ecology and management for species at risk. She completed her postdoctoral research on management and conservation genetics of moose and caribou at Trent University and in 2009 she wrote the Designatable Units for Caribou report for COSEWIC.

Gord Stenhouse is a research scientist and the leader of the fRI Grizzly Bear Program. This research program began in 1998 and has grown to be one of the largest and most comprehensive bear research programs in North America. There have now been more than 1000 scientific papers from the research team working on this program published over the past 15 years. Gord received both his Bachelors and Masters Degree from the University of Manitoba. After graduating he moved to the NWT where he worked as a wildlife biologist for the Northwest Territories government. During this time he focused primarily on polar bear research. Gord is on secondment from Alberta Environment and Sustainable Resource Development and is an adjunct professor at the Western College of Veterinary Medicine at the University of Saskatchewan. He is also the past chairman of the Alberta Grizzly Bear Recovery Team.

Terrance Larsen is a research biologist with the fRI Grizzly Bear Program with over 14 years of wildlife research experience. He received his MSc in Ecology from the University of Alberta in 2012. His thesis research was focused on the potential effect of MPB control harvesting on grizzly bear habitat in west-central Alberta. Some of his expertise includes designing and implementing research projects focused on assessing the impacts of forest harvesting on grizzly bear habitat, particularly vegetation, and in developing models of species distribution and abundance.

SPEAKERS

Is it a disaster or merely a catastrophe? Living with disturbance

Dr. Bruce Larson, Professor and FRBC Chair of Silviculture, Faculty of Forestry, University of British Columbia, Vancouver, BC

Abstract

In forest stand dynamics we refer to catastrophic disturbances as those where most of the aboveground vegetation is destroyed and a new stand grows. As long as there is adequate annual precipitation some type of forest will grow and dominate the site – eventually. Our notions of forest recovery are often coloured by our social goals such as getting a forest back quickly or having our favourite species return. Because we depend on forests it is considered a disaster if this recovery does not occur in a time and a manner that is desired socially.

The ecological trajectory of forest recovery is usually quite predictable if we break it down into the fundamental processes. Growing space is made available and growing space is then reoccupied by residual vegetation or by various regeneration mechanisms. We have centuries of examples showing how recovery takes place. Because the natural world is dynamic, different events will shape this recovery; some will have a high probability of occurrence and some low. Through silviculture we change these probabilities in order to make our social objectives more likely to be realized. In order to live with disturbance we must understand what could happen, what most likely will happen, and how we might influence what happens during this recovery period.

Biographical Sketch

Bruce Larson is Professor and FRBC Chair of Silviculture in the Forest Resources Management Department at the Faculty of Forestry at the University of British Columbia (UBC). He received degrees from Harvard and Yale before earning his PhD at the University of Washington. Prior coming to UBC he was on the faculty at Yale for 17 years; the last 10 of those years he was also Director of School Forests. He came to UBC 14 years ago and served as Head of the department from 2006-2011. Among other books and papers he is co-author of the books Forest Stand Dynamics, and The Practice of Silviculture: applied forest ecology. In 2007 he was made an Honourary member of the Association of BC Forest Professionals (ASBCFP).

How ecosystem services thinking can be used to guide rehabilitation of affected landscapes

Gillian Kerr, Manager, Biodiversity and Ecosystem Services, Environment and Sustainable Resource Development, Edmonton, AB

Abstract

The Government of Alberta, led by Environmental and Sustainable Resource Development (ESRD) has been developing the use of ecosystem services as support tools and approaches to deliver on our natural resource and environmental mandate.

Ecosystem services ('ES') are the full spectrum of benefits that nature provides to people. Ecosystem services provide innumerable services that are underestimated in most economic development decisions; however, these services contribute to development objectives (e.g., timber, water quality and water supply) and to realizing quality of life goals.

This presentation will provide a brief overview of ES and some examples with a focus on forestry, how ES thinking can be integrated into our thinking on rehabilitation and some examples of this ES thinking can be incorporated into the plans to restore forest landscapes.

Biographical Sketch

Gillian Kerr is the Manager of the Biodiversity and Ecosystem Services team within the newly formed Biodiversity and Ecosystem Services and Science Section in Alberta Environment and Sustainable Resource Development, in the Policy Division. The ecosystem services work is to support integrated resource development and cumulative effects management. Using an Ecosystem Services approach provides an opportunity to look at landscapes and ecosystems holistically versus looking at environmental media one by one. This information is being used to inform options development and trade-off decisions within the government around natural resource management, but is still in the early stages of use.

Gillian has worked within the department for ten years and is in the final stages of her PhD at the University of Calgary.

Working towards successful outcomes on post beetle landscapes within Alberta

Brooks Horne, RPF, Senior Forester-Forest Rehabilitation, Environment and Sustainable Resource Development, Edmonton, AB

Abstract

While the province has been extremely aggressive and successful in keeping MPB at manageable levels, there are areas killed by the 2006 and 2009 in-flights that are no longer being actioned through level 1 control and are unlikely to be harvested by industry. These predominately grey attack areas constitute the target for the rehabilitation program.

To date we have set a high level objective for the rehabilitation program of mitigating the impacts of MPB to ensure the continued production of ecological goods and services from our pine dominated forests. This provides an overarching landscape level framework to work within to create positive impacts on the ground. The next step in the evolution of the program is to begin to create the specific forest and stand level objectives necessary to guide future actions. This will then allow us to then define successful outcomes both at multiple levels.

Before we can create specific objectives and define successful outcomes there are foundational pieces of information which are needed to base the program upon. At the very basic level, we need to know where and at what magnitude MPB impacts have been. Only once this spatial picture is arrived at can we then begin to understand what specific, identified ecological goods and services may be at risk and to what degree. This understanding then gives us the ability to begin setting specific mitigative objectives and allows us to define what success may look like.

During the past year progress has been made regarding the collection of this baseline mortality data, determining what appropriate ecological goods and services from pine forests may be, what stands may develop into post-MPB and how we can consolidate this information to begin prioritizing stands for rehabilitation.

Biographical Sketch

Brooks is the Rehabilitation Forester for Environment and Sustainable Resource Development in Edmonton. With the GOA since 2006, he worked with the Forest Health Section as a field Forest Health Officer in Hinton, Edson and Grande Cache before moving into his current position 1 year ago. His responsibilities included the detection, monitoring and management of all biotic tree pests and diseases. His focus is now on the rehabilitation of Alberta's beetle affected landscape and is enjoying the challenge with lots of fun projects ongoing. Brooks holds a diploma in Natural Resource Management from BCIT as well as BSc degree from the University of Alberta. Prior to working for the GOA, Brooks spent 15 years in the forestry industry throughout British Columbia.

Photo Credit: Brooks Horne, Environment and Sustainable Resource Development

SPEAKERS

The silviculture prescription and an exercise in mountain pine beetle damage rehabilitation decisions

Marty O'Byrne, RPF, Senior Forester Silviculture Practice, Environment and Sustainable Resource Development, Peace River, AB

Abstract

A Silviculture Prescription can be defined as a formulated strategy of silviculture treatments (harvest system, thinning, site preparation, planting, tending) for managing a forest that is intended to meet one or more resource objectives. The elements of a silviculture prescription will be discussed in a formal presentation to achieve a common forest renewal perspective amongst participants. From the basis of this renewal perspective, participants will apply the elements of the silviculture prescription decision making process to a series of real-world-accurate scenarios as an exercise in rehabilitating Mountain Pine Beetle (MPB)-damaged forest stands. This exercise is intended to elicit in-depth discussion, illustrate challenges and opportunities, and the fiscal realities of choosing approaches in forest stand damage rehabilitation. Importantly, the exercise is specifically structured to act as a wrap-up of the subject matter from the workshop's formal presentations and provide hands-on experience in applying elements of resource management specifically to formulate practical strategies for forest rehabilitation. As well, the exercise is expected to serve as an opportunity for various professional backgrounds to come together in an applied decision-making role and hopefully experience a positive level of creativity as the scenarios are planned and executed within the various groups assigned. All groups' rehabilitation strategy choices will be reported in a plenary session to further elicit valuable input to the overall discussion.

Biographical Sketch

Marty is a Senior Forester – Silviculture Practices in the Forest Management Branch, Forest Resource Management, Alberta Environment and Sustainable Resource Development. After emerging on the scene in Saskatchewan and spending some of his early life in Nova Scotia and New Brunswick, he entered the Forestry Program at the University of Alberta in 1974, graduating in 1978. He began his career with the Alberta government in the Public Lands Division as a field agrologist. In 1990, Marty moved to the Alberta Forest Service in the Reforestation & Reclamation Branch transferring to Peace River Forest as a field silviculturist. Between 1992 and 2005, Marty assumed increasingly responsible positions in forest management and in 2005 accepted his present position as Senior Forester, Provincial Silviculture Practices. Marty is happily married, with three grown children, two grandchildren, and resides in the town of Peace River. Marty is an active outdoorsman, he loves to travel and wood work and is an excellent amateur musician.

Photo Credit: Alberta Environment and Sustainable Resource Development

Effect of energy reserves on mountain pine beetle (*Coleoptera: Curculionidae: Scolytinae*) dispersal by flight

Asha Wijerathna and Maya L. Evenden, Department of Biological Sciences, University of Alberta, Edmonton, AB

Abstract

Mountain pine beetle, *Dendroctonus ponderosae Hopkins (Coleoptera: Curculionidae: Scolytinae)*, is a major pest of pine in Western North America. Dispersal by flight is a poorly understood aspect of mountain pine beetle (MPB) ecology. Research using computer linked flight mills has shown that beetles utilize stored energy during flight which is dependent on physiological condition (sex and age). The purpose of this study is to investigate the metabolites used to fuel MPB flight. MPB adults from naturally infested lodgepole pine, Pinus contorta Douglas bolts were flown on flight mills for 23 hours and flight distance and duration were recorded. Metabolites including carbohydrates, lipids and proteins were extracted from flown and un-flown male and female beetles. Results comparing total, neutral and polar lipids remaining after flight will be presented. The utilization of other metabolites such as glycogen, trehalose, glucose and protein by flown and unflown beetles will be compared. This study gives insight into energy use of beetles during their obligatory dispersal phase and may provide important information to be used to parameterize models of MPB dispersal and spread.

Consequences of mountain pine beetle outbreaks on forest ecosystem services in western Canada

Amalesh Dhar and Lael Parrott, Okanagan Institute for Biodiversity, Resilience, and Ecosystem Services (BRAES), University of British Columbia, Kelowna, BC, Scott Heckbert, Alberta Innovates Technology Futures, Edmonton, AB

Abstract

The current mountain pine beetle (MPB) (Dendroctonous ponderosae Hopkins) epidemic has severely impacted forests of Western Canada (British Columbia and Alberta) and killed millions of hectares of pine forests. Aside from having a major impact on timber volume, the outbreak has had wide-reaching consequences on ecosystem services provided by the forest landscape. Here we describe an initial review of the impacts of MPB on a range of provisioning, supporting, and regulating services. We find that, aside from timber production, the current MPB outbreak has negative effects on provisioning services such as water supply, fish and pine mushroom production, and on cultural services such as scenic beauty, while effects on regulating services (carbon and forest fire) are still in debate. Habitat ecosystem services showed both positive and negative responses to the outbreak. However, the overall MPB impact on many ecosystem services could be more severe if salvage logging is used as a means of post MPB forest management. These results highlight the degree to which human response to MPB outbreaks mediates landscape-scale impacts. Using an ecosystem services framework for MPB infested stands may thus provide insight into the cumulative effects of MPB mortality and management, informing forest management decisions in current and future MPB ranges.

Salvage logging after mountain pine beetle outbreaks reduces the social-ecological resilience of forest landscapes

Amalesh Dhar and Lael Parrott, Okanagan Institute for Biodiversity, Resilience, and Ecosystem Services (BRAES), University of British Columbia, Kelowna, BC

Abstract

The current mountain pine beetle (MPB) (Dendroctonous ponderosae Hopkins) outbreak in the forests of Western Canada poses a serious challenge for sustainable forest management. Recent policy has accelerated overall timber harvesting levels to prevent further tree mortality and to permit salvage logging operations to recover dead timber value before it deteriorates. While such management operations may have short-term economic benefits for human communities, the potential impact on the long-term social-ecological resilience of the forest landscape is unknown. We explore the consequences of salvage logging activities on system resilience and recovery using the metaphor of the Panarchy cycle. Salvage logging after MPB attacks contributes to impairment of ecosystem recovery and homogenization of forest stand structure, with negative impacts on forest regrowth, biogeoclimatic and hydrological processes, water quality, aquatic habitats, and soil. It also has social costs, including reduced mid-term timber production, increased reforestation expenditures and possibly increased vulnerability to future disturbances. Unsalvaged stands, on the other hand, develop complex, heterogeneous landscapes with multi successional pathways. Such heterogeneous landscapes will be more resilient to future climate change and natural disturbances, and will provide a mid-term timber supply for forest-dependent communities. It is thus essential to find the right balance between salvage and non-salvage logging operations so as to maintain the social-ecological resilience of future forests.

Quantitative analysis of network indices to measure resilience in a dynamic social-ecological network (SEN)

Matthias Bass, Rebecca Tyson, and Lael Parrott, The Okanagan Institute for Biodiversity, Resilience, and Ecosystem Services (BRAES), University of British Columbia, Kelowna, BC

Abstract

Forests and their interacting social and socioeconomic components, such as timber production per timber supply area, are complex social-ecological networks (SENs), constantly changing over time. We propose a new method to model and

analyze the resilience of SENs, and apply it to study the impact of the recent mountain pine beetle (MPB) outbreak on forests and human communities in British Columbia, Canada. Our novel approach is a combination of graph theory and decision-making network components (nodes). The model represents a weighted, directed and multiplex network, composed of both social and ecological nodes in interaction. We will simulate structural changes in the SEN due to the MPB impact in BC. The emerging patterns will be quantitatively measured with network indices such as connectivity and modularity. By quantifying the structures we characterize their importance within the MPB SEN and identify their relationship to the resilience of the system. The proposed model may reveal important structural characteristics of an SEN, which in the long term lead to more resilient forest landscapes. It also may be applied to other SENs facing natural disturbances similar to the MPB outbreak in BC.

Modelling mountain pine beetle's (Dendroctonus ponderosae) neutral and adaptive genetic structure during range expansion

Paul Mayrand, MSc Candidate and Patrick James Lab, Patrick James, Assistant Professor, Département de Sciences Biologiques, Université de Montréal, Montréal, QC, and Élise Filotas, Professor, Unité d'Enseignement et de Recherche Science et Technologie, Télé-Université du Québec (TÉLUQ), Montréal, QC

Abstract

Identifying loci potentially under selection in expanding MPB populations can provide insights about the evolutionary potential, outbreak dynamics, and continued invasive capacity of this important forest pest. However, during rapid range expansions, spatial patterns in neutral genetic variation can mimic those created through adaptive processes. This confounding effect in genetic data can result in misinterpretation of classic genetic analysis and misapplication of tools to identify outlier loci. In this project, our goal is to identify the demographic conditions and environmental context under which it becomes impossible to distinguish neutral from adaptive genetic patterns. The current MPB epidemic offers a great opportunity to examine this problem in detail. Using a spatially explicit genetic simulator (CDPop), we examine the consequences of habitat connectivity, dispersal, and strength of selection on MPB spatial genetic structure for several adaptive and neutral loci. Preliminary results show that dispersal (a not well known element of MPB's biology) has great influence on speed and extent of range expansion, which have great impacts on genetic structure. We also observe neutral loci that can mimic adaptive loci depending on sampling timing and location. Insight derived from this project will help us to better understand the spatial evolutionary dynamics of this irruptive species.

Adaptive variation in lodgepole and jack pine population responses to mountain pine beetle fungal associates and abiotic stresses

Kate St.Onge and Janice Cooke, Postdoctoral Fellow and Associate Professor, Molecular Physiology and Genomics of Forest Trees, Department of Biological Sciences, University of Alberta, Edmonton, AB

Abstract

As part of the TRIA-Net project, I will investigate adaptive variation in lodgepole and jack pine across north-south and east-west gradients in Canadian pine populations for traits that may influence the host quality of these trees to mountain pine beetle (MPB). Characterizing the susceptibility of pine populations that have never experienced MPB attack is important for predicting and anticipating the impact MPB will have as the beetle expands beyond its historic range in south-central BC. I will test the hypothesis that genetic variation along north-south and east-west gradients in lodgepole and jack pine correspond to a gradient in susceptibility to MPB fungal associates. I will also test the hypothesis that traits that could affect tree defense capacity, such as water use efficiency, differ across these same gradients; thus, under conditions of water deficit, may contribute to variation in host quality. To test these hypotheses I will conduct a large-scale phenotypic screening of two year old seedlings from 18 pine provenances from across Canada. I will test seedlings for variation in response to infection by Grossmania clavigera, the most pathogenic of the MPB fungal associates. I will also test seedlings for responses to water deficit. In the second part of my project, I will discover genetic components that are responsible for the variation in fungal and drought susceptibility observed in the 18 pine populations. I will do this by complementing the phenotypic screen with large-scale molecular marker (SNP) data and conducting a genome-wide association analysis, thereby identifying genomic regions that are involved in these traits. The results of this work will contribute to our understanding of whether genetic variation in pines could contribute to differences in host quality.

Development of innovative practices to recover value, reduce risk and rehabilitate MPB impacted forests in northern Alberta

Derek Sidders, Regional Coordinator and Program Manager and Tim Keddy, Wood Fibre Development Specialist Canadian Wood Fibre Centre, Canadian Forest Service, Natural Resources Canada, Edmonton, AB

Abstract

The Canadian Forest Service's Canadian Wood Fibre Centre is actively involved in the development of innovative practices to recover value from MPB attacked stands in northern Alberta.

These practices include selective logging to recover merchantable lodgepole pine grey, red and green stems as well as incidental hardwoods and other softwood species. The objective is to transform a protection and rehabilitation prescription into multiple commercial values including sawlogs, OSB, pulp, and pre-processed, densified and packaged woody biomass. Risk to continued MPB and fire hazards are also incorporated into the management objective with selected removal and processing of active attack trees, vulnerable dense trees and dead and damaged trees impacting lodgepole and non-lodgepole softwood and commercial hardwood species. The rehabilitation strategy is to open up the stands to allow for a re-establishment of selected softwood crops trees to fully stock the affected stands. This will involve selective microsite preparation using small scale prime movers and excavators with powered and passive treatment heads and planting of seedlings. The objective of the regeneration treatments are to establish the plantation quickly and to diversify the species mix, maximizing future values both ecologically and economically.

Multi-scale landscape genetics of the mountain pine beetle outbreak using direct gradient analysis and variation partitioning

Julian Wittische and Patrick M. A. James, PhD Student and Assistant Professor, Département de Sciences Biologiques, Université de Montréal, Montréal, QC

Abstract

The mountain pine beetle (Dendroctonus ponderosae) outbreak has expanded beyond its historical range and has resulted in significant socio-economic and ecological consequences. Landscape genetics is a tool that can be used to understand the factors shaping the genetics of this outbreak and this knowledge is crucial to help protect Canada's forest resources. The goal of this project is to integrate genetic, spatial and environmental information to investigate the environmental processes shaping beetle dispersal in the landscape and identify possible causes of population differentiation. Using eigenfunction-based methods on data from 4616 individuals in a regression framework, we undertook a multi-scale analysis to answer questions about the relative importance of spatial and environmental variables in shaping genetic variation across the current MPB range. We compare the performance of non-directional (Moran's eigenvector maps) and directional (asymmetrical eigenvector maps) eigenfunctions, as spatial variables, to gain insight into the directionality of expansion across multiple spatial scales. Finally, we partition the variation explained by the best spatial eigenvectors, as well as topographic, climatic and biotic variables to determine what factors are driving MPB gene flow and dispersal. Ongoing research includes using circuit theory and Bayesian kriging to model gene flow and patterns of adaptation will also be briefly presented.

Population genetic structure of mountain pine beetle (Dendroctonus ponderosae Hopkins) across its geographic range.

Batista, P.D. and Sperling, F.A.H., Department of Biological Sciences, University of Alberta, Edmonton, AB; Janes, J.K., Environment and Sustainable Resource Development, Government of Alberta, Edmonton, AB; Boone, C.K. and Murray, B.W., Ecosystem Science and Management Program, University of Northern British Columbia, Prince George, BC

Abstract

The mountain pine beetle (MPB), Dendroctonus ponderosae, has seen frequent major changes in population density in recent years as a result of a warming climate, including a northward range expansion in Canada. Previous work examining the continent-wide genetic variation of MPB identified gene flow occurring around the Great Basin Desert in the United States, following the distribution of host tree species, as well as north-south structuring in British Columbia and Alberta. Our study characterized genetic structure of MPB across its geographic range using putatively non-neutral single nucleotide polymorphisms (SNPs). We genotyped 93 outlier SNPs with the Sequenom iPlex method to evaluate the genetic structure and diversity of 62 MPB populations across North America. SNPs were selected based on their association with functionally important candidate genes. Our results for these non-neutral SNPs were consistent with previous work that examined population structure of MPB based on neutral variation, showing a similar north-south subdivision of Canadian populations and an isolation-by-distance pattern of gene flow seen by around the Great Basin Desert. Our results highlight the use of outlier SNPs data for the use of population assignment and defining management units.

Machine learning for spatial prediction of MPB infestations

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Abstract

Existing research into the prediction of outbreaks of the mountain pine beetle (MPB), Dendroctonus ponderosae Hopkins, has typically sought biological insight through hypothesis testing and model selection, with prediction accuracy playing the secondary role of model validation. Using machine learning algorithms, I am developing classification models that maximize prediction accuracy, with the aim of producing a practical tool to assist with operational decision to manage the MPB. I implemented classification and regression tree (CART) algorithms to find patterns in a high-dimensional dataset of weather and MPB outbreak history in the province of BC from 1942 to 2003 (aerial red-top data from the Forest Insect and Disease Survey). Preliminary results indicate excellent predictive performance in recent years, as measured by area under the receiver-operator curve. This indicates a good overall accuracy, as well as an ability to favour sensitivity or specificity in prediction, as necessary.

NOTES

Photo Credit: Dr. Katherine Bleiker, Canadian Forest Service.

Research Growing Into Practice

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