# 2017–2018 **Annual Report**

fRI Research

Informing Land & Resource Management

# TABLE OF CONTENTS


photo credit: Amy Stenhouse




photo credit: Bill Tinge


Written by Ben Williamson, fRI Research
Designed by BubbleUp Marketing

# PRESIDENT'S MESSAGE

## Jesse Kirillo

Alberta is a busy landscape and those of us who are entrenched in the everyday workings of that landscape rely on outcomes of the programs and associations at fRI Research. Here at fRI Research we recognize our role in producing that critical knowledge, and we work hard to make sure the best available information gets to the people working on this ever-changing landscape.

This is first year of implementing the 5-year business strategy that will take us forward and keep this organization and its research leading the way. The staff and the board of directors remain dedicated and focused on reaching the strategic goals, and I couldn't be prouder of the hard work being done—in the field and in the office—to realize these goals for our partners.

The challenges for funding continued to mount in 2017–2018 but the board has recognized this and as part of our 5-year business plan we have made it a priority. We will look at alternative funding strategies and innovative ways to ensure the continued success of the organization, and, as always, the uninterrupted research outcomes expected by our partners. The organization as a whole continues to be a leader in applied research that provides practical value to our partners.

**We thank you**

for your continued support.

This year we worked towards protecting our critical assets. We have taken major steps to secure the digital information fRI Research has been collecting and building for the past 25 years. We have also made our safety program more robust, protecting our greatest assets: our people. The fRI Research team is our most important resource and I admire their continued focus, dedication, and passion for the work they carry out.

We appreciate the continued support of our partners, in the form of funding, information, and their willingness to expand the scope of research. Together we will continue to fill information gaps, leading to more informed decision-making.

I hope you enjoy this look at the highlights of our past year!

# GENERAL MANAGER'S MESSAGE

## Ryan Tew

"If fRI Research didn't exist, someone would have to invent it"- Bob Bott

I agree wholeheartedly with this statement from the soon-to-be-released book about the 25 year history of fRI Research: *Learning from the Landscape - the fRI Research Story*. fRI Research fills a niche for industry and government, providing sound, practical science to inform land and resource management.

For many organizations, "busy" is the norm; our team is no different. The most important question that I keep my eye on is: are we focusing our "busy" in all the right places? The answer is yes thanks

to the new 2017–2022 Strategic Plan. Building on the successes of the past while looking boldly into the future, the plan enables us to be confident in our approach to the next five years. There are five goals and associated objectives to work towards, thoughtfully and with dedication. The road map has been defined—all we need now are the tools and support to follow it. I encourage you to review our Strategic Plan on the fRI Research website.

photo credit Amy Senhouse

# 2017–2018 Board of Directors

**Jesse Kirillo** (Board President): Repsol Oil & Gas Canada Inc.

**Bruce Mayer** (Board Chair): Alberta Agriculture and Forestry

**Erica Sivell** (Treasurer, Non-voting): Hinton Wood Products, West Fraser Mills Ltd.

**Mark Boulton**: Suncor Energy

**Richard Briand**: West Fraser Mills Ltd.

**Paul McLauchlin**: Rural Municipalities of Alberta

**Shawn Cardiff**: Jasper National Park, Parks Canada

**Mark Cookson**: Blue Ridge Lumber Inc., West Fraser Mills Ltd.

**Wendy Crosina**: Canadian Timberlands, Weyerhaeuser Company Ltd.

**Garth Davis**: Cenovus Energy

**Julienne Morissette**: Northern Forestry Centre, Canadian Forest Service

**Alan Fehr**: Jasper National Park, Parks Canada

**Ken Greenway**: Alberta Agriculture and Forestry

**Dawna Harden**: Alberta Indigenous Relations

**Stan Holmes**: Alberta Timberlands, Weyerhaeuser Company Ltd.

**Dr. Ellen Macdonald**: Department of Renewable Resources, University of Alberta

**Fred Radersma**: Norbord Inc.

**Travis Ripley**: Alberta Environment and Parks

**Gordon Sanders**: West Fraser Mills Ltd.

**Darren Tapp**: Alberta Agriculture and Forestry

**Jon Taszlikowicz**: Alberta Fibre, Canadian Forest Products Ltd.

**Noel Roberts**: Woodlands Alberta, Norbord Inc. (alternate)

**Dwight Weeks**: Canadian Forest Products Ltd. (alternate)

# PARTNERS

Partnerships are the foundation and lifeblood of fRI Research. Through the contributions and actions of partners, issues are identified and analyzed, resources are assembled, and new knowledge is created, transferred, and integrated into land and resource management in Alberta and beyond. The strength of the fRI Research organization would not be what it is today without partners' commitment, and fRI Research is honoured to have their contributions in any form. fRI Research offers and supports flexible and inclusive partnership structures and opportunities that are broadly described by the categories listed below. These are not exclusive, and many partners find a role for themselves in more than one category.

## Shareholders

Under Alberta legislation, shareholders are legally responsible for directing the affairs of the non-profit fRI Research. Shareholders provide stable core funding and in-kind contributions to support the overall operation of fRI Research. The 2017–2018 shareholders of fRI Research are Alberta Agriculture and Forestry; ConocoPhillips Canada*; Parks Canada, Jasper National Park; Norbord Inc.; Repsol Oil & Gas Canada Inc.*; Suncor Energy Inc.*; Hinton Wood Products, a division of West Fraser Mills Ltd.; Canfor Corporation; and Weyerhaeuser Company.

** Companies are shareholders through the Foothills Energy Partners*

## Program and Association Partners

These partners provide funding and/or in-kind contributions to directly support fRI Research programs and/or associations, or collaborate on projects or other matters of mutual interest. Many of these partners are also responsible for land, resource, or forest management, and are interested in using fRI Research knowledge and tools in their businesses.

Alberta Indigenous Relations
Alberta Agriculture and Forestry
Alberta Biodiversity Monitoring Institute
Alberta Conservation Association
Alberta Energy Regulator
Alberta Environment and Parks
Alberta Fish & Game Association
Alberta Institute of Agrologists
Alberta Innovates
Alberta Labour
Alberta Newsprint Company
Alberta-Pacific Forest Industries Inc.
Alberta Plywood, a division of West Fraser Mills Ltd.
Alberta Professional Planners Institute
Alberta Riparian Habitat Management Society
Alberta Upstream Petroleum Research Fund
Apache Canada Ltd.
Arctos Ecological Consulting
Aseniwuche Winewak Nation of Canada
Athabasca Watershed Council
Bandaloop Landscape-Ecosystem Services
Battle River Watershed Alliance
BC Oil and Gas Commission
BC Oil and Gas Research and Innovation Society
Beaver River Watershed Alliance
Blue Ridge Lumber, a division of West Fraser Mills Ltd.
Borealis Ecology Wildlife Research
Bow River Basin Council
Canadian Association of Petroleum Producers
Canadian Boreal Forest Agreement
Canadian Institute of Forestry
Canadian Natural Resources Limited
Canadian Wildlife Health Cooperative
Cenovus Energy Inc.
City of Grande Prairie
Colleges and Institutes Canada
Conservation Ecology Lab
County of Grande Prairie No. 1
Craig International
Cumulative Environmental Management Association
Daishowa-Marubeni International Ltd.
Denali National Park

Devon Energy Corporation
Ducks Unlimited Canada
Edson Forest Products, a division of West Fraser Mills Ltd.
Encana Corporation
Environment and Climate Change Canada
Explorers and Producers Association of Canada
Fisheries and Oceans Canada
Followit Sweden AB.
Foothills Forest Products
FORCORP
Forest Products Association of Canada
Forest Resource Improvement Association of Alberta
Forest Stewardship Council
Forsite Consultants Ltd.
Fuse Consulting Ltd.
Golder Associates
Government of British Columbia (Ministry of Environment; Ministry of Forests, Lands and Natural Resource Operations)
Government of Northwest Territories (Ministry of Environment and Natural Resources)
Government of Saskatchewan (Ministry of Environment)
Grande Cache Coal Corporation
Greenlink Forestry Inc.
Hammerhead Resources Inc.
High Prairie Forest Products, a division of West Fraser Mills Ltd.
Hinton and District Chamber of Commerce
Husky Energy Inc.
Inside Education
Integrated Ecological Research
Jasper National Park
Jasper-Yellowhead Museum & Archives
Joss Wind Power Inc.
Jupiter Resources
Lesser Slave Watershed Council
Louisiana-Pacific Corporation
Manning Forest Products, a division of West Fraser Mills Ltd.
Métis Settlement General Council
Mighty Peace Watershed Alliance
Millar Western Forest Products Ltd.
Milk River Watershed Council Canada
Mistik Management Ltd.
Mitacs
Natural Sciences and Engineering Research Council of Canada
Natural Resources Canada, Canadian Forest Service
Northland Forest Products Ltd.
North Saskatchewan Watershed Alliance
Northern Rockies Museum of Culture & Heritage
Norwegian University of Life Sciences
Norwegian Institute of Bioeconomy Research
Oldman Watershed Council
Paramount Resources Ltd.
Pembina Pipeline Corporation
Peregrine Helicopters
Peter J. Murphy Forest Consulting Ltd.
Petroleum Technology Alliance Canada
Prairie Mines & Royalty ULC
Red Deer River Watershed Alliance
Saskatoon Forestry Farm Park & Zoo
Scandinavian Brown Bear Research Project
Seven Generations Energy Ltd.
Shell Canada Limited
South East Alberta Watershed Alliance
Spray Lake Sawmills
St'at'imc Government Services
Sundre Forest Products, a division of West Fraser Mills Ltd.
Sustainable Forestry Initiative Inc.
TAQA North Ltd.
Teck Resources Limited (Cardinal River Operations)
TerrainWorks
Timberworks Inc.
Tolko Industries Ltd.
Tom Peterson
Toronto Zoo
Tourmaline Oil Corp.
Town of Grande Cache
Town of Hinton
TransCanada Corporation
Trout Unlimited Canada
United States Department of Agriculture
University of Alberta
University of British Columbia
University of Calgary
Université Laval
University of Oslo
University of Saskatchewan
University of Victoria
Washington State University
Vanderwell Contractors (1971) Ltd.
Westmoreland Coal Company (Coal Valley Mine)
Wild Year Productions Ltd.
Woodland Operations Learning Foundation
XTO Energy Inc.
Yellowhead County
Yellowstone to Yukon Conservation Initiative

## Alignment Partners

These partners do not provide direct financial or in-kind support to fRI Research, but they have specifically expressed their support for, and alignment with, our vision and goals.

Alberta Chamber of Resources
Alberta Forest Products Association
Alberta Forest Genetic Resources Council
Alberta Society of Professional Biologists
Alberta Trappers' Association
Association of Alberta Forest Management Professionals
Banff National Park
British Columbia Institute of Technology
Brock University
Canada's Oil Sands Innovation Alliance
Canadian Land Reclamation Association, Alberta Chapter
Carleton University
City of Dawson Creek, British Columbia
Conservation Biology Institute
Council of Forest Industries
Defenders of Wildlife Canada
EMEND (Ecosystem Management Emulating Natural Disturbance) Project
Ember Research Services Ltd.
F.C. Pollett Inc.
Forest History Association of Alberta
Forest Products Association of Canada
FP Innovations (Wildfire Operations Research)
Hinton Fish & Game Association
International Model Forest Network
KBM Resources Group
Land Stewardship Centre (Alberta Stewardship Network)
McCarthy Tétrault LLP
Millenium EMS Solutions Ltd.
Municipality of Jasper
NAIT Boreal Research Institute
Nature Conservancy of Canada
NatureServe Canada
Ontario Ministry of Natural Resources and Forestry
Palisades Stewardship Education Centre
Silvacom
Tourism Jasper
Town of Edson
University of Guelph
University of Montana
University of New Brunswick
University of Waterloo
Vilhelmina Model Forest
Western Boreal Aspen Corporation
Western University
Wildlife Habitat Canada
Wilfred Laurier University
World Wildlife Fund Canada

# THE MOVE

One question leads to another. It was 2015 and we had just finished a massive effort to find out how many grizzly bears are living in a sprawling area of Alberta called BMA 3 to answer the question: is the population stable, going up, or going down? The headline result was that the population in BMA 3 has doubled from about 36 to 74 in the 10 years since the first census was done. That's an unusually large increase for grizzly bears, so we then had to figure out why.

It would be great news for bears if efforts since 2006 to reduce human-caused grizzly bear mortalities had simply lowered grizzly bear deaths across the province enough that there was a true recovery underway. But we couldn't rule out another explanation that complicates the picture.

For decades, the Government of Alberta has been dealing with conflict, or "problem" bears that cause trouble because, for example, they have taken to killing livestock or hanging around towns for the easy meals we leave in garbage bins. When things like public education, electric fences, bear-proof bins, and even active deterrents are not enough, officers either have to kill the bear or move it. Moving, when possible, is preferred.

We knew from working with Alberta Fish and Wildlife on translocations—that's what wildlife managers call moving a bear to a new BMA—that some bears were being moved into BMA 3. So the next thing to figure out is how much of the population increase that we found in BMA 3 was just a result of translocation,

and how much was from more grizzly bear births and fewer deaths.

To find out, Sarah Milligan, one of the **Grizzly Bear Program** biologists, went digging through the province's grizzly bear translocation files. She found records of over 500 translocations going back as far as 1974. Once compiled and merged with our long-term database, our team was able to check if any of the bears we detected during our 2014 inventory had been translocated into the area. What we found was that approximately 30% of the population increase was a result of moving bears into this BMA over the decade prior.

Milligan also looked at what successful moves have in common. She found that translocation failed 77 times out of the 110 cases for which she could determine the outcome because the bear died, it returned to the area it was captured in, or it kept causing trouble. For the 33 cases that succeeded, there are specific things that wildlife managers can do right now to improve the odds of success: releasing the bear in an area with fewer roads and near a river, moving the bear at least 100km away from where it was captured, and doing translocations earlier in the year.

We've now partnered with Alberta Environment and Parks, whose Fish and Wildlife officers carry out the translocations. Beginning in 2017, they notify us as soon as they start mobilizing for a potential grizzly bear translocation. We drop what we're doing and drive there immediately to assist with handling and collect a suite of samples and health information about the bear. Finally, we fit the bear with a GPS collar to track its movement for the next year or two.

Now that we're tracking what happens to conflict bears much more comprehensively, we can start to get answers on questions about whether translocation affects a bear's behaviour: how it moves, what habitat it selects, when and where it dens in the winter, and a big one: the survival rate.

From just the first year of data, the early pattern we're seeing is that translocated bears have very large home ranges—they just move around a lot more, although they still seem to rest and roam at the usual hours. The sample size is too small to know anything for certain yet, but with a few more seasons and our ever-improving methods for monitoring grizzly bears, we are set up to gather insights that can make a difference in management decisions.

2018 is a big year for grizzly bear management in Alberta. We will be surveying two more grizzly bear populations: BMA 4 and BMA 7. BMA 7 has never had a population inventory, and this will be the first inventory of BMA 4 since 2005, which will allow us to find out if that population has been changing too. And just like BMA 3, we'll be able to check to see if translocation is a factor there. This information will be very valuable for grizzly bear conservation, but we're just as excited about all the new questions for us to understand.

**17%** of the Chinchaga range had a high probability of overlap between caribou and wolves

photo credit: Adam Sprott

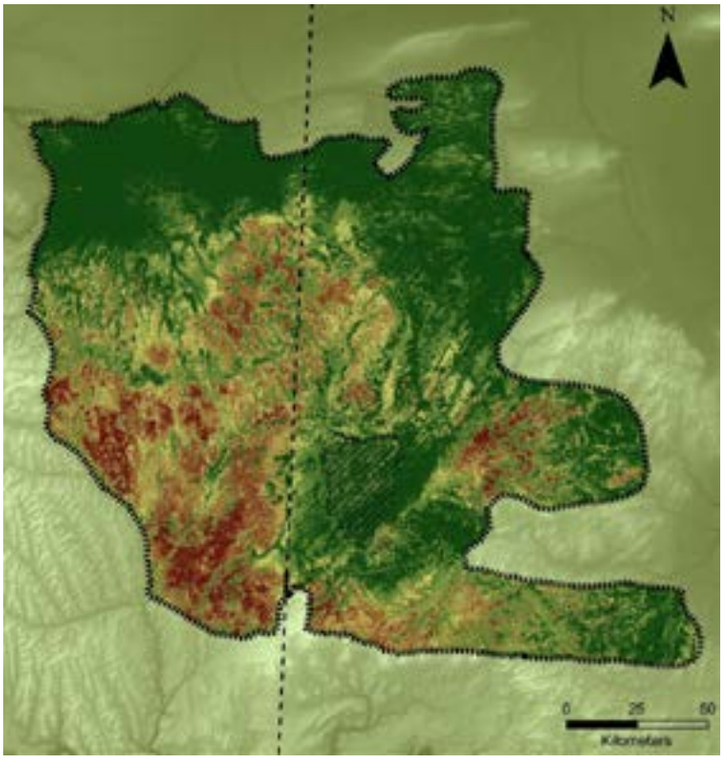



photo credit: Adam Sprott

# A CARIBOU SAGA IN THE CHINCHAGA

Though the caribou in the Chinchaga herd don't know it, the Alberta-BC border cuts invisibly through the middle of their range. A FRIAA-funded project by the **Caribou Program** had examined how oil and gas development on the Alberta side was affecting caribou behaviour, but that was only ever half the story. In 2017, the team, supported by the BC Oil and Gas Research and Innovation Society, completed the tale for the BC half, and in the process set some inter-provincial firsts in caribou conservation.

Boreal caribou generally avoid disturbance on the landscape: roads, cutblocks, seismic lines, well pads, you name it. While these generalities are well established, specific management actions require answers to much more specific questions.

First, as activity on wells ramps down from construction to production to reclamation, does the effect on caribou and wolf behaviour also change? In other words, the actual footprint of the disturbance might be the same, but maybe a well pad has a higher impact during the initial construction phase. We got well site activity and pipeline data from both provincial regulators, and compared that with the locations of GPS-tracked wolves and caribou.

As expected, caribou avoided all high- and moderate-activity well sites during all seasons, but the more active the well, the further away was the habitat that they selected. They avoided low-activity well pads overall, but during winter, they actually selected for areas near these sites. Wolves were less averse to well pads; they didn't select habitat quite as far away as caribou did, and even preferred areas near moderate-activity well sites with only regular but brief visits by people. They also selected areas near low-activity wells during the winter season—the same time that caribou are also near.

The team studied pipelines too. Using GPS-tracked caribou and wolves, they created the first interprovincial maps of caribou and wolf habitat use, broken down by season, across the entire Chinchaga range. Next, our field crews went out and visited hundreds of sites in both provinces to document the fine-scale features of the pipelines and surrounding forests. They looked for direct signs—tracks and scat—of predators and alternative prey like moose, deer, and elk, as well as foods that would attract them.

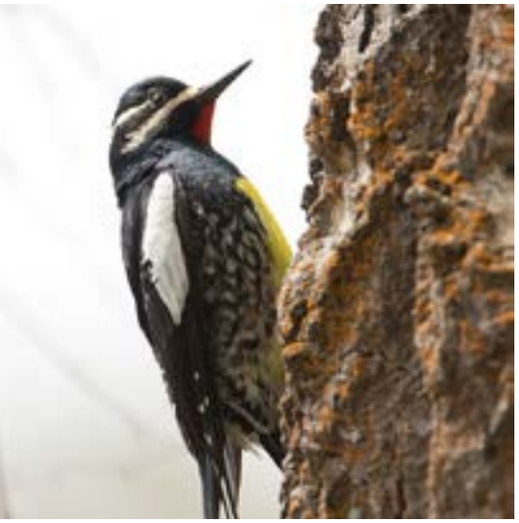
The goal was to discover which pipelines are likely to be visited by both caribou and those other species, because such pipelines raise the risk of caribou predation, making them a logical target for conservation actions. What we found was that pipelines with gentle slopes were used by predators and alternative prey, and moose specifically liked pipelines running through broadleaf forests.

Between the well sites and pipelines, the team identified 17% of the entire Chinchaga range that had a high probability of overlap between caribou and wolves. These results will allow our partners to take specific, coordinated action in both provinces. All the details of the project and its findings were released in a final report in the fall of 2017.












# NEW PROJECT TAKES FLIGHT

fRI Research partnered with Fuse Consulting on the FRIAA-funded **Migratory Bird Project**.

In December 2016, migratory bird experts flocked to Alberta for a workshop hosted by fRI Research. We asked that they bring their knowledge, but also their questions to help identify knowledge gaps in bird conservation in western Canada. The group determined that there were high-level resources at the national level available to forest managers, and the scientific literature had robust information about the biology of many individual species. But that information had not been synthesized and made accessible to forest managers so that it could actually be applied on the ground, in a cutblock, for different bird species.

Matthew Pyper and Sonya Odsen of Fuse Consulting put in a proposal to remedy this. With the support of FRIAA funding, they began a literature review in the summer of 2017. Since then, they have produced fact sheets for 40 different species, such as the Canada Warbler. In one or two pages, each sheet distills the key scientific facts about a migratory bird relevant to forestry.

The team also put together a further seven habitat-level accounts to summarize the science for all the relevant bird species in, for example a deciduous forest in Alberta. Finally, Pyper and Odsen wrote a landscape-level summary.

"The idea is to make it easy for forest managers to consider migratory birds when planning at a variety of scales," says Pyper. "For example, some bird species rely on burned patches, so a forest manager could look for opportunities to preserve some of those habitats during their planning."

Pyper and Odsen were helped throughout the project by a forest management advisory group that included biologists from West Fraser Mills, Weyerhaeuser, Canfor, and former fRI Research president Rick Bonar, who got a doctorate studying an important bird species, the pileated woodpecker.

Pyper and Odsen are now working with partners to determine what they can do next to maximize the utility of the project. One idea is to embed the products into the GIS layers that forestry planners use, so as they are designing cutblocks, they can easily reference the information.

# WHAT MAY STOP THE BEETLE

"When they mass attack, they produce a cloud. Farmers in Alberta said they heard the beetles raining down on their tin roofs. Tingtingting."

Jordan Lewis Burke, a post-doc at UBC, is describing this new kind of bad weather for Alberta's forests because he's trying to forecast what's next. A project of the **Mountain Pine Beetle Ecology Program** asks: will the mountain pine beetle front continue east through Canada's boreal forest, or will it dry up?

photo credit: B. O. Sweeney

"When they mass attack, they produce a cloud. Farmers in Alberta said they heard the beetles raining down on their tin roofs. Tingtingting."

-Jordan Burke

In BC, where MPB is endemic, we know that it would periodically explode into an epidemic state, maybe every 40 years or so.

"The records are kind of limited, but First Nations knew about it and Lori Daniels' Tree Ring Lab can pick up the signature of beetle attack going back more than 100 years," says Burke. "But now they've breached the Rockies into Alberta, where they've never really been except for small patches far in the south."

As with the uptick in extreme weather events, this new natural disaster is almost certainly because of climate change. Milder winters are allowing the beetle to survive in areas that were once too cold. As Canada continues to warm, it's a safe bet that MPB will creep further and further north. But the situation to the east is a bit more complicated.

"The Alberta boreal flattens out from the foothills into a gradual transition to jack pine, which is a prominent pine species in the boreal and extends even into the Maritimes. So that's a big concern. If the beetle does well in jack pine," says Burke, "then uh oh."

Burke's research indicated that this concern was well placed. In his UBC lab, he put out jack and lodgepole pine logs and found that MPB actually preferred the jack pine. Nadir Erbilgin's lab at the U of A found a likely reason why: When a female beetle lands on a tree she converts one of the tree's own organic compounds into trans-verbenol, a pheromone that guides other MPB in the area towards this tree, starting a mass attack. Erbilgin found that jack pine had 5–10 times the concentration of the organic precursors, allowing the beetles to produce twice as much of the pheromone. In Burke's experiment, he found that the jack pine logs attracted double the beetles.

"But there was a discrepancy," says Burke. "You'd expect jack pine to just be wiped out. But they weren't."

In the eastern zones, the beetles would successfully attack and kill jack pine, their larvae would develop, but the outbreak would fizzle out there. They didn't emerge in ever-larger clouds the next summer and keep spreading.

To understand the fate of MPB in Alberta, UBC researchers from Dr. Burke's lab went out to the eastern edge of the invasion to see what's actually happening in the forest. They surveyed 12 five-hectare areas of lodgepole and jack pine in Alberta, and looked at every single tree to try to find out what was slowing down the expansion. They had a few hypotheses to test.

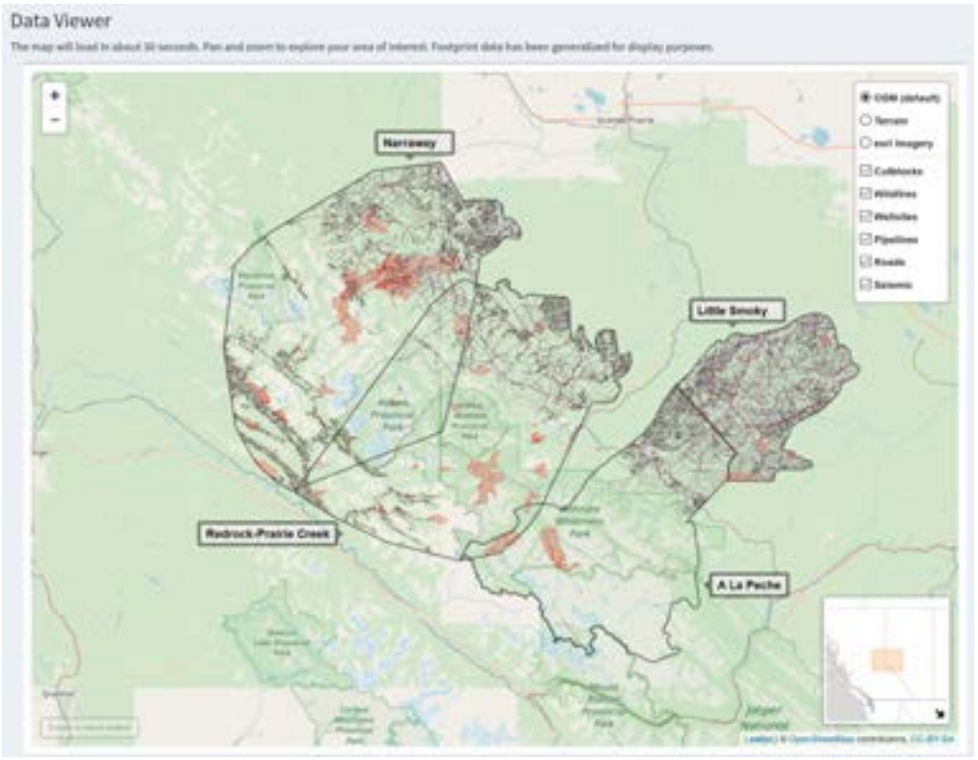
First, lodgepole pine grows very densely in BC and western Alberta, but as you move east into poorer, drier sites, there's a gradual transition to hybrid stands, and then eventually pure jack stands, and these tend to be much less dense. This means that there are fewer trees to sustain an epidemic of mountain pine beetles in a given area.

Second, a new host tree species comes with its own bark beetles, and the MPB newcomers do not stand much of a chance. MPB don't finish developing into adults and fly from their host tree until much later in the year than many other beetle species. This means that they will miss out on the best trees, of which there are fewer in the less dense jack stands. And it's no good letting the other bark beetles do the hard work of actually killing the trees and then flying over later to join the feast.

"The other beetles have like two-inch larvae," says Burke. "They just shred the dying trees. In 6 months, there is nothing left under the bark. They eat everything including other beetles."

The presence of these other big, juicy beetles is also a big draw for woodpeckers, which will not turn down MPB if they happen on them. This combination of fewer trees, being outcompeted by other beetles, and beset by woodpeckers makes jack pine stands a pretty dangerous place for MPB to try to invade. It's possible that some combination of these factors will explain why MPB aren't having the same success as they were in previous outbreaks, and with this information, Burke and his colleagues will be able to predict what happens next.

Until the results are in, Burke offers his hunch. "They seem to have hit a wall. My guess is they won't march across Canada because the problems MPB will face will just get worse. If they get to Manitoba or Ontario, it will be by truck."




**Tools available:**

caribou RSF

wolf RSF

cougar RSF

caribou connectivity

The Caribou Webtools have been rigorously tested and were released in the

**spring of 2018**

# CARIBOU TOOLS MIGRATING ONLINE

"I have to let the model run overnight."

We hear this a lot around the office. These days, spatial models are powerful, essential tools for ecologists and resource planners alike. But they can be monstrous: often querying huge datasets that are not easily shared, taking hours to run even while devouring all of a computer's resources, and requiring expensive GIS software with a specific configuration of extensions.


For years, the **GIS Program** has collaborated with our research programs to build these tools. When it's time to deliver, all the necessary parts are loaded onto thumb drives and mailed to partners. This process works, but clearly has its limits. Mailing hard drives is not very efficient, many smaller organizations might not have access to the software needed to run the models, and there may be agreements preventing us from handing over all the data used by the models.

This year, the GIS Program put their heads in the cloud and saw a better way.

Our GIS analyst Dan Wismer is working with the **Caribou Program** to build their tools in the programming language R so it can be offered online. The Caribou Webtools suite allows users to upload different scenarios, such as adding roads and a cutblock, or restoring seismic lines. This lets planners see how different options affect habitat quality and connectivity for caribou and their predators.

"This is a new service that the GIS Program is providing," says Wismer. "We're making our models more accessible by combining them with internet technology."

Anyone with an internet connection can log on and run the model directly in their browser. Everything is already on a server—the data, the software, and the code that runs the model—so the user doesn't have to have any of that. No more thumb drives in the mail, and because the server is doing all the calculations, the user can continue working on their computer, completely unaffected by the model running in the cloud.

"At the end of the day, we want it to be used," says Wismer. "If our partners are using these tools in their planning process—that would be a huge success."

This goes to another advantage to putting the model into the cloud. Not only does it make it more accessible (and therefore hopefully used more often and more widely), but we can also track its use to get a better idea of what impact it is having.

The models take minutes to run, and there can be multiple runs at the same time, making it a compelling product for land managers who want to compare a bunch of scenarios to get a preliminary sense of what the options will mean for wildlife. At the same time, the outputs are all grounded in the Caribou Program's peer reviewed science, and are precise enough to guide final decisions by government and industry, or to be used by academic partners in their own research.

The Caribou Webtools have been rigorously tested and were released in the spring of 2018.

# 2017

the program hosted dialogue sessions in Athabasca, Grande Prairie, Calgary, and Edmonton

# THE EBM DIALOGUE SESSIONS

**The Healthy Landscapes Program** has, through reports, papers, conference presentations and all the other usual scientific channels, advanced ecosystem-based management for more than a decade. This is the concept of managing for the entire landscape, not just for individual and often conflicting values, in an effort to avoid harmful cumulative effects. But despite a growing body of evidence that points to the potential of the idea, there are still barriers for some stakeholders.

To help translate science into action, the Healthy Landscapes Program has added more outreach activities. In 2017, the program hosted dialogue sessions in Athabasca, Grande Prairie, Calgary, and Edmonton. As the name implies, the goal was to facilitate a genuine conversation between government, industry, environmental groups, landowners, and scientists. Instead of debating positions, the team was interested in discussing the deeper interests, beliefs, and values from which people's positions arise. The goal was for everyone to better understand each other, increase trust, and find common ground.

"We went to those communities and provided people with a forum to tell us what they think ecosystem-based management is and what they think the barriers to implementation are," says Matthew Pyper, who helped organize the events.

For the four sessions, 81 people signed up to share their views with the team and the other participants. This included strong turnouts from the provincial government, the forest industry, and environmental groups, as well as valuable representation from indigenous organizations, academia, other industries, and a range of community groups.

The attendees were surveyed before and after their session. The first question the team looked at was simply how likely people were to recommend ecosystem-based management. Going in, attendees were strongly in favour of the concept—no one was less than a five out of ten. After the session, views were much less uniform. There were still many people highly likely to recommend ecosystem-based management, but some had become less sure.

Perhaps surprisingly, the team is proud of this result because it shows that a real conversation took place. The goal wasn't to give people the hard sell; it was to increase trust in the science, and between the different stakeholder groups. By that metric, the surveys had more good news. 72% of attendees said they gained an appreciation of other perspectives. More specifically, the only statistically significant distrust between groups going in—between environmental groups and the forest industry—disappeared by the end.

Science is always ahead of practice. It takes time for new ideas to be embraced by regulators, and to become accepted by the public. But by building trust and genuinely listening, the team hopes to bridge the gap between scientific advances and a healthier landscape.

# COOPERATIVE MANAGEMENT OF HISTORIC RESEARCH TRIALS

When this study began, there were no computer models of growth and yield. No computers at all, actually. No one had studied a tree's genome or even figured out that genomes are written in DNA. But even in the 1930s, silviculturalists wanted to know the same thing as they want to know today: what they should do to get more wood fibre of higher quality.

So the Canadian Forest Service (CFS) started a study of lodgepole pine stands regrowing after forest fires. For the next 50-odd years, they watched the trees grow. At some stands they fertilized, at others they thinned the trees to different densities early or midway in a stand's lifespan, and in some trials, they both fertilized and thinned. Every so often someone would go out to measure them or apply some part of the treatment.

By the late 1980s, the original researchers having retired, the trials began to lapse. The pine trees kept growing, but for a time, went unwatched. Meanwhile, the model forest program began, the Foothills Growth and Yield Association (FGYA) was formed, and in 2001, the FGYA, the CFS, and the Government of Alberta visited the trial sites. Growth and yield research is a patient pursuit, but even by those standards, it was immediately clear that this long term study was something special. The next year, the FGYA had signed on to manage the trials, along with Alberta Agriculture and Forestry and the CFS. This will ensure the trials will continue for decades.

The CFS uses the data to understand and model the relationships between tree growth and wood fibre properties, and the influence of site and silviculture treatments. Their models of these relationships have been integrated with the Mixedwood Growth Model. For foresters, the results from these trials will assist in timing stand treatments, as well as knowing which densities might yield the fastest growth and highest volumes. Re-measuring growth in the coming decades could also improve other planning tools that foresters use.

These projects are coordinated by **FGrOW**, the Forest Growth Organization of Western Canada.

# MIXED WOOD GROWTH MODEL

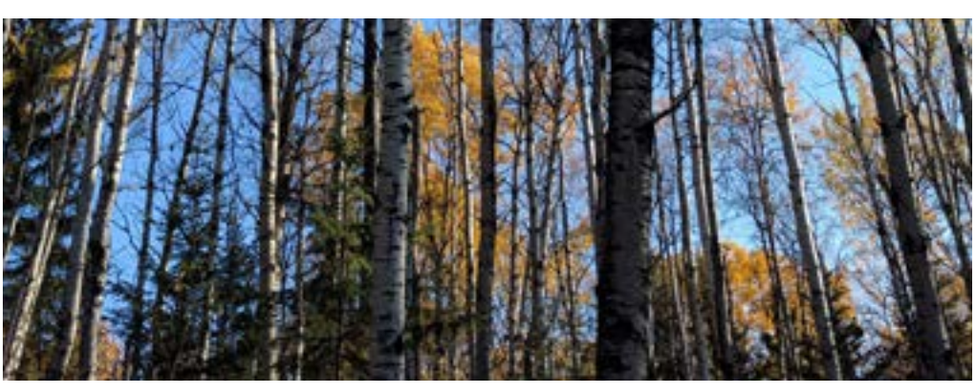
Mixedwood Growth Model (MGM) is an individual tree model for the boreal forest developed by University of Alberta researchers to grow and kill individual trees within a stand based on their size relative to other trees nearby and how each species responds to competition. By taking this approach, MGM can simulate the effects of events like thinning treatments, and is generally more realistic about complex stand structures than stand-level models.

Forest companies want to use MGM for forest management planning, which requires approval for use by the Government of Alberta but the government's stand-level Growth and Yield Project System (GYPSY) model is the only one approved for use in forest management planning. The Western Boreal Growth and Yield team is making several major improvements that extend what MGM can do.

Previously, MGM was robust for white spruce, lodgepole pine, and aspen, but recent enhancements have significantly improved the ability to add jack pine and black spruce to the mix. The MGM team has also added the 2009 Government of Alberta site index equations to the model. Combined with good documentation that makes MGM more transparent to regulators and users.

The team is also giving MGM the ability to accept measurements from permanent sample plots from around the province, to better calibrate model runs with real-world data. They are also adding the ability for users to factor tree improvement into their model forecasts.

MGM will not replace other models like GYPSY, but it will provide foresters with a tool that can do things GYPSY was never designed for. And because the models are different, using both will provide excellent validation, giving the province and industry greater confidence that Alberta's forests are well managed.



# MAKING HISTORY

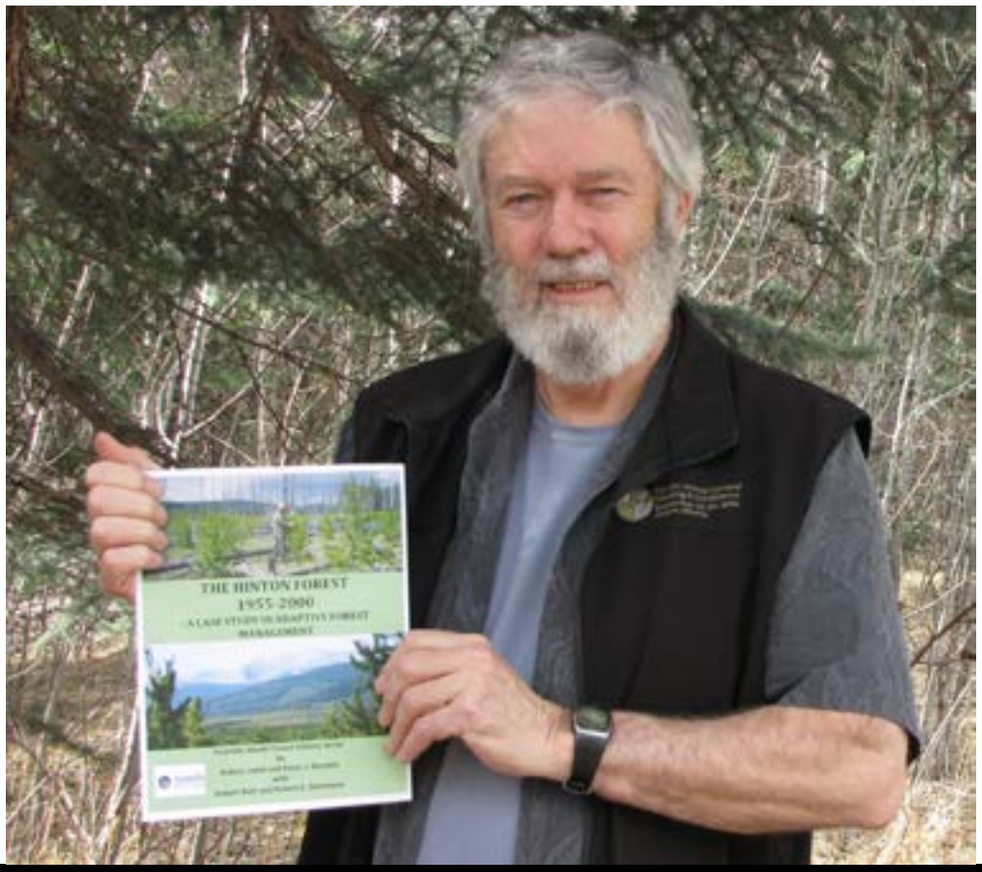
After the grey and white beard, the most noticeable thing about Bob Udell is his voice: a resonant bass that rolls and rumbles through his vast collection of stories: stories of the forests, of the people working on the land, and lately of the organization, fRI Research, he helped found in 1992. Udell would lead that organization until 2005, growing it from a small team researching forest values east of Jasper to a full-fledged research institute with over 100 partners and many projects across western Canada.

But long before all that came to be—back in 1995 in fact—Udell presented a paper showing how growth and yield research had contributed to a steadily increasing allowable cut on Weldwood's Hinton forest. A pointed question from professor Les Reed of UBC's forestry faculty planted a seed in Udell's mind. Reed wanted to know why no one had documented the remarkable story of one of Canada's most celebrated industrial forest management programs. The idea took root, and Udell pitched the idea to Weldwood as a 40th anniversary project for the company. Forestry professor Peter Murphy, writer Bob Bott, and historian Bob Stevenson enlisted to help with the project, and after producing "Living Legacy" for Weldwood, they began expanding the story and the geographic scope to encompass the crown lands and industrial forest of the entire original model forest research landbase. Thus began the Adaptive Forest Management/ History Program and its first book *Learning from the Forest*. To research this book, the team interviewed many key players in both industry, the public, and government. We have shared several of these on our website.

Even as the team was working on that project, Murphy and Professor Marty Luckert, along with grad student Michael den Otter, proposed a parallel study of adaptive management on the large protected areas within the now-expanded model forest: Jasper National Park, Willmore Wilderness, and Switzer Provincial Parks.

These two early projects only served to whet the appetite within the program team—as well as the fRI Research Board of Directors—for more work on the forest and landscape history of west-central Alberta. As the program grew, it branched into topics besides adaptive forest management, and the original (rather specific) name was eventually generalized

photo credit: DFB Photo, 1912



to the **Forest History Program**.

"I really enjoyed working on the Forest History Program," says Udell. "It allowed me to work on projects with old colleagues such as Pete Murphy, Bob Stevenson, Steve Ferdinand, and Fred Pollett, as well as developing new associates like Bob Bott and Tom Peterson."

Hinton historian Tom Peterson joined Udell, Murphy, and others on a deeper history of the area, completed in 2007, called *A Hard Road to Travel* that reached back 10,000 years. Soon after, retired

CFS Director General of Science Pollett joined the team to develop the Northern Rockies highway guidebook, which pulled together the geology, ecology, and of course, the history of the landscape of Jasper and its neighbours to the east and west. This was the latest publication in the TransCanada Ecotours series, originally created by the Canadian Forest Service and now overseen by Pollett.

That a history program can thrive in a research institute that is constantly asked urgent scientific questions speaks to the long-term mindset of the fRI Research management, and in particular, its Board. They understand that although the program might not serve up quick easy answers for the pressing land management questions of the day, in the long run, understanding how old approaches have succeeded or come up short provides invaluable perspective and a starting point for moving into the future.

"It's been heartening to have had such strong support from the Board and in particular the Assistant Deputy Ministers Cliff Henderson and Bruce Mayer," says Udell.

Now retired and moved away west over the mountains and down to the sea, Bob Udell is winding down the Forest History Program. In the last year, Murphy's logging history of the Whirlpool River has been exhibited at the Jasper Yellowhead Museum. Murphy is also putting the finishing touches on his work to relocate and map the historic Columbia Trail through Jasper National Park, which was used by first peoples and fur traders to cross the Rocky Mountains, and later by loggers supplying timber for railroad ties in the early 1920s.

The program has released e-book versions of some of their publications, and issued corrections and updates to others. But the biggest loose end to tie off is a final book, about an organization that has become part of the history of the area; *Learning from the Landscape* is something of a memoir recounting the first 25 years of our organization, and elements of the last 25 years of Udell's career in the foothills.

With a quarter-century of sound, useful research to our name, it's time we shared our remarkable contributions to land management, even as we continue making history.

## Learning from the Landscape: the fRI Research story

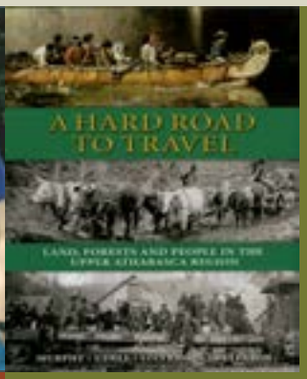
The 25 Year History of fRI Research is the 2-man effort of Bob Bott, who was a lead writer on the first Forest History Program book, and Bob Udell, who has been hardwired to the organization from day one. The chapters, based on the Canadian Council of Forest Ministers' "Criteria and Indicators of Sustainable Forest Management," tell the story of fRI Research programs from their inception until today. This structure was chosen because it gives clear narratives to each topic, shows the relevance of the program to Canada's sustainability objectives, and provides a sense of the impact our contribution has had on each subject.

The outsize impact our small organization has had on so many subjects—from caribou to climate, from wildfire to watersheds—is reflected in a word count of over 150,000, including four appendices. 26 maps and nearly 170 historical photos have been assembled to help tell the story of this organization. Publication is on track for fall 2018.

# HIGHLIGHTS

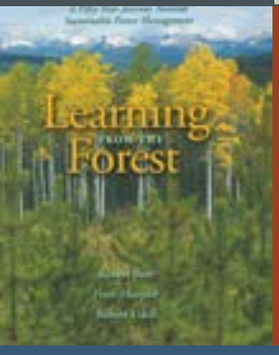
## 1996

Bob Udell starts a history program.




## 2007

*A Hard Road to Travel* follows up Learning from the Forest by reaching back not 50 years, but 10,000, to trace the geological, ecological and anthropogenic history of the upper Athabasca, a pivotal area in Canada's history.



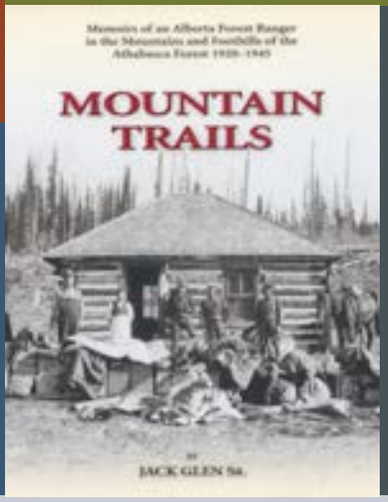

## 2003

*Learning from the Forest: a fifty-year journey towards sustainable forest management* traces the evolution of forest management from the narrow concern for timber supply in the 1950s to a far more holistic approach to managing all the forest values from biodiversity to recreation.

*The Resilient Forest* revisits the sites that were the focus of a highly-publicized and vitriolic anti-forestry campaign in 1971. The publication examines the dire predictions of that campaign and compares them—including before and after images—to how the sites actually developed in the ensuing 35 years.

## 2004

In 2004, the Canadian Institute of Forestry and the Society of American Foresters hosted a joint conference in Edmonton with about 1,500 delegates. The Forest History Program organized on of only two plenary sessions, entitled "The Roots of the Present are Buried Deep in the Past" with five distinguished speakers including our own Peter Murphy. These presentations were recorded and can be found on our website.




## 2008

From 1920 to 1945, Jack Glen Sr. was a forest ranger for the aptly community of Entrance, the eastern gateway through the Rocky Mountains. His memoir, *Mountain Trails*, was adapted and enhanced by the Forest History Program, and tells the stories of adventure and colourful characters that filled his days with the Dominion Forest Branch and, after 1930, Alberta Forest Service.

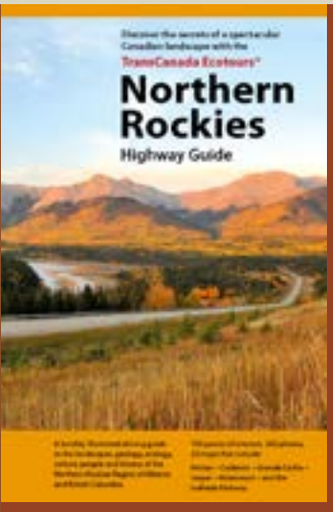
# Logging in the Whirlpool Museum Exhibit

The project began, fittingly, where it ended: in the Jasper-Yellowhead Museum & Archives. Pete Murphy of the Forest History Program was sifting through records from the park's infancy when local archivist Karen Byers showed him a remarkable map from 1919. It was of the Whirlpool Valley, which the voyageurs used to cross over the Rocky Mountains via the Athabasca Pass (now a National Historic Site) in the 1800s, and it showed a surprising thing for those without a deep knowledge of park history: timber limits.

"It was kind of a well-kept secret," says Rob Hubick, the manager of the JYMA. "Even the locals—I don't think a lot of people were aware that there was logging in the park until the exhibit launched."

With the help of his friend and local historian Tom Peterson, along with Parks Canada historian Mike Dillon, Murphy was able to piece together the entire story over the course of the next few years, including many field visits to the Athabasca and Whirlpool Rivers. They found the overgrown ruins of the logging camps and sawmill sites, the remnants of a boom anchor used to catch the logs floated downriver by the logging crews, and even a half-buried railroad tie at an old tie-piling ground along the Whirlpool River that the river drivers missed one spring.

Murphy, Peterson, and Dillon worked




## 2013

Lavishly illustrated and deeply researched, and combining information from previous work as well as new investigations, the *Northern Rockies Highway Guide* serves as a reference for hundreds of historical, ecological, and geological points of interest along highways in the foothills and mountains of west-central Alberta and west to Valemount.

*A 50-year History of Silviculture on the Hinton Forest 1955–2005*. This ebook provides insight into the science, philosophy and practice of silviculture as it evolved under an adaptive forest management framework.

## 2014

*The Hinton Forest: A Case Study in Adaptive Forest Management 1955–2000* is an ebook which provides a more in-depth review of the remarkable industry-led forestry program begun by Des Crossley in 1955, and how it developed on the industrial forest that was the core of the original Foothills Model Forest.

## 2017

After years of trips up the Whirlpool Valley (and some help from our GIS Program), it was time for Pete Murphy to tell the story of the tie logging operation in Jasper National Park in the 1920s. What better place to tell it than in the museum in Jasper itself?

## 2018

The Forest History Program wraps up with the publication of the 25-year history of fRI Research, which will chronicle the impact of our research on how the landscape is managed.

with Val Delille of the JYMA on the exhibit in the spring of 2017. When the doors opened, visitors were treated to genuine artefacts from the logging operation, photographs, and the hand-hewn tie log that Murphy and Dillon retrieved from the river. The centerpiece was an image, produced by our friendly GIS Program, of the Whirlpool Valley stretching across an entire wall, about 20 feet long, showing the locations of the camps, the old fur trading trail, and of course, the timber limits from the 1919 map.

"We had a huge positive response from all our visitors, and especially the locals," says Hubick. "The tourists found it interesting, but it was quite amazing for people who live here and had no idea."

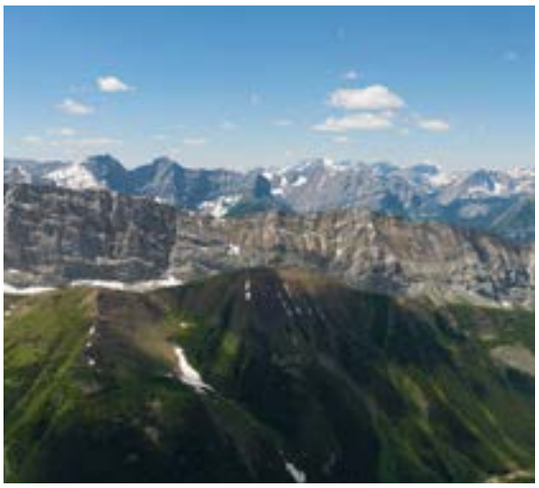
The exhibit ran in the JYMA Showcase Gallery from June 9 until November 12, 2017.

## The Fires of Jasper

In some ways, Landscapes in Motion builds on another Healthy Landscapes project that sought to understand the historical fire regime of a region in Alberta's Rockies, but about 400km north, in Jasper. That effort was also led by Daniels, as well as Raphael Chavardes, and was published in the fall of 2017. They found that climate was the main factor in determining whether there would be a fire in any given year. But then about a century ago, that changed. Fire suppression policies superseded climate as the main control and that had profound implications for the landscape.

photo credit: Cameron Naficy

# LANDSCAPES IN MOTION



**The Healthy Landscapes Program** has never been accused of thinking too small, and a new project in southwestern Alberta is no exception: landscape-scale science peering far back in time, and an interdisciplinary team trying to answer the fundamental question of why the landscape is what it is.

We know that in the past, a major force that sculpted the landscape were large fires that basically replaced an entire swath of older forest, resetting the fuel levels and the stand age. But increasingly, we've been finding evidence around the Canadian boreal of low-and moderate-severity fires that leave many trees scorched but alive, as well as some patches entirely untouched. The result is a forest mosaic providing rich diversity of habitat for animals.

Now the Healthy Landscapes Program has assembled a team to investigate the landscape stretching from the US-Canada border up the continent's spine all the way to Canmore, from the BC border on the west to highway 2 on the east. This is a rugged and remote 20,000 square kilometers to study, and the topic is nearly as sprawling. An extraordinary team is needed; this project has three.

To learn about past fire regimes, the gold standards for evidence are the physical objects that fire has carved its story into—the scorched and scarred snags, stumps, and tree cores. The Fire Regime Team is led by Lori Daniels who directs the Tree Ring Lab at UBC. Her team will be collecting and analyzing samples that reveal when and how often fires passed through, and how severe they were.

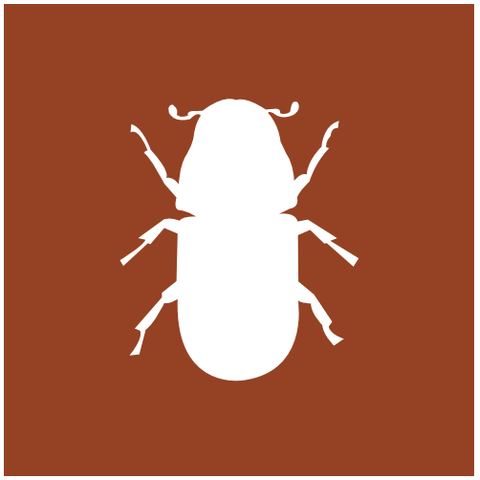
There is a unique opportunity to follow another line of evidence, afforded by the fact that the peaks overlooking much of this landscape were surveyed and photographed a century ago. Eric Higgs directs the extraordinary Mountain Legacy Project at the University of Victoria, where his team returns to those peaks to take a new picture from the precise places where the surveyors of old stood, capturing in a glance 100 years of landscape change.

The third team brings to bear the awesome power of spatially discrete modeling to understand how factors like fire size, climate, and fuels all interact with each other. The modeling team is headed by Eliot McIntire of the Canadian Forest Service, who co-created the SpaDES modeling platform and the LandWeb suite of models. By working with the first two teams, the modellers will be able to piece together the what, where, when, and why of historical fires in the area.

And there's one more really important element to the project: local engagement. This is a region of Alberta well known for its passionate people who care about the land. Other research projects in the area have run into controversy by not talking with the people who live there. We've been engaging from the beginning. We reached out to local groups to explain what we are trying to achieve, and we launched landscapesinmotion.ca where we post regular updates on this project. In response, the Crowsnest Conservation Society invited our project lead David Andison to their annual meeting. This is a big project tackling big questions on a big scale, but we have to keep in mind that this is most important for the people of the region, and that's no small concern.

# ADAPTING TO BEETLE

For Rob Friberg, people and forests have a two-way relationship: we impact forests and they impact us—our economy, our water, our social values, and more. Originally a professional forester in BC, Friberg is now working on a PhD on that relationship, and in particular, how communities can respond when something happens to the forest.



In past decades, rural communities commonly held the assumption of a stable, predictable supply of resources like timber or commercial fish stocks. The potential for unpredictability and change was not at the forefront of the way we think about resource-based economies. This view is still relevant, but, perhaps in parallel with our growing understanding of ecology, many communities are realizing that we have less ability than we first supposed to control nature and the supply of goods and services it provides us. Many communities are beginning to think in terms of resilience, of adaptation, of accepting uncertainty.

This is increasingly the case in the face of mountain pine beetle. Now that climate change has opened the way for MPB to breach the Rockies from Sundre to Grande Prairie, planners are deploying adaptations like changing forestry harvesting plans to reduce the amount of timber that is susceptible to MPB, salvaging MPB affected timber, and removing dead and dying trees around towns to reduce the fire risk.

Friberg, in a project with the **Mountain Pine Beetle Ecology Program**, has developed a framework for assessing and strengthening community resilience to events like mountain pine beetle. The framework looks at resilience features drawing on both the natural and social science literature, from how economically diverse the region is, down to individual factors like how much neighbours help each other out. Communities can strengthen social networks, volunteerism, leadership, government policies, the skills of the local workforce, and relationships with other levels of government that support adaptation and foster collaboration so that they are ready to take coordinated action when the time comes.

With this as a foundation, Friberg is working with three Alberta forest communities in the path of MPB—Jasper, Hinton, and Grande Cache. He is interviewing town managers, elected leaders, community stakeholders, and representatives from other levels of government, to see which adaptation strategies might be relevant in helping to deal with MPB. Based on the experience of the communities themselves, Friberg hopes to help them identify the strategies that will make a tangible difference.

The community meetings and interviews are taking place during 2018. Friberg will distill this information into practical summaries and a user-friendly "guidebook" for communities as they seek to implement the strategies appropriate for their specific situation. While this is the immediately goal of Friberg's research, he may also make contributions beyond resilience specifically to MPB. For all the uncertainties around the beetle, at least land managers know what they're up against. But the future holds greater unknowns; this research may help communities develop resilience more broadly, so they can adapt to whatever anticipated or unexpected disturbances may come.


photo credit: Michael Wagner


photo credit: Erin Humeny


photo credit: Michael Wagner

Unpaved roads, with their loose surfaces, compacted adjacent soil, steep ditches, and reduced vegetation, can dramatically increase the amount of sediment that ends up in nearby streams if special care isn't taken

# REMOVING AN IMPEDIMENT TO REDUCING EXCESS SEDIMENT

Each spring snow melt and every time it rains, water runs toward a watercourse; and as it travels, it carries along sediment—particles of silt, sand, or gravel. Ordinarily this would be unremarkable, but unpaved roads, with their loose surfaces, compacted adjacent soil, steep ditches, and reduced vegetation, can dramatically increase the amount of sediment that ends up in nearby streams if special care isn't taken. When this happens, it can be bad news for fish living in that stream, such as Bull Trout and Cutthroat trout, both classified as species at risk in Alberta.

It's a hot topic now; biologists with government and industry recognize the issue and are trying to pick places to remediate. But there are many roads in Alberta's foothills and only at particular points do they cause enough extra sedimentation to warrant concern. This makes a project, headed by Sheena Spencer of the Water Program, very timely.

Spencer is coordinating a team with **Water Program** Lead Axel Anderson and Michael Wagner, a forest hydrologist for the Government of Alberta, to deploy a tool called NetMap that quantifies sediment sources in critical watersheds. NetMap uses Alberta's excellent LiDAR data to model the terrain of a watershed. It takes into account things like sediment types, road width, trails, cut lines, and the presence of culverts to simulate the routes water will travel to form streams, thereby showing where sediment travels. This is exactly the information needed to identify and fix problem spots along roads.

"A lot of people are very keen to see what this tool can do," says Spencer. "Because of the timing, there's potential to do something really positive for our watersheds."

Wagner collected data on the roads and drainage features throughout critical Bull and Cutthroat Trout habitat during the summer of 2017. That fall and winter, Lee Benda of TerrainWorks, who developed the model, began doing runs for critical regions. The first to finish were the Old Man and Bow watersheds in southern Alberta. NetMap analyzed over 4,000 kms of roads and identified 362 sections that deliver sediment directly into Bull Trout habitat. By improving drainage at just 7% of road segments, or improving the road surface at 12%, it's possible to significantly cut down on the amount of sedimentation.

Next up are the Red Deer and North Saskatchewan watersheds, and later in the summer of 2018, a Water Program team will revisit those roads and streams to "ground truth" the results to verify and potentially improve NetMap. While the main objective of the project has been conserving fish species of special concern, sedimentation can also affect municipal drinking water. If the tool helps improve the health of Alberta's watersheds, the benefits trickle down.

## FSCP Members

- Canfor
- Cenovus
- Chevron
- Devon
- Hammerhead Resources
- Husky Energy
- Millar Western
- Paramount
- Repsol
- Seven Generations Energy
- Shell Canada
- Strath Resources
- Taqa North
- West Fraser
- Weyerhaeuser

# AN AWARD-WINNING PARTNERSHIP

In 2017, the **Foothills Stream Crossing Partnership** won the Shared Footprint Emerald Award for a decade of improving Alberta's watersheds one culvert at a time.

There are tens of thousands of places in Alberta where a road crosses a stream. These crossings include everything from a simple ford to a multi-span bridge. Many were built decades ago to lower standards than the Regulator requires today. Many crossings aren't in compliance and are potentially putting the watershed at risk.

This is where the FSCP comes in. At this scale, the only solution is collaboration, so a growing group of companies (now up to 15) came together in 2005 to systematically inventory, inspect, prioritize, and fix stream crossings all down the foothills of the Rockies.

Culverts are often a barrier to fish passage. Over time, they erode the streambed at the end of the culvert and eventually they become "hanging". These "hanging culverts" block fish from habitat they use to overwinter, spawn, or rear young. This sort of disconnect in a watershed can also genetically isolate fish populations, hindering their conservation.

The other major problem is when road material works its way down into a watercourse. This extra sediment can cover spawning gravel, smother eggs, damage gills, fill overwintering pools, or even kill the invertebrates that the fish rely on for food.

To prioritize crossing repairs, the FSCP considers the environmental needs of the whole watershed. On certain high priority crossings, the membership will also work with other non-profits such as Trout Unlimited Canada.

The results of all this work: over 200 stream crossings in Alberta have been repaired, and in 2017 alone, FSCP members inspected 1,173 crossings. But the Emerald Award wasn't just for these accomplishments. It's also for how they did it. The key has been innovation at every step of the way.

The most important thing has been the partnership itself—an inventory of stream crossings at this scale, across competitive companies and industries, is absolutely unprecedented. But it has fostered cooperation between crossing owners and the regulators, more stable funding for remediation, and a proactive approach.

The other key was a carefully designed inspection protocol that allows anyone at an organization, with just a few hours of training, to start collecting consistent, standardized data on their crossings. For that, the FSCP created an app with a manual and all the inspection forms pre-loaded. This allows inspectors to efficiently gather stream crossing data and seamlessly sync to the FSCP's state-of-the-art database. Inspections are validated in the central database, crossing data is visible only to the crossing owner, high priority issues are automatically emailed up the chain at the relevant company, and each crossing automatically comes up for re-inspection after the correct length of time.

As the name implies, the partnership has so far focused on the foothills, but the FSCP is working with the Regulator to calibrate the protocol for boreal streams. Once the protocol is adapted, the FSCP will be able to expand the partnership to include owners of the many thousands of crossings east of the foothills.

With this extension and the continued acceleration of crossing inspections and repairs, the FSCP is showing that daunting environmental challenges can be tackled with collaboration and innovation. Maybe in the end, that's what the Emerald Award recognized.

# RAMPING UP

In December 2017, the Government of Alberta released its long-awaited draft range plan for woodland caribou. Along with prescriptions on habitat restoration, predator control, maternal penning, and other measures, the plan took a hard look at current management of a landscape that has to support both communities and caribou.

> "The need for coordinated access planning has become evident since the cumulative effects of high levels of access development have resulted in the unintentional consequence of poor landscape outcomes. Individual resource companies can experience advantages through a collaborative approach to access planning and management."
>
> –Provincial Woodland Caribou Range plan, p 41

The **Foothills Landscape Management Forum** is a group of forestry and energy companies committed to doing just that. Instead of each company planning their operations in isolation, they all collaborate with the government and use the latest science to create a single Regional Access Management Plan (RAMP) for an entire caribou range.

The effort began in April, with a pilot project for the Little Smoky and A la Peche caribou ranges. This first phase asked if the RAMP could have less impact on caribou than business as usual. The answer was a clear yes.

The pilot project showed that with better planning and deployment of new oil and gas technology, the same resources could have been developed with significantly fewer roads and other disturbances, meeting targets for grizzly bear and caribou conservation.

With the benefits of integrated land management clearly demonstrated, the FLMF and government are embarking on phase two. They will create a roadmap to get there from the landscape we have today, a landscape of unintended cumulative effects borne of decades of non-integrated, non-collaborative landscape and access planning.

When the roadmap is completed, it will have been more than a modeling exercise and it will do more than just guide restoration and future industrial development. It will have proved that with collaboration, better land and resource management is possible.

## Current Landscape

## Scenario with ILM and New Technology

> "By expanding on the findings of the pilot project, and applying these new capabilities to future access planning, we may be able to achieve significantly lower access footprint while minimizing constraints on resource extraction opportunities"
>
> – Provincial Woodland Caribou Range plan, p 42

# CARIBOU PATROL: SEASON SIX


Photo credit Michael Merriam

The high slopes of the Rocky Mountains offer summer refuge for many caribou in Alberta, but winter drives the A La Peche herd back down to the shelter and food of the forest. This migration brings them across Highway 40, a major industrial corridor. The Aseniwuche Winewak Nation's **Caribou Patrol** program, operated in partnership with FLMF, is charged with preventing vehicle collisions through public education, better road signs, and of course, patrols.

The purpose of the patrols during caribou migrations is to deter caribou from crossing at dangerous points and collect data on wildlife sightings. Thanks to an additional $50,000 contribution from Imperial, the Caribou Patrol program was able to purchase a truck, adding capacity for more patrols in the coming seasons.

In 2017, the program added new signs on Highway 40 at the migration path, including two large billboards to help drivers understand that, contrary to common misconception, caribou could cross anywhere along a 35 km stretch of highway—they do not queue up right beside the first hazard sign.

The Patrol program also worked with Alberta 511 to get a hazard icon added to online maps during migration seasons, as well as social media and email notifications.

As well as the local efforts on the highway, the Caribou Patrol has wider public awareness efforts. They have expanded this outreach thanks to new partnerships established in the previous year. Parks Canada invited them to festivals in Jasper and Edmonton, where they handed out educational booklets and spoke to over 1500 people about caribou conservation.

Though the road is never without risk for caribou, we can hope that through more patrols and greater public awareness, the odds of a safe migration continue to improve.

**2017** the program added new signs on Highway 40 at the migration path

photo credit: Bill Tinge

# THE PATCHED QUILT

The boreal forest is like a quilt of dark green conifers, undulating where the hills and valleys fold the land. But west towards the Rocky Mountains are patches of rust-red and ash-grey pine trees, no longer evergreens, increasing in numbers.

This is the mosaic of a landscape visited by mountain pine beetle. Carried on the wind from BC, clouds of adult beetles have been landing like embers among Alberta's forests. Guided by smell, they swarm a lodgepole pine tree, burrow under its bark, and deposit their eggs and a fungus. In the fall, the eggs

hatch and the larvae and fungus go to work under the bark, destroying the connection between roots and needles. By early summer, they have grown into adults, and all at once fly up and away to repeat the cycle.

Meanwhile, the tree still stands as tall and green as if nothing was wrong. But it is already dead. Cut off from nutrients, the needles turn red over the next couple years, and finally fall to the ground, leaving only a dry grey trunk and creaking outstretched branches until wind, root rot, or fire bring them down. It's the risk of the latter that has foresters and town planners worried.

Chris Stockdale and Neal McLoughlin know about the rumours that followed the beetle over the Rockies. Wildfire experts for the governments of Canada and Alberta, respectively, they have heard of the fires that burned through a beetle-ravaged forest in BC so fiercely that they created an ashen moonscape. Did they burn so hot because of the beetle? Is that what's coming for Alberta?

There is good information about what MPB does to a stand of trees, but there's a big gap in the research at the landscape level, and as often happens, that gap has been filled with anecdote and simple narratives. Stockdale and McLoughlin are determined to replace these with a quantitative, actionable measure of fire risk that takes into account nature's complexity.

The type of fuel changes from BC to eastern Alberta; mixed in with Lodgepole Pines, the Firs, Cedar Hemlock, Ponderosa Pine, and Engleman Spruce give way to Black and White Spruces, and even the Lodgepole Pine itself gradually transitions to Jack Pine. Then there are the MPB outbreaks, some of which expand from a few trees to thousands, others stop growing but seed new infestations kilometers away, and some just peter out. The result is a lot of spatial variation across the landscape. Over time, new patches are scattered across the quilt, but the patches themselves change too.

At first, the green-attack stage is not very different from non-infested stands. There is plenty of fine fuel in the canopy, and it is still full of moisture, a major factor that slows down wildfires. But after a few years, the needles dry out and turn red. If conditions are right, and the fire has enough energy to develop a convection column, those needles, twigs, and cones can scatter as embers, creating a fire storm that sparks new ignitions far and wide. But if no calamity comes to those trees, eventually they reach the grey-attack stage and the fine fuel falls to the forest floor. The result is complicated. The decaying ground fuel doesn't speed up a fire's spread much, but on the other hand, the opened canopy allows wind down to the ground to fan the flames.

Using data from the fires that followed BC's MPB outbreaks in the 90s and early 2000s, Stockdale and McLoughlin are modeling the fire risk for the whole quilt, not just individual patches. By zooming out to the landscape scale and taking into account which stage of attack a stand is at, they will be able to give a more realistic estimate of how fire could spread through a given area. For example, a stand-level model might suggest that an area that was passed over by the beetle will be resistant to wildfire. However, wildfires are rarely limited to single stands. Stockdale and McLoughlin's analysis will offer a better understanding of how the extent, arrangement, and stage of the MPB patches affect fire risk across the quilt.

Fire risk is dynamic and complex. Displacing anecdotes with hard numbers, while not prescriptive, does give planners a benchmark to reference for their situations. It can help them plan evacuation timing and inform area closure decisions to prevent ignitions in places where a fire would spread faster. It could also evaluate different mitigation strategies, such as logging, to avoid ineffective efforts.

Ultimately, this project of the **Mountain Pine Beetle Ecology Program** will provide a much needed landscape perspective on fire risk through time. The results might be reassuring in some places, and in others, at least there will be information to act on, which sure beats helpless worry.

# A RENEWED PARTNERSHIP

In 2011, the Alberta Land Use Secretariat chose fRI Research to create and administer the **Land-use Knowledge Network**, a curated collection of resources for land use practitioners across the province. Since then, landusekn.ca has grown steadily to offer over 1900 carefully catalogued records, host two online courses and has recorded and released 1277 videos from conferences, to make sure that knowledge shared at these events makes it out of the room to everyone who needs it.

The LuKN also improved the search functionality on the site and began adding information specifically related to key components of the regional plan.

This follows the direction of the Secretariat, which in 2017 renewed the mandate of the LuKN to serve as the hub of land-use information, but focused on helping land managers implement the Regional Plans. In order to allow land use planners as much flexibility as possible in implementing the regional plans, the Secretariat is careful not to prescribe any broad-brush requirements, and is instead seeking to foster collaboration between planners, to empower them to find their own, local solutions that work best for their area.

To that end, landusekn.ca is building a new discussion forum. The Land Use Planning Hub (www.landusehub.ca) will be a place for planners across Alberta to share with their peers their experiences, advice, and solutions for implementing the Regional Plans.

Planning for the forum wrapped up at the end of 2017 and the web development was completed in the following February.

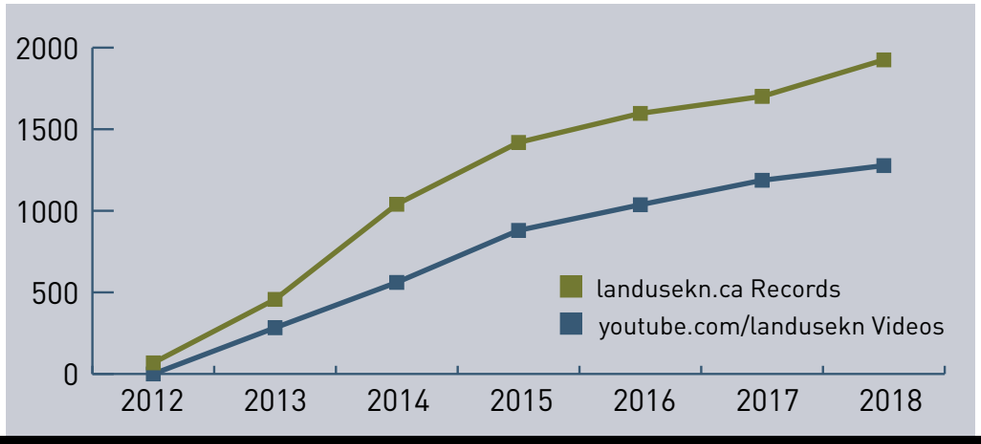
In preparation for a spring launch, the community manager for the project, Jeff Wiehler, has been in conversation with planners from the Lower Athabasca and South Saskatchewan regions, where regional plan implementation is furthest along. From these conversations, Wiehler is creating a series of articles to seed discussion when the site goes live.

"I hope it can inform land use decisions and be useful for implementation of the regional plans as the planners share stories from across the province," says Wiehler. "This really extends LuKN by being a place where people can comment, discuss, and share and go beyond knowledge to actually doing."

There are now a few years of experience with the regional plans to draw on and share, but the majority of regions have not yet implemented a plan, making the forum a timely resource for proactive managers as they prepare for their area's regional plan.

## What Are the Regional Plans?

The seven Regional Plans, based on Alberta's major watersheds, will provide big picture guidance for everyone from land owners to municipalities within each region. The aim is to get more consistent decisions on land-use topics such as water management, development, conservation, and air quality.



# CONNECTIONS

The field crew knew roughly what the terrain would be like. Conifers on a fairly steep slope with a small stream at the bottom. Nearest road: about 500m. What they were there to find out was why a caribou from the Redrock-Prairie Creek herd had slowly tacked back and forth across this particular hill.

Since 1998, the forestry company Weyerhaeuser and the Government of Alberta have been fitting about 10 caribou per year with GPS collars to track their movements, as part of broader conservation effort. When our Caribou Program started a little over five years ago, we began managing that dataset and using it to tackle research questions. The question that led our crew to dozens of areas around west-central Alberta came to us from the Alberta Conservation Association and the Sustainable Forestry Initiative and our forestry partners, who wanted to know exactly where the patches of high quality caribou habitat are, and how caribou herds actually travel between them, in order to guide conservation and restoration.

In the fall of 2016, the **Caribou Program** began developing a method to find out using the GPS collar locations. They reasoned that in general, caribou spend more time in good habitat than in bad. So they tapped the GIS Program to create an algorithm that found all the clusters of points where caribou lingered, walking back and forth. By overlaying these patches of "high-residency" habitat on maps of geographic features, the team were able to generalize what sort of terrain, soil, habitat type, level of disturbance, etc. these sites had in common. This could then predict where there might be other high-residency patches that a collared caribou hadn't happened to visit. These places would be important for conservation.

And this brings us back to the crew on the hill, sent out to a high-residency habitat patch to see what the maps missed: vegetation, lichen abundance, whether there were good places for a caribou to conceal itself from predators. With these fine-scale factors, the researchers could make much better predictions for which habitat patches are likely to be used by caribou herds, and therefore which areas could be prioritized for conservation, and also where and how to restore already-disturbed patches that have potential to once again be high quality caribou habitat.

But focussing exclusively on these high-residency patches would be a mistake. Conserving them alone will not ensure the long-term conservation of a caribou herd if that herd has no safe way to get from one patch to another. So, back in the office, the researchers are drawing paths between the patches, tracing the routes caribou have travelled for at least these past two decades. This information can also guide management. If too many roads and other disturbances sever the connections between patches, the entire network could collapse; if connectivity is prioritized in management plans, the risk to the herd may be reduced.

photo credit: Laura Finnegan

# SPLITTING HAIRS

We have a lot of grizzly bear hair. Like boxes and boxes of it. We've been collecting it for over a decade because the hair follicle at the root of each hair contains the bear's DNA. The lab techs extract it and check several specific short sections of the DNA that identify whether the hair is from a black or grizzly bear, which individual grizzly bear the hair is from, and even tell us about familial relationships—mother and cub, for example—because bears that share the same DNA sequences at many of those locations are probably more closely related than bears with different sequences. The DNA also tells us the sex of the bear.

This is what makes hair collection studies the gold standard for monitoring grizzly bear populations. It's a non-invasive way to identify individual bears and with enough individuals, we can estimate the

## What about Scat?

While hair can be collected non-invasively and therefore much more easily than capturing whole bears, scat samples can also provide important genetic information to researchers and best of all: citizen scientists can help collect these samples. We've been collecting scat for years, and we're working with wildlife laboratories in Norway to develop techniques for getting genetic and hormonal information from it, too. We're already getting about as much information from the DNA in scat (actually, the gut cells that come out with the scat) as for hair—we can get 23 different genetic markers off scat, easily enough precision to ID an individual.

population in an area. We've put this method to use in a seven large scale surveys since 2004, including the first ever repeat inventory of an area called BMA 3 in 2014, allowing us to determine if the population is changing.

But there's more that we want to know about grizzly bears than just their numbers, and over the years, we've been able to pry more and more answers out of those boxes of hair.

The first breakthrough came in 2010 when Brian Macbeth at the University of Saskatchewan was able to extract hair cortisol from grizzly bear hair samples. The cortisol level in these samples reflected chronic stress that the bear had experienced during the hair growing cycle. The key point is that these values were not short term stress as one might see from a blood sample taken after a bear had run from a another bear. With this new methodology in place, we were then able to reanalyze the hair we had already collected from 10 years of research to help us understand the stress levels of bears in different years and in different areas of the province.

Building on our success with stress hormones, we then investigated reproductive hormones from hair samples. In a similar way, we can relate the levels of the hormone progesterone in the hair of adult female bears to their pregnancy status. This has some profound implications for population monitoring, because we can, again, go back to our hair stockpile and see what percentage of females are reproducing at any given time and place. This tells us the reproductive performance of the population and provides some answers to basic questions about grizzly bear biology in the wild.

Then, in early 2018, we published a paper with our collaborators at Washington State University that took it one step further. Grizzly bears, like all other animals, grow and develop under the guidance of certain steroid hormones like testosterone, progesterone, estradiol, and cortisol. As cubs grow up into adults and reach sexual maturity, generally around age 3, the levels of these hormones change. You see where this is going. We could already accurately get the concentrations of two of those hormones from hair samples. With the help of our partners in Saskatchewan and Norway, we determined the different profiles of all four hormones for immature and adult bears of both sexes. In other words, we could theoretically test our hair samples to see if an individual bear had reached sexual maturity.

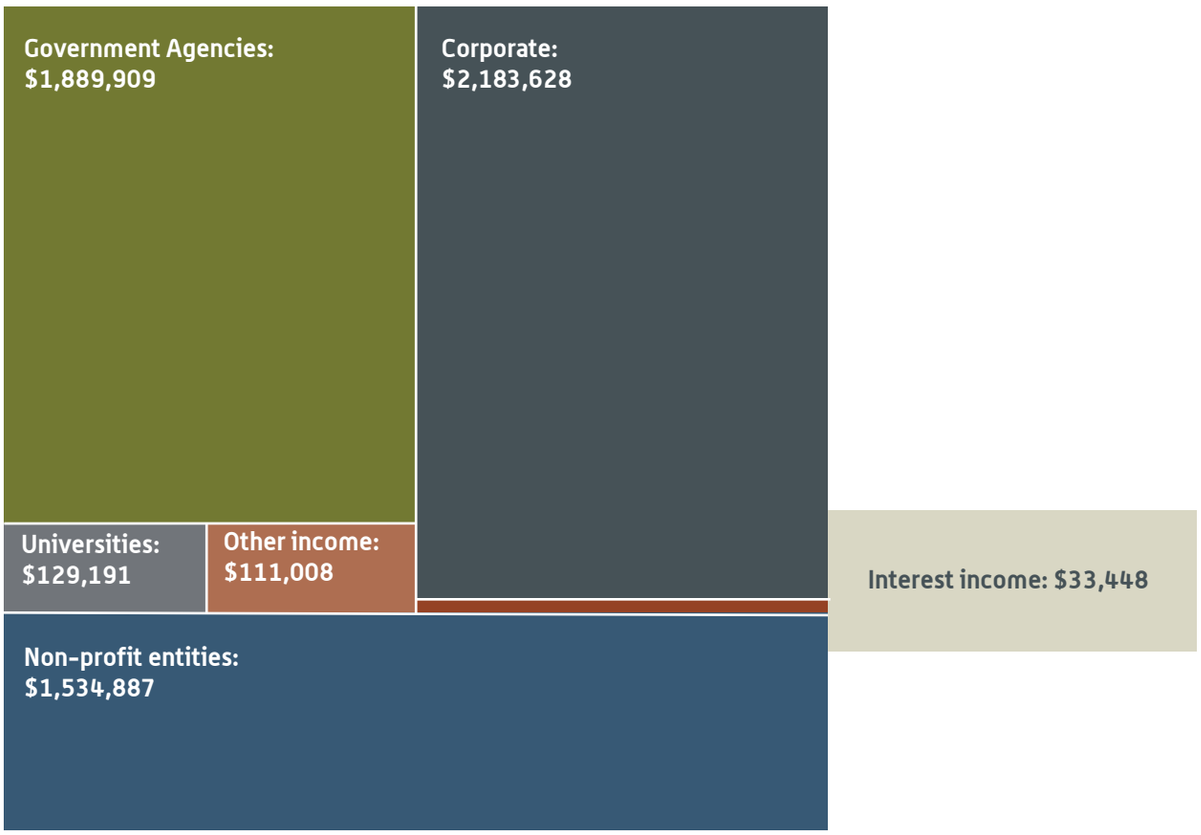
Theoretically, because this is early days for this ground-breaking method. For the paper, we put our profiles to the test on 400 of our hair samples from bears, of which the age and sex we already knew. The results were very encouraging. We were right about whether male bears were adults or sub-adults 88% of the time, and 77% of the time for females.

This method, once refined, will open up far more sophisticated population monitoring using just hair. Knowing the general age structure of a population—how many adults vs how many cubs—is extremely useful for determining which direction a population is trending. Or, since sub-adults generally expand out into new habitat first, age class can help determine whether individuals are establishing in a new area rather than just passing through, which would indicate a growing population.

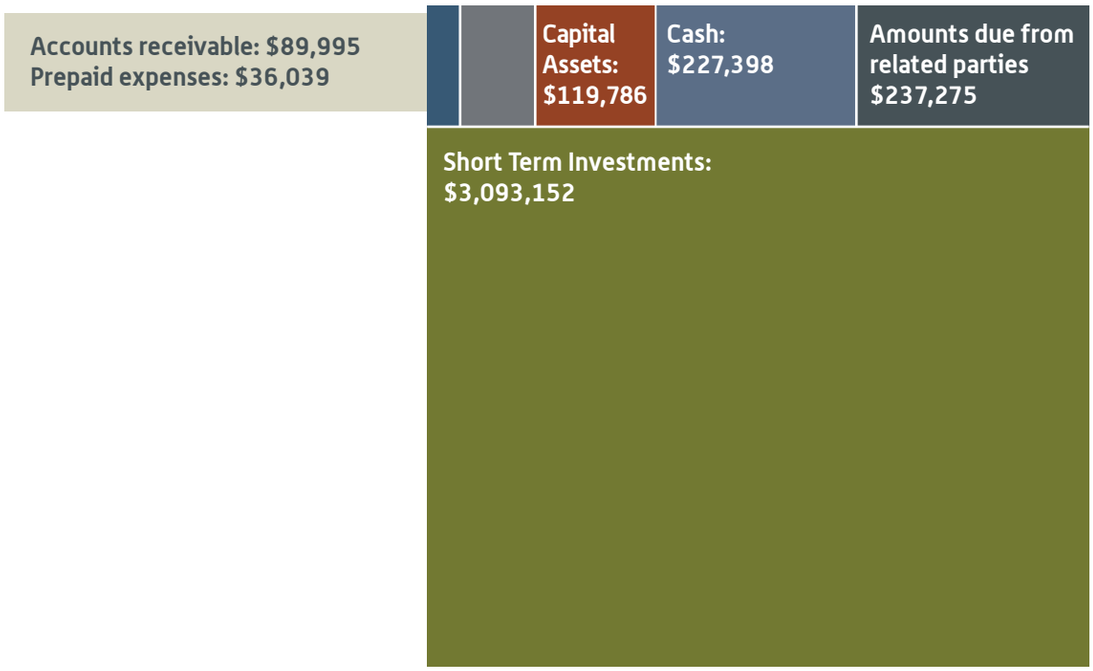
Being able to get population numbers, age class, pregnancy status, and general health from a non-invasive method that doesn't involve tracking, darting, and sampling live bears greatly expands the questions that the **Grizzly Bear Program** can tackle. And with years of stored bear hair, and more on the way from upcoming population inventories, there is an immense amount of information we can glean about grizzly bears in Alberta. Better information will help land managers make better decisions as they work to conserve this threatened species.

# SUMMARY OF 2017–2018 FINANCIAL STATEMENTS

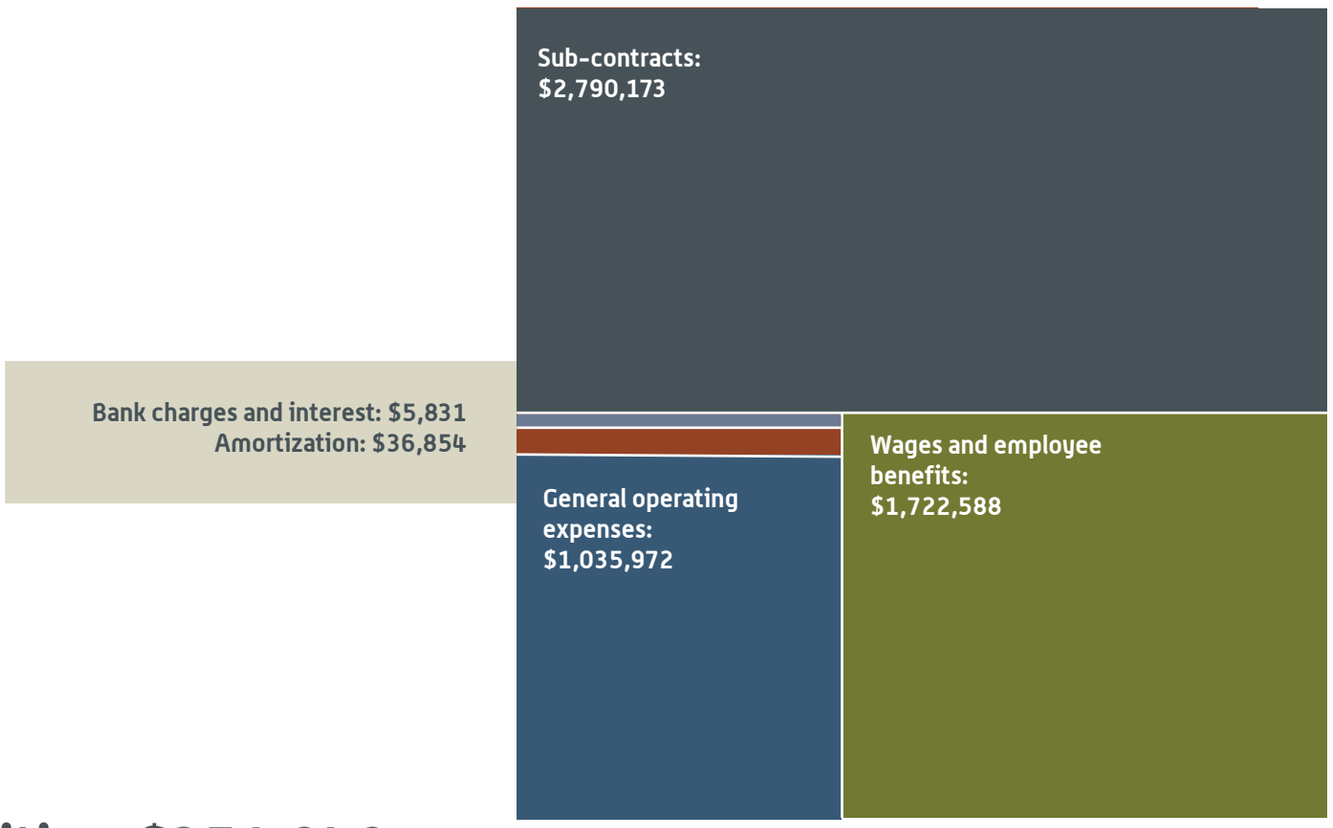
## Revenues $5,882,071



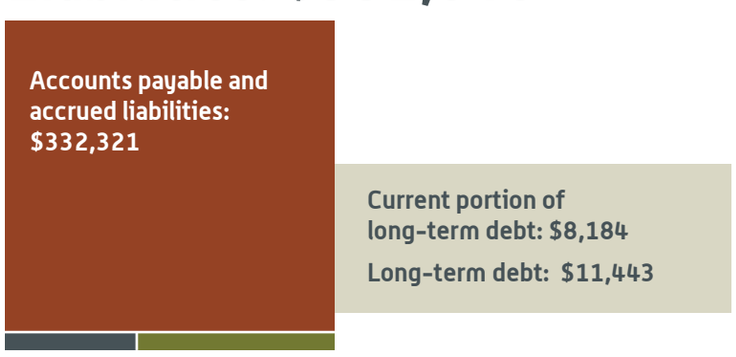

## Total Assets: $3,803,645



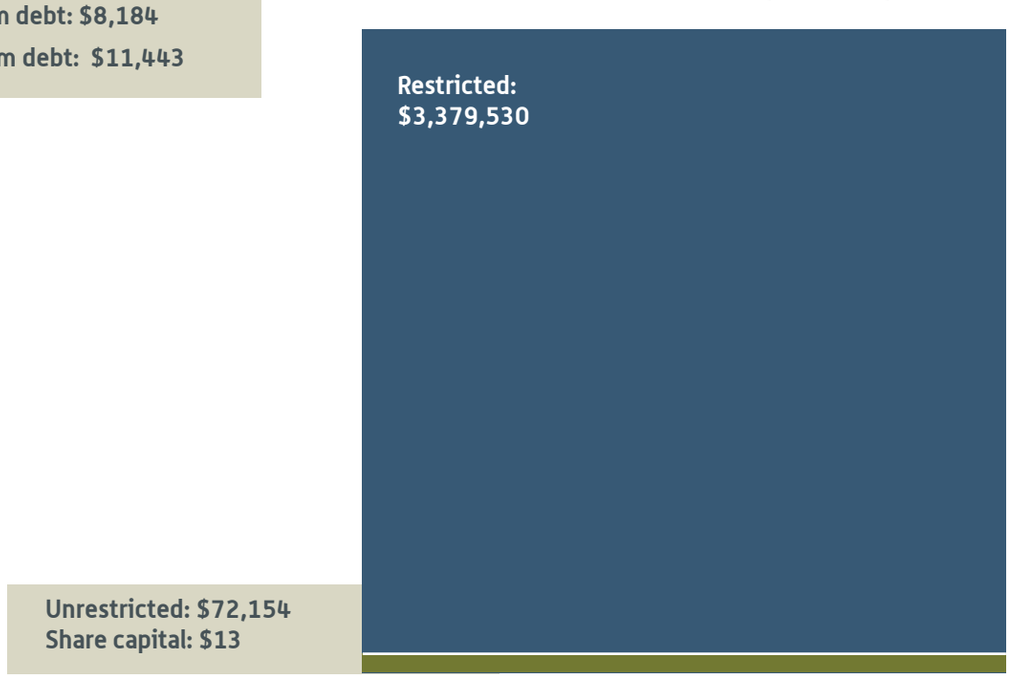
## Expenses: $5,591,418




## Liabilities: $351,948




## Fund Balance: $3,451,697



fRI Research
Informing Land & Resource Management

Questions? Comments on this annual report?

**Please contact us at:**
1176 Switzer Drive, Hinton, Alberta, Canada, T7V 1V3
Tel: 780.865.8330 | www.fRIresearch.ca | info@friresearch.ca