fRI RESEARCH
ANNUAL REPORT

2023–2024

fRI Research
Informing Land & Resource Management

We are an independent research institute focused on practical solutions for better land management. Our non-partisan science and 30-year tradition of neutrality has made us a trusted hub for all sectors of society to work together on urgent issues.

The topics we tackle are driven by the needs on the landscape, and we are always ready to adapt to remain relevant. In this annual report, you'll find a remarkable breadth of work. There are projects focused on a single species of interest, and projects that take a whole-ecosystem approach. There are studies in five provinces and territories and collaborations around the world.

What unites all these efforts is the belief that science can lead to better outcomes for people and all the other species we share this planet with.

Written by Ben Williamson
Design by Penny Snell

TABLE OF CONTENTS

Jesse Kirillo
BOARD PRESIDENT

It is hard to express how pleased I am with all the staff at fRI Research. Not only do they tackle some incredibly difficult research projects put forward by our funding partners, but they do it safely and in challenging field conditions as well. 2023 was an extraordinarily tough year for wildfires. Most of the staff had to live and work under the threat of imminent evacuation, adapt to area closures, and deal with, at times, heavy smoke, and they did so with professionalism and care for one another.

Recently I had the chance, along with others at the Board, to connect with all the program leads as they shared some of the highlights of their programs. It was a true moment of pride as I listened to them share what they have been working so hard on over the years. In addition to new projects, there are a number of new incredibly talented people around the table. I could sense the excitement and passion each one of them had for their programs.

I'm impressed by the people at fRI Research every year, and I'm confident that this coming year will be no exception. Our partners will continue to see the fantastic results that fRI Research is known for.

Dr. Barry White
EXECUTIVE DIRECTOR

In my new role as Executive Director, I have a front row seat to witness the amazing work and collaborations between our dedicate staff, our shareholders and our partners. Their optimism and collective commitment to making a difference is both truly inspiring and commendable.

We are most fortunate to be in a growth phase and have welcomed some outstanding talent and energies to the fRI Research family. These included the addition of Christina Oliver as our new Operations Manager and Tracy Hedge as our new Accounting Specialist. We also welcomed Dr. Ben Kissinger to lead our Water and Fish Program and Dr. Darío Fernández-Bellon to lead our new Grizzly Bear Monitoring Project. They join a family of exceptional scientists and staff working on other critical issues such as caribou and moose conservation, mountain pine beetle, and landscape ecology.

I would be remiss not to also mention the outstanding contributions of other members of the fRI Research family: our five associations. Though independently pursuing their own members' mandates, we're all contributing to science-based land and resource management. Handling their administrative tasks to minimize their overhead is just one way we provide value to our shareholders.

As I look ahead to my second year as Executive Director, my priorities include finding ways to enhance both shareholder value and the pursuit of research excellence. We also must not fixate on today's issues; we must embrace agility in a rapidly changing world. Supported by our dedicated and diligent staff, I look forward to continued growth, outstanding science and innovation, and shared success.

2023–2024

BOARD OF DIRECTORS

Jesse Kirillo (Board President)
Peyto Exploration & Development

Ken Greenway (Board Chair)
Alberta Forestry and Parks

Erica Sivell (Board Treasurer, non-voting)
Hinton Wood Products, West Fraser

Allan Bell
Tolko Industries

Steve Blanton
Manning Forest Products, West Fraser

Mark Boulton
Suncor Energy

Richard Briand
West Fraser

Amy Cairns
Parks Canada

Wendy Crosina
Weyerhaeuser Company

Stuart Cruikshank
Alberta Indigenous Relations

Lyle Dechief
Weyerhaeuser Company

Nadir Erbilgin
University of Alberta

Alan Fehr
Parks Canada

Mike Haire
Vanderwell Contractors (1971)

Daniel Lux
Alberta Forestry and Parks

Bob Mason
Canfor

Fred Radersma
West Fraser

Travis Ripley
Alberta Environment and Protected Areas

Karen Rosvold
Rural Municipalities of Alberta

Jon Taszlikowicz
Canfor

Laura Trout
Hinton Wood Products, West Fraser

Matthew Wheatley
Canadian Forest Service

Current as of March 2024

Learn more at
firesearch.ca

Program and Association Partners

Partnerships are the foundation of fRI Research. These partners provide funding, invaluable datasets, and other in-kind contributions to directly support our programs and associations. They also help us identify important land-use issues for future projects, assemble resources, and integrate our results into land and resource management. Without our partners' commitment, we would not be the strong, effective source of knowledge and tools that we are today.

Alberta Conservation Association
Alberta Energy Regulator
Alberta Newsprint Company
Alberta-Pacific Forest Industries Inc.
American Fisheries Society
ARC Resources
Aseniwuche Winewak Nation of Canada
Athabasca Oil Corporation
Baytex Energy
Bighorn Wildlife Technologies
Blue Sky Resources
Canadian Institute of Forestry
Canadian Natural Resources
Canadian Parks and Wilderness Society
Canadian Wildlife Health Cooperative
Canfor Corporation divisions: Grande Prairie and Whitecourt
Canlin Resources Partnership
Cardinal Energy
Carleton University
Cenovus
Chevron Canada
Clayton T. Lamb Ecological Research
Colleges & Institutes Canada
County of Grande Prairie No. 1
Cows and Fish Riparian Management Society
Ducks Unlimited Canada
Environment and Climate Change Canada
Fisheries and Oceans Canada
FORCORP Solutions
Forest Protection
Forest Resource Improvement Association of Alberta
Government of Alberta: Ministry of Environment and Protected Areas; Forestry and Parks; Indigenous Relations
Government of British Columbia: Ministry of Environment; Ministry of Forests, Lands, and Natural Resource Operations
Government of Manitoba: Natural Resources and Northern Development
Government of New Brunswick: Natural Resources and Energy Development
Government of Newfoundland and Labrador: Department of Fisheries, Forestry, and Agriculture
Government of Nova Scotia: Department of Natural Resources and Renewables
Government of Ontario: Ministry of Northern Development, Mines, Natural Resources, and Forestry
Government of Québec: Ministère des Forêts, de la Faune et des Parcs
Government of Saskatchewan: Ministry of Environment
Government of Yukon: Ministry of Environment
Greg Johnson Biometrics
Habitat Conservation Trust Foundation
Hammerhead Resources
Hawthorne Energy
Keyera Corporation
Louisiana-Pacific Corporation
MacHydro
Mercer Peace River Pulp
Mistik Management
Mitacs
Municipality of Jasper
Natural Sciences and Engineering Council of Canada
NAIT Centre for Boreal Research
Natural Resources Canada, Canadian Forest Service
Northland Forest Products
Nuvista Energy
Outlier Resources
Paramount Resources
Petrus Resources
Peyto Exploration & Development
Repsol Oil & Gas Canada
Sakâw Askiy Management
Shane Sadoway
Shell Canada
Silvacom
Société de protection des forêts contre les insectes et maladies
Spartan Delta
Splitrock Environmental
Spray Lake Sawmills
St'at'imc Government Services
Strath Resources
Swan River First Nation
TAQA North
Teck Resources
TerrainWorks
Tidewater Midstream
Tolko Industries
Tourmaline Oil Corporation
Town of Hinton
TRIA-Net
Trout Unlimited Canada
United States Department of Agriculture
University of Alberta
University of British Columbia
University of Calgary
University of Lethbridge
University of Northern British Columbia
University of Saskatchewan
University of Toronto
University of Victoria
Vanderwell Contractors (1971)
West Fraser Mills divisions: Alberta Plywood, Blue Ridge Lumber, Edson Forest Products, Grande Prairie, Manning Forest Products, North Central Woodlands, Slave Lake Pulp, and Sundre Forest Products
Weyerhaeuser
Yellowhead County

Our Shareholders

Over 30 years ago, we got our start as a not-for-profit. Right from the beginning, we were supported by organizations who saw value in the kind of independent, practical research we do. These shareholders generously committed to providing stable, long-term funding to support core operations such as administration, IT, and communications – the necessary services that allow our scientific programs and associations to focus on their projects.

Our partners already provide money, data, and in-kind expertise to specific projects, so choosing to additionally support us at the shareholder level is a testament to their commitment to science-based decision making and sustainable land and resource management. In return, we provide them with a ready-made forum to discuss new research directions with resource managers in industry, regulators in government, top scientists, NGOs, and communities.

Alberta Government

SINCE 1992

Though ministries and departments have shuffled, the Government of Alberta has been a steadfast supporter of our institute through core funding, data sharing, seconded positions, and more. We fill an important role: providing independent science to inform their decision making and connecting policy-makers to practitioners on the landscape.

West Fraser

SINCE 1992

The Hinton Division of West Fraser Mills, then called Weldwood, was a sponsoring partner back when we were part of the Model Forest program. It was on their land base that we did our first research, and they have supported our growth ever since.

Parks Canada Parcs Canada

SINCE 1995

Ecosystems don't care about lines on a map. Our neighbours to the west recognized this early, collaborating with us on many projects right up to the present day. We have regular, informal knowledge sharing as well as formal participation on projects about bears, beetles, and many things in between.

PEYTO

SINCE 2007

When we transitioned from a Model Forest to a research institute, five companies called the Foothills Energy Partners stood behind us. The local assets of one company, Talisman Energy, are now owned by Peyto Exploration and Development, which has opted to maintain its shareholder contributions.

Weyerhaeuser

SINCE 2012

In 2012, Weyerhaeuser became the first forestry company to become a shareholder since Weldwood sponsored our model forest proposal 20 years previously. Their contributions go far beyond monetary support and include data sharing essential for many caribou conservation projects.

CANFOR

SINCE 2014

Canfor's forest management areas in western Canada gave them a natural interest in many of our longstanding projects from hydrology to mountain pine beetle to caribou. In 2014 they opted to increase their support for science-based solutions to these issues by becoming a shareholder.

TOLKO INDUSTRIES LTD.

SINCE 2021

Tolko became one of our newest shareholders in 2021. They were, and continue to be, part of several large collaborations working on big projects such as Landweb modeling, grizzly bear population surveys, and the Alberta Regional Caribou Knowledge Partnership.

Vanderwell

SINCE 2021

This family-owned and operated company in the Lesser Slave Lake area is an enthusiastic supporter of our research both when it is widely applicable to forestry in Alberta, as well as more specific to their landbase, such as a recent grizzly bear population survey and a marten study. They became a shareholder in 2021.

Caribou

For over a decade, our Caribou Program has been uncovering the web of interactions that have caused the decline of caribou herds in Alberta. Some of our projects have used GPS data from collared caribou to understand the resources they select and avoid, how activity on the landscape affects the timing and location of calving, and which landscape features raise the risk of mortality. The goal is to understand what a caribou-friendly landscape looks like and provide policy makers and industry a goal to work towards.

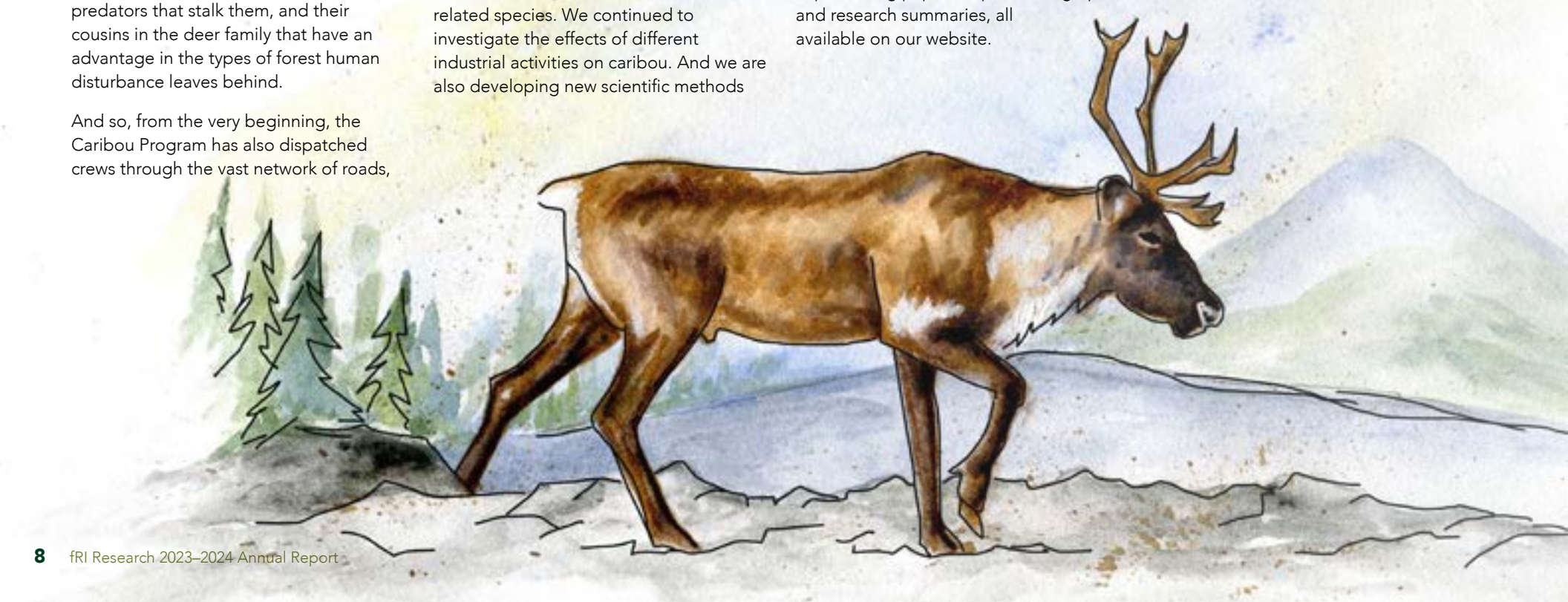
But we can't do that by only studying one species. The effects of human activity on caribou are mediated through many other species – the plants they eat, the predators that stalk them, and their cousins in the deer family that have an advantage in the types of forest human disturbance leaves behind.

And so, from the very beginning, the Caribou Program has also dispatched crews through the vast network of roads, pipelines, and seismic lines across the province. They have stooped over thousands of vegetation plots, carefully counting and characterizing the foods important to caribou and their neighbours. They have maintained arrays of camera traps, meticulously cataloguing animal use throughout caribou ranges. They have monitored snow depth. They have matched these things up to a host of natural and anthropogenic landscape characteristics.

The picture of a caribou-friendly landscape is not getting simpler, but it is coming into focus. In projects underway and completed in 2023–2024, the Caribou Program explored interactions between caribou, white-tailed deer, and other related species. We continued to investigate the effects of different industrial activities on caribou. And we are also developing new scientific methods biologists can use to study species in the boreal more efficiently.

At the same time, the program is sharing results. Dr. Ian Best traveled to Alaska for the North American Caribou Workshop to present on a joint Caribou Program-University of Northern British Columbia project. Program Lead Dr. Laura Finnegan, and newly minted MSc Suzanne Stevenson presented results at the Alberta Chapter of the Wildlife Society conference in Jasper in March. We are also very active in publishing papers, reports, infographics, and research summaries, all available on our website.

For over a decade, our Caribou Program has been uncovering the web of interactions that have caused the decline of caribou herds in Alberta.



SELECTED PUBLICATIONS

Cavedon, M., Neufeld, L., Finnegan, L. et al. 2023. Genomics of founders for conservation breeding: the Jasper caribou case. Conservation Genetics 24: 855-867. https://doi.org/10.1007/s10592-023-01540-3

Finnegan, Laura, Hebblewhite, Mark, and Pigeon, Karine E. 2023. Whose line is it anyway? Moose (Alces alces) response to linear features. Ecosphere 14: e4636. https://doi.org/10.1002/ecs2.4636

McKay, T., and Finnegan, L. 2023. Ungulate occurrence in forest harvest blocks is influenced by forage availability, surrounding habitat and silviculture practices. Ecological Solutions and Evidence 4: e12226. https://doi.org/10.1002/2688-8319.12226

Stevenson, S. 2023. Resource use of mountain caribou (Rangifer tarandus caribou), white-tailed deer (Odocoileus virginianus), and other sympatric ungulates, in west-central Alberta, Canada. MSc. Thesis, University of Northern British Columbia. https://doi.org/10.24124/2022/59441

Best, I.N., Brown, L., Elkin, C., Finnegan, L., McClelland, C.J.R., and Johnson, C.J. 2024. Cut vs. fire: a comparative study of the temporal effects of timber harvest and wildfire on ecological indicators of the boreal forest. Landscape Ecology 39: 81. https://doi.org/10.1007/s10980-024-01882-4

Advancing Harvest System and Silvicultural Practices for Improved Woodland Caribou and Fibre Outcomes

ACTIVE

Forest harvesting creates young stands favoured by moose, deer, and elk, which in turn draws predators and drives caribou declines. This project explores stand characteristics of areas woodland caribou use, the likelihood of harvested areas becoming woodland caribou habitat, and how this potentially differs from burned stands.

Previous work by the Caribou Program used camera traps to understand how wildlife use of harvest blocks was affected by cutblock characteristics in west-central Alberta. This project takes the next step by investigating how those characteristics came to be, by relating them to silvicultural systems, ecotype, and many other factors. The project also greatly expands the geographic scope by sampling from every caribou range in Alberta, covering 88,900 km2, increasing its applicability across the Canadian boreal. Using the same data, this project

is also comparing similarly aged harvests and fires, as well as forests with confirmed caribou use.

The project started in the fall of 2020, when the team did a literature review and developed a fieldwork protocol. In 2021 and 2022, crews visited hundreds of sites in west-central Alberta to take vegetation inventories and collect fine scale site data. In late 2022, Dr. Ian Best at the University of Northern British Columbia began the analysis, and in just a little over a year, the first paper made it through peer review, with an accompanying QuickNote and infographic.

The next stage in analysis is to identify gaps and opportunities in Alberta's forest policies in order to improve the trajectory of harvested stands to become caribou habitat. Finally, we'll bring all the results together into an interactive GIS tool for land managers.

Response of Wildlife to Restored Wellsites

ACTIVE

Many wellsites have been certified as reclaimed, but their condition varies. This project assesses wildlife use of wellsites to understand how restoration treatments contribute to important species like moose, bears, and deer.

In 2023, our crews used camera traps to monitor wellsites that had been planted and treated by Weyerhaeuser over a decade ago, wellsites that had not been treated or planted, and forested sites as a comparison. We also recorded vegetation at the forested sites, while technicians from NAIT's Centre for Boreal Research collected detailed vegetation data at the wellsites. Back at the office, a full-time biologist classified approximately 125,000 photos and is working on the analysis.

Using Camera Traps to Estimate Density and Population Composition of Deer, Moose, and Elk

ACTIVE

Aerial surveys are the primary method to assess ungulate population size, demographics, and trends in Alberta. However, it can be difficult to get accurate estimates for some ungulates in forested habitat due to poor sightability. Recent advances in analysis methods of camera trap studies have eliminated many problems for estimating population densities. However, camera survey methods still need refinement to be an informative and cost-effective alternative to aerial surveys.

This project has two goals: to estimate the density and demographics of ungulates, and to test several methods simultaneously to determine the best way of doing this for future studies in this general area. To do this, in 2023 we set up a grid of camera traps in the wildlife


Solène Williams

management unit north of Hinton. The study was carefully designed so that this grid can be sub-sampled and analyzed in different combinations in order to learn the optimal number and layout of cameras. The hope is that there will be at least one method that is at least equivalent to estimates from aerial surveys.

Our biologists are also using this project to test different parameters in two AI programs for analyzing the photos to make all our future camera trap work as efficient as possible.

Wildlife Response to Forest Stands Impacted by Mountain Pine Beetle in western Canada

ACTIVE

Both mountain pine beetle and actions taken to slow its spread have wide-ranging effects on wildlife, including species at risk such as caribou. The goals of this project are to provide land managers in government and industry with knowledge and tools to evaluate the consequences of these disturbances.

Results will support proactive planning and policy for areas where MPB do not yet occur, allowing land managers to mitigate the potential impact of MPB on ecological and economic values.

This project uses Government of Alberta GPS data from collared moose and vegetation data collected by the Caribou Program and the Hebblewhite Lab at the University of Montana. The analysis this year was led by a post-doc at the University of British Columbia, Dr. Laura Griffin.

Resource Use of Mountain Caribou, White-tailed Deer, and other Sympatric Ungulates in West-central Alberta

COMPLETE

Deer, moose, and elk are increasing in caribou ranges in Alberta, resulting in increased populations of shared predators like wolves, cougars, or bears. This raises the risk of predation for caribou, resulting in population declines. Little is known – about white-tailed deer in particular – in many forested parts of Alberta.

This Master's project by Suzanne Stevenson used GPS collar data to model summer and winter habitat use by white-tailed deer for the first time in west-central Alberta. She then compared this with caribou abitat use to understand spatial overlap that may increase apparent competition between these species. Additionally, Stevenson used DNA metabarcoding from the fecal pellets of moose, elk, caribou, mule deer, and white-tailed deer to compare their winter diets. This is the first such information on white-tailed deer diet in Alberta.

Among many important findings, this study identified human disturbance and landscape attributes that increase overlap between white-tailed deer and caribou such as mature conifer in the winter. While all five ungulate species share certain forage species, there is low overlap of the abundance of each plant food between each species. More results are discussed in the related publications.


Both mountain pine beetle and actions taken to slow its spread have wide-ranging effects on wildlife, including species at risk such as caribou.


The Grizzly Bear Program began in 1998 to answer questions about how bears and people can co-exist on the landscape.

Grizzly Bears

After a brief hibernation, our grizzly bear crews are once more roaming the foothills, now with a focus on monitoring populations as efficiently as possible. Dr. Darío Fernández-Bellon leads the monitoring work, ensuring that our unique long-term dataset remains relevant to important questions about grizzly bears in Alberta.

Building on History

The Grizzly Bear Program began in 1998 to answer questions about how bears and people can co-exist on the landscape. Led by Gord Stenhouse, the first study focused on understanding the effects of a coal mine on the local bear population. Forestry and oil and gas companies were also soon calling to understand the impacts of their activities. By the early 2000s, there was growing evidence that Alberta's grizzly bears were in trouble, and the provincial government turned to our group to begin surveying populations.

Over the decades, this research has had an impact in many ways. Among biologists, we've contributed to the field's understanding of grizzly bears and their ecology and, just as importantly, significantly improved the methods by which wildlife is studied. Our GIS planning software, called GBtools, is used by industry and government agencies to understand and reduce the potential impact of forestry activities on grizzly bears. The provincial government has considered our population and mortality estimates and used it to make decisions such as listing the species as threatened, putting a moratorium on hunting grizzly bears, and setting science-based road density limits.

Renewed Mandate

In 2023, Fernández-Bellon and a small crew set up 39 hair snag sites and 56 habitat measurement sites throughout Bear Management Area 3, spanning the foothills from Highway 16 to Highway 11.

Our current work is not designed to be another full re-survey, which is a huge and expensive effort. Instead, the goal is to track population trends indirectly using, for example, survival rates (inferred from finding previously detected bears), reproduction rates (by drawing bear family trees and by measuring pregnancy and lactation hormones in the hair), and overall health (by the levels of stress hormones such as cortisol).

At each site, we surround a scent lure with barbed wire; curious bears leave behind tufts of hair, which we collect and analyze for DNA and hormones. Despite the pared-down fieldwork, the sites yielded nearly 300 hair samples from 31 individual grizzly bears, five of them cubs. These more efficient methods are only possible because of the decades of refinement we've made to non-invasive techniques, and we're going to continue to improve our methods by experimenting with different approaches.

Rotten cattle blood has been a mainstay of this work for decades. It's an effective


Hailey Guysbers

attractant for bears but can be difficult to source and is challenging to safely handle, so this year we began testing commercial scent lures and other stinky products such as fish fertilizer.

Our previous monitoring efforts started in the spring and wrapped up before the end of the summer. For the first time, we ran sites well into fall and discovered that there appears to be a lull in grizzly bear detections in mid to late summer, followed by a big peak in activity in the fall during hyperphagy, when grizzly bears are focussed on getting as many calories as they can before hibernation.

To get data about grizzly bears on the eastern edge, where the boreal forest meets agricultural land, Fernández-Bellon began working with landowners. In a very promising pilot project, seven landowners invited us to set up hair snag sites, allowing us to compare bear activity to what we detect in core grizzly bear habitat.

As well as monitoring grizzly bear populations, the team has also partnered with Dr. Scott Nielsen from the University of Alberta to study bear habitat, repeating a protocol that Nielsen first used in the 2000's. The crews measured vegetation at over 200 plots at harvest block edges, and deployed about as many climate sensors to see how different forestry practices affect grizzly bear habitat quality.

As in the past two years, we are continuing to make our data available to our academic partners and publishing important new results. We are working with five university labs in Canada and the US, four government agencies, and numerous NGOs and environmental consultants, as well as working on research questions internally. In 2023–2024 alone, this resulted in three new papers.

Selected Publications

Bradley, M., Boulanger, J., & Stenhouse, G. (2024). Variation in density of grizzly bears and American black bears in relation to habitat covariates and co-occurrence in Jasper National Park, Alberta, Canada. *Ursus, 2024*(35e1). https://doi.org/10.2192/ursus-d-21-00018

Palm, E. C., Landguth, E. L., Holden, Z. A., Day, C. C., Lamb, C. T., Frame, P. F., Morehouse, A. T., Mowat, G., Proctor, M. F., Sawaya, M. A., Stenhouse, G., Whittington, J., & Zeller, K. A. (2023). Corridor-based approach with spatial cross-validation reveals scale-dependent effects of geographic distance, human footprint and canopy cover on grizzly bear genetic connectivity. *Molecular Ecology, 32*(19), 5211–5227. https://doi.org/10.1111/mec.17098

Zubiria-Perez, A., Bone, C., & Stenhouse, G. (2023). Evaluating the role of environmental familiarity and behaviour in the success of wildlife translocation: A Grizzly Bear case study using agent-based modelling. *Ecological Complexity, 53*, 101042. https://doi.org/10.1016/j.ecocom.2023.101042

Hailey Guysbers

There's No Easy Way to Study Grizzly Bears

Grizzly bears are generalists; adaptable animals that thrive in many different habitats. In his first year studying this species, Fernández-Bellon has shown similar attributes.

"My background had a big range of projects with all different kinds of challenges, so luckily, I was well-prepared to be flexible," says Fernández-Bellon.

By the time the ink on his contract was dry and he arrived in Hinton, there was no time to lose to get the first field season rolling.

"It was hectic. I had to wrap my head around the big picture of where we're taking the program, while at the same time designing the specifics on the ground. Everything from the logistics of getting cattle blood to picking sites and designing a protocol.

One person played a key role in Fernández-Bellon's success: the now semi-retired founder of the Grizzly Bear Program, Gord Stenhouse.

"Very big shoes to fill. Gord had 25 years of experience; it's his life's work. It would be naïve of me to think I can just jump in and know what he knows. That's why having him as a part of the team is so helpful. He's the ideal character to take over from. He's still interested and is a walking encyclopedia on grizzly bears, but he is also keen on new ideas. It's been the perfect level of advice and guidance while letting the project evolve in new directions.

"When I'm out meeting people, everyone knows Gord. It took him decades to get to that point and it showcases the amount of work he put in. It's also ridiculous the amount of research that has been done. To step into a project that has that history and to be involved and contribute to it is so cool.

"Everyone at fRI Research has been so friendly and helpful, and the field technicians rose to the challenge of joining a project where the person leading it was new and also learning. We all had to just take it as it comes."

Healthy Landscapes

For over 25 years, Dr. David Andison has led a landscape ecology program studying how the Canadian boreal forest is changed and renewed by human and natural disturbance.

Andison's research has drawn attention to how far fire suppression and industrial development have taken the landscape beyond its natural range of variation. At the same time, making individual land management decisions in isolation has led to unintended cumulative effects. The Healthy Landscapes Program has, over the decades, developed an alternative – ecosystem-based management. This approach starts by defining the landscape we want to end up with, and using development, restoration, and fire as tools to get there.

Despite growing acceptance of the issues with current land management approaches, there are still barriers to changing status quo policy and practice. The Healthy Landscapes Program works across academic disciplines, jurisdictions, and partners with groups with diverse perspectives. As well as developing the science underlying ecosystem-based management, the Healthy Landscapes Program has a slate of projects addressing socio-economic questions, building partnerships, and sharing results.

Fire-Harvest Blueprint

NEW

This project lays the groundwork for a bold experiment future: a joint prescribed burn – harvesting plan at operational scale. While unorthodox, this could be a powerful tool for creating more natural disturbance and recovery. Before such a management plan can actually be approved, the Healthy Landscapes team including Andison and Jules LeBoeuf are working out the details for all the preliminary steps, such as how to manage risk, who takes on which responsibilities, and identifying policies that will enable this new kind of plan. And, as always when challenging the status quo, an essential element in this project is to build trust between everyone involved.

Whole Landscape Approach to EBM

NEW

When a fire moves through a wetland, what happens? Because of a historical focus on the uplands with their actively managed, merchantable timber, there is much less data for the boreal lowland part of the landscape. Many models simply use data from upland events to predict fire spread and subsequent regeneration in wetlands, making assumptions which may not be appropriate.

Ecosystem-based management is supposed to be a holistic approach, but for that to be true, we can't focus exclusively on uplands. This project begins to invest in a real understanding of fire behaviour in wetlands in order to update models such as Landweb. A literature review with researchers at Ducks Unlimited Canada is underway, which will identify the key knowledge gaps to work on next. This is the foundation of the program taking an interest in the whole landscape, not just upland ecosystems.

Fire Risk and Forest Management

NEW

After a tree is harvested, it has to be limbed and trimmed to length before being trucked to a mill. There are different ways of treating the left-over debris (called slash), ranging from chipping it on site to hauling it away and burning it. These treatments leave behind fuels that could create very different wildfire behaviours. Even the presence of machine tracks to create gaps in the fuel covering the ground could have an important effect on fire behaviour.

Natural Resources Canada manages the Canadian Forest Fire Behavior Prediction System, a model that estimates things like spread rate and intensity of active wildfires. It classifies areas into one of 16 different fuel types, but there are only three options for post-harvest slash, and all make similar assumptions about how the slash is treated. This project aims to characterize additional slash fuel types to more accurately model fire behaviour.

Post-Disturbance Stand Type Shifts

NEW

Fires are natural agents of renewal, regenerating soil nutrients, clearing space and light for new growth, and diversifying the landscape with patches of young and old forests. Burnt stands go through several different stages of regeneration, but after many decades, will typically comprise similar plants and animal communities as before the fire, completing a cycle that has repeated for thousands of years.

But not always.

Sometimes fire is a trigger for a stand to begin a new trajectory. An exceptionally large, intense fire might overcome the resilience of an area to regenerate the same as before. Or perhaps the climate has shifted enough so that some regions are now more suitable for different communities. Using pre- and post-fire aerial imagery of 139 historical fires, Dr. Nasim Kheirkhah Ghehi in Dr. Charles Nock's lab at the University of Alberta is exploring these factors to unpick when and why fires cause a shift on the landscape.

Benefits of Disturbance

ACTIVE

Subject matter specialists may champion the concept of treating fires, forest harvesting, and other industrial activities as tools for returning the landscape to its natural range of variation. But putting these concepts into practice requires broad buy-in from affected communities. To understand how the general public views the different types of disturbance, Andison and a socio-economic team at the University of Alberta led by Dr. John Parkins have surveyed 8,000 people in Alberta, Saskatchewan, and Manitoba.

The team is currently analyzing the answers to questions about the public's feelings about natural fire, prescribed burns, different types of forest harvesting, and strategies for managing insect and forest disease outbreaks. There are also questions about which groups are most trusted to manage these disturbances. A follow up survey of forestry professionals is also planned.

Beyond the Trees

ACTIVE

After a fire, berries and other medicinal plants important to Indigenous communities often grow in abundance. One of the ways that forest harvesting differs from fire as a type of disturbance is in how these vegetation communities develop (or don't). This project will bring together First Nations communities with foresters to explore alternative harvesting techniques that could allow these plants to come back.

In the first year of the project, team members visited Ahtahkakoop Cree Nation and Ile-à-la Crosse in Saskatchewan, where the goal was to listen to their perspectives, build trust, and collaborate on next steps. Those will include field trips with community members to learn from them about the plants and ecology of the area, and work with local forest companies to design field trials. Because of interest from other Indigenous communities, we are exploring relationships in Alberta, British Columbia, Manitoba, and Ontario.

Comparing Fire and Harvest Patterns

ACTIVE

Building on more than 20 years of Healthy Landscapes Program research and GIS tools, this project aims to help industry and regulators understand and emulate natural patterns on the landscape when planning forest harvesting.

While the shapes of many individual harvest blocks have evolved to have features such as irregular perimeters and island remnants, if you zoom out, the overall pattern of how those harvested areas were historically spread across the landscape is unlike a natural wildfire. Forest management practices have led to many smaller patches of different ages distributed evenly across the landscape, whereas fires tend to aggregate the disturbance into few larger patches, leaving much larger patches of interior forest undisturbed.

This study compares two forest harvesting techniques, business as usual and a new more aggregated scenario, to see if and where harvesting could get us closer to a pre-industrial landscape while still allowing for economic activity.

Ecosystem-based Management Tips and Techniques

ACTIVE

To help bridge the gap between research and practice, the team is developing resources to help forest planners at all levels apply ecosystem-based management principles. These are not rules, but advice for creating more biodiversity at the stand level, and natural conditions at the landscape scale. This kind of extension requires a deep understanding of the day-to-day operations of forestry and forest management-planning in order to provide useful tips and techniques.

Exploring Aggregated Harvest in Woodland Caribou Ranges

ACTIVE

This joint Healthy Landscapes Program – Alberta Regional Caribou Knowledge Partnership project tests whether aggregating forest harvests can benefit caribou habitat compared to the business-as-usual approach. It will look at trade-offs with other ecological and socio-economic values, and the team will investigate practical ways that aggregated harvesting can be part of forest planning. Led by Tom Moore, the creator of Spatial Planning Systems' Patchworks model, the project is using Patchworks on three areas in Alberta and one in Saskatchewan.

Landweb

ACTIVE

Landweb is a suite of models that facilitate land management at a very large scale: much of the boreal forest from Manitoba to BC, and up into the Northwest Territories. Landweb simulates the pre-industrial natural range of variation of a landscape, and then compares that with the current state or future management scenarios. This is still relatively new information and there aren't yet guidelines on how this should be used in forest policy. It's also been an open source project from the beginning, with dozens of developers contributing from university researchers to Canadian Forest Service scientists.

This has been a big success, but without coordination and clear management, there is a risk of confusion over different configurations of model versions.

A user group of forest companies, the Government of Alberta, and the model's developers are working to standardize model versions and inputs, and to agree on how to interpret the outputs. They have also set priorities for future work on Landweb, including making the model more useful and the outputs more reliable, particularly regarding how it simulates fire spread in certain areas like wetlands. They are also exploring the integration with traditional Ecological Knowledge.

Socioeconomics of EBM

ACTIVE

Alongside research on how to create more natural conditions on the landscape, The Healthy Landscapes Program also has a long history of working to better understand how management practice can align with that vision. In 2017, the program hosted dialogue sessions to try to reach a common understanding of ecosystem-based management among forestry professionals and other groups. They followed that up with a workshop in 2018 to create actionable steps towards implementing ecosystem-based management in Alberta. The results suggested that the challenges are broader than the team originally assumed, and these were thoroughly explored in a set of reports in 2021 on roadblocks and opportunities.

This project is the next step. Gary Bull and Dr. Jeremy Williams used that past work to identify the most critical socioeconomic aspects of ecosystem-based management. Through surveys and interviews with forestry professionals and Indigenous groups, the investigators are illuminating potential pitfalls and developing critical partnerships for the journey ahead.

GIS

When we delivered the first version of GBtools to our partners in the forest industry in 2006, it was a technological marvel. Integrating seamlessly with their GIS software, the suite of tools allowed managers to simulate different scenarios for harvesting, replanting, and building roads over a vast area – just over 100,000 Km^2!

Every few years GIS Services, led by Julie Duval and working with our grizzly bear biologists, have released a new version. Each iteration updates the data layers and has gradually expanded its coverage to include all grizzly bear habitat in Alberta, reaching over 266,000 km^2. GIS Services writes new tools based on our published research so that, for example, managers can quickly visualize the change in habitat quality or mortality risk after any given scenario.

The underlying code also needs to be maintained to continue to work with new versions of GIS software, fit with our partners' workflows, and take advantage of new features. This task has been the focus of efforts for the past two years, as organizations move from ArcGIS Desktop to ArcGIS Pro. The team has also been working on a new analysis tool that identifies and characterizes patches of secure habitat based on their size, resources, and distance from roads.

And service doesn't stop once the upgrade has shipped to our partners. Duval regularly fields queries from users, helping them to get the most out of the tools and troubleshoot any issues that crop up.

GIS Services doesn't only support our grizzly bear work. This year, Dr. Laura Griffin (page 10) needed maps of mountain pine beetle attack. Duval's experience working with data of all kinds allowed her to efficiently support the project and recognize pitfalls with data sources from different provinces.

Duval is also working behind the scenes to help the field season go more smoothly. 2023 was a very challenging year for wildfire. Some field sites were burnt, others were too close to danger and had to be deferred. And heavy smoke posed a health issue for crews in the bush. GIS Services was there with brand new applications that ingested real time data on fires, air quality, and weather and pushed those layers to the crew's tablets.

Another application helps crews deal with the challenge of industry gates on roads. These gates are sometimes locked and require a combination. Previously, teams would have to spend time calling the company and explaining what they needed it for, sometimes having to drive a considerable to get back into cell service. Gate combinations can also change, sometimes daily. The mobile app built by Duval lets our crews store and share the combinations and gate schedules to minimize wasted time.

Many of the contributions from Duval are not, strictly speaking, even GIS. The expertise of her and her analysts have grown beyond data management and GIS software skills. GIS Services are experts in bringing efficiency to every step in the scientific process, and they have always been there to help our staff and partners over the next hurdle.

Mountain Pine Beetle

In the early 2000's, the mountain pine beetle made it over the Rocky Mountains and, helped by warmer winters, began a range expansion that has attacked more than two million hectares of forest in Alberta, and counting. In 2007, fRI Research started the Mountain Pine Beetle Ecology Program to learn about the direct and indirect effects on Alberta's forests and watersheds. Since then, it has played a leading role in identifying knowledge gaps, funding practical research, and ensuring the results are communicated to governments, industry, and communities.

The governments of Canada and Alberta recognized that this issue cannot be ignored, and that more research is needed to get insight into the beetle's biology, predict its dispersal, develop better ways to detect its arrival, learn about its ecological and social impacts, and understand how it alters wildfire risk and behaviour. To this end, a federal and provincial partnership has provided funding for a suite of projects to address these topics.

In 2023–2024, 22 projects were in progress or completed.

Community Resilience to Mountain Pine Beetle and Other Forms of Environmental Disturbance and Change: Phase 2

Led by Dr. Rob Friberg

NEW

First Nations and rural communities face changes driven by pine beetle and other landscape-level impacts. These include events driven by climate change, cumulative impacts on the landscape, and more.

Throughout 2022, Friberg met with communities in Alberta to develop relationships, build trust, and help discover their local priorities. In 2023, the team finished phase one by identifying opportunities and gaps in knowledge, and the team is now working on Phase Two. The goal now is to work with the communities on an approach to greater resilience by identifying concrete actions, based on their own unique values and needs.

Assessment of Eastern Spread Risk of MPB Through Studies on Beetle Dispersal and Host Colonization

Led by Dr. Maya L. Evenden, University of Alberta

ACTIVE

MPB emerge from their host tree in the summer and fly to a new area. They generally travel a few kilometers before they are guided by tree pheromones to a new host tree. Dr. Evenden and colleagues hypothesize that the act of flying and using up their fat stores makes MPB sensitive to those tree pheromones.

The Evenden lab is testing whether flight changes the physical response of antennae to those chemicals and the MPB behavioural response to those chemicals. They have also deployed bait traps to collect beetles and determine whether their body condition and fat content varies across MPB's expanded range.

Assessment of Risk Factors Influencing Landscape Level Fire in MPB Forests

Led by Dr. Christopher Bone, University of Victoria

ACTIVE

Weather conditions during wildfire such as temperature, relative humidity, wind speed, and precipitation can amplify or mask the effect of MPB.

This project will determine if the number of wildfire ignitions is different before and after MPB outbreaks, and the degree to which weather, stand characteristics, and time since MPB-attack influences the chances of a large wildfire. Being able to predict large wildfires would be important information that communities at risk could act on.

Development of Fine Spatial Resolution Tree Species Information for MPB-impacted Ecosystems for Species-at-Risk Habitat Assessment

Led by Dr. Nicholas Coops, University of British Columbia

ACTIVE

These researchers are creating maps of overstory tree species covering Alberta, BC, and the Yukon, which are accurate, high resolution, and current. These maps are critical for managing MPB control efforts, particularly in caribou habitat where the impacts of beetle and beetle control can have cascading effects on species at risk.

The GIS layers, code used to create the layers, and published papers based on the layers will all be distributed freely for future research and use by land managers.

How Do the Spatial Legacies of MPB Outbreaks Affect Fire Severity in Canadian Lodgepole Pine Forests?

Led by Dr. Patrick M. A. James, University of Toronto

ACTIVE

This study looks at stands that were attacked by MPB and subsequently burned by wildfire in order to find the relationship between the attack stage and burn severity. These relationships can be used to forecast fire severity throughout Alberta's boreal forest. This work may also reveal conditions where MPB does not affect fire severity.

First Nations and rural communities face changes driven by pine beetle and other landscape-level impacts.

Impacts of the Mountain Pine Beetle on the Snow Hydrology of the Peace and Athabasca River Basins

Led by Dr. Siraj ul Islam, University of Northern British Columbia

ACTIVE

Mountain Pine Beetle outbreaks can lead to the sudden death of a large portion of an area's overstory, with unknown effects on the local and regional hydrology. This project quantifies the hydrological response in parts of the McLeod watershed, a region that has seen extensive mountain pine beetle infestation.


Herb Cerezke

The approach is a series of experiments using a state-of-the-art hydrological model to test the effects of different forest cover thresholds on water quantity and timing. The models will also evaluate how long it will take for an area to recover as the forest grows back, and the effects of climate variability over the long-term. These results will be transferable to other watersheds in Alberta.

Modelling Eastern Spread Risk of MPB Using Host Genetic Ancestry

Led by Dr. Catherine Cullingham, Carleton University

ACTIVE

Alberta's boreal pine forest gradually fades from lodgepole pine in the west to jack pine in the east. A major concern is to what degree MPB will be able to spread in jack pine. Along the lodgepole-jack gradient, there are mixed stands with both species, as well as hybrid pines – some more lodgepole-like and some jack-like, which are difficult to distinguish without genetic testing.

This project uses landscape genetics, creating predictive maps that identify pure and hybrid zones. Having previously identified genetic markers to distinguish pure and hybrid trees, researchers will verify these predictions of pine ancestry by sampling trees in less certain areas. This will allow Dr. Cullingham's group to compare the overlap of MPB with pure and hybrid pine, providing quantitative data for predicting the risk of spread to eastern Alberta and beyond.

Modelling Long-term Dynamics of MPB in Alberta Under Climate Change

Led by Dr. Mark Lewis, University of Victoria

ACTIVE

Forest stands in western Canada are subject to both mountain pine beetle and climate change; their ability to respond to the combined impacts of these stressors is not clear. This project develops models to estimate how climate change and intermittent mountain pine beetle outbreaks affects the long-term susceptibility and resilience of forests to those stressors, as well as the effects on the persistence of endemic beetle populations.

This project is using two complementary approaches: a deterministic one that gives insight as to the key features governing low-level endemic populations, and a semi-empirical and stochastic approach, allowing the team to fit the model directly to Alberta MPB data.

The Physiological Costs and Consequences of Overwintering in MPB

Led by Dr. Heath MacMillan, Carleton University

ACTIVE

We know, roughly, how severe a cold snap has to be to kill mountain pine beetle, but temperatures that do not quite get low enough for long enough to cause high beetle mortality probably still reduce their ability to thrive in the next breeding season.

This study is discovering to what extent MPB suffer tissue damage, ion regulatory collapse, or simply consume excess energy in different overwintering conditions. This will allow for better predictions about future population growth and spread in new habitats, under a changing climate.

Mountain pine beetle-disturbed forests have altered fuel structures.

Quantifying Spatio-temporal Variability in Post-MPB Outbreak Fuels in Jasper National Park, Using Terrestrial Laser Scanning, and Bi-temporal Multi-spectral Airborne LIDAR

Led by Dr. Laura Chasmer, University of Lethbridge

ACTIVE

Dr. Chasmer and colleagues will use several aerial imaging technologies to measure coarse and fine fuels of

unaffected stands and those at different attack stages. They will use this to explore how the local environment, time since attack, and attack severity affect the stand structure and fuel connectivity.

This project will deploy new technology and data analysis methods. Not only will it provide Jasper National Park with maps showing wildfire risk, it will also advance our understanding of the effects of MPB on wildfire risk, and develop new research methods.

Understanding Fire Behaviour in Mountain Pine Beetle: Disturbed vs. Managed Fuel Complexes Using Novel Data Sources

Led by Dr. Laura Chasmer, University of Lethbridge

ACTIVE

Mountain pine beetle-disturbed forests have altered fuel structures. To understand fire spread in these areas with atypical fuels, physics-based models are more appropriate than more generalized methods. This type of modeling requires 3D data of the trees, and so this project collected ground and airborne lidar data to feed into a state-of-the-art physics-based model called FIRETEC.

In addition to modeling how mountain pine beetle attack influences fire behaviour, the team is testing different management strategies such as stand thinning and removing fine woody debris.

Using Innovative Techniques to Understand How MPB is Shifting Ecosystem Composition and Configuration in Jasper National Park

Led by Dr. Eric Higgs, University of Victoria

ACTIVE

Mountain pine beetle is causing a large change in the landscape of Jasper National Park, but to understand the significance of this disturbance event, we need to know how the landscape has historically varied.

The Mountain Legacy Project team used 1915 survey photos, 1949 aerial photographs, 2002 LANDSAT imagery, 2020 aerial imagery, and repeat oblique photographs to reconstruct geo-referenced landcover for the area around the Jasper townsite. This is allowing the University of Victoria and Parks Canada researchers to quantify land cover changes over more than a century.

Using Novel Approaches to Understand Mountain Pine Beetle Impacts on Upper Elevation Sites in Jasper National Park

Led By Dr. Eric Higgs, University of Victoria

ACTIVE

The Mountain Legacy Project has digitized over 100,000 historical mountain photographs, many from over a century ago, and has completed thousands of repeat photographs allowing for a remarkable way to understand how mountain landscapes have changed. The team has now classified and geo-referenced land cover information in photographs from Jasper National Park going back to 1915, to provide a snapshot of the landscape before fire suppression and the recent mountain pine beetle outbreak.

Because this work requires new methods for georeferencing and classifying land cover from oblique photographs, part of this project will be validating the accuracy of the approach. The team will also derive land cover data from 1949 aerial photographs, repeat photographs, satellite imagery, and modern aerial imagery. The goal is to quantify changes to land cover since 1915 to evaluate the impact of mountain pine beetle and the potential for regime shifts.

Community Resilience to Mountain Pine Beetle and Other Forms of Environmental Disturbance and Change: Phase 1

Led by Dr. Rob Friberg

COMPLETE

The purpose of this project is to promote and assist First Nations and rural communities with developing road maps that support their resilience in the face of changes driven by pine beetle and


Adam Sprott

Detecting and acting early when mountain pine beetle reaches a new area has a better chance of controlling beetle population.

other landscape-level impacts. These include events driven by climate change, cumulative impacts on the landscape, and more.

Phase one is exploring the priorities of the communities and identifying gaps in knowledge, needs, and opportunities. Phase two, now underway, continues this community collaboration to create an approach and actions for greater resilience.

Dynamic Species Distribution Modelling to Predict MPB Boreal Invasion

Led by Dr. Allan L. Carroll, University of British Columbia

COMPLETE

Detecting and acting early when mountain pine beetle reaches a new area has a better chance of controlling beetle population. Classical species distribution models, especially paired with dynamic species distribution models, can help identify areas at risk of invasion and give managers a chance to get ahead of spread.

Dr. Carroll's team developed both types of models based on data from vegetation inventories, remote sensing, climate, and previous dispersal models. These predict where MPB currently occurs, and where there is a high risk of spread, MPB distribution into the future, for Alberta and the rest of the western boreal. The models were validated by data from MPB monitoring in Alberta and Saskatchewan.

Effects of Mountain Pine Beetle Outbreaks on Population Dynamics of Secondary Bark and Ambrosia Beetles

Led by Dr. Nadir Erbilgin, University of Alberta

COMPLETE

Bark and woodboring beetle species frequently attack dying and dead trees, but rarely attack healthy ones. However, stands with an increased number of dying or stressed trees may lead to a population density where they are able to kill live pine trees. Currently, it is unknown whether MPB-attacked pine stands create these conditions. This project investigated how lodgepole pine mortality affects the abundance of three groups associated with MPB: bark beetles, woodboring beetles, and their predators in Alberta.

Efficient Monitoring of MPB Outbreak Spots Using Artificial Intelligence Applied to Drone Thermal Imagery

Led by Dr. Erbilgin, University of Alberta

COMPLETE

The Government of Alberta does regular aerial surveys to find red-attack trees, followed by ground surveys to spot pitch tubes on nearby green-attack trees. These can then be cut and burned before the beetles emerge.

A more efficient method may be possible because living trees transpire, creating an evaporative cooling effect at the end of warm days. Dead trees also emit less longwave radiation during cooler mornings. These signatures are detectable with thermography. Dr. Erbilgin and colleagues advanced the technology for differentiating healthy trees from green-attack trees to enable earlier and more efficient detection of MPB spread.

Gene Conservation to Mitigate Impacts of MPB on Endangered Whitebark Pine at Its Northern Limit in Alberta

Led by Jodie Krakowski, Whitebark Pine Ecosystem Foundation of Canada

COMPLETE

In addition to blister rust, MPB is a major threat to whitebark pine, so replenishing the provincial genetic archives with seeds from healthy trees is a conservation

priority. Because whitebark pine grow in high elevation areas that are difficult to access and have irregular seed crops, it is hard to plan these efforts.

In recent years, the team collected seeds from the northern whitebark pine range. At the same time, the Whitebark Pine Ecosystem Foundation of Canada is also learning about the timing of cone crop abundance and seed variability. This will allow the team to better predict when to launch future collection efforts.

Generation of Tree level-Fire Fuel Information across MPB Infestation Mosaics

Led by Dr. Nicholas Coops, University of British Columbia

COMPLETE

The next generation of fire modeling uses information about individual trees, rather than relying on stand-level data. Dr. Coops' team used high-density lidar to scan typical green-, red-, and gray-attack stands in a range of forest types and conditions. They used both handheld and UAV-based lidar to capture individual tree attributes, thus revealing how MPB attack stage alters fuels.

After verifying, the researchers are providing reference tables so that fire modelers can look up similar stand and environmental characteristics and get representative lidar-derived individual tree fuel information. This will allow forest managers to more accurately predict fire behaviour.

Improving Monitoring Tools to Detect MPB at Low Densities in Novel Habitats: incorporating host-tree stress and fungal volatiles in beetle attraction

Led by Dr. Nadir Erbilgin, University of Alberta

COMPLETE

When mountain pine beetles are in high densities, they can cause landscape-scale effects that can be easily noticed during aerial surveys. To detect low density MPB populations, the Government of Alberta relies on traps and trap trees, but these are only as good as the chemicals used for bait. Since MPB in low densities typically attack dead or weakened trees, Dr. Erbilgin and his lab tested out the compounds that trees release when stressed, as well as compounds released by fungal species that infect MPB-attacked trees.

This project identified new chemicals, tested them in the field, and the results can be used to develop a new and more effective bait for detecting MPB at low population densities. This will make provincial control efforts more effective by helping crews find and remove more single trees during the green attack phase, before the populations can explode. The traps can also directly help control populations by luring enough of the beetles away from real trees, causing local MPB extinctions.

Soil Carbon Stocks in Forests Recovering from MPB Outbreak: a possible carbon sink?

Led by Dr. Justine Karst, University of Alberta

COMPLETE

Living trees add carbon to the soil by dropping litter, but they also prime soil for carbon mining by microbes, which reduces carbon stocks. MPB's large-scale effects on forests could therefore have a major impact on the complex carbon balance of forest soil.

This project compared the soil carbon stocks in undisturbed and MPB-attacked lodgepole pine stands. This helps us understand an important effect of MPB, as well as give insight into boreal soil microbial communities.

Toward Pre-emptive Management of Future Outbreaks: predicting the distribution of post-epidemic MPB populations in the western boreal forest

Led by Dr. Allan Carroll, University of British Columbia

COMPLETE

During epidemics, MPB can mass attack healthy pines, but during endemic phases, the low-density populations are limited to attacking weak or dead trees. If endemic populations of MPB are left unmanaged, then they may erupt into epidemics if there is an event such as drought that creates a lot of susceptible trees.

Dr. Carroll and colleagues developed a model that predicts where endemic populations are persisting, by using stand density. The researchers validated the model with on-the-ground measurements to see if it is correctly predicting stand structure, endemic suitability, and the actual presence of endemic populations. After verification, the team can use LANDSAT-derived data to model the rest of the boreal without the Alberta Vegetation Inventory data used to calculate stand density.

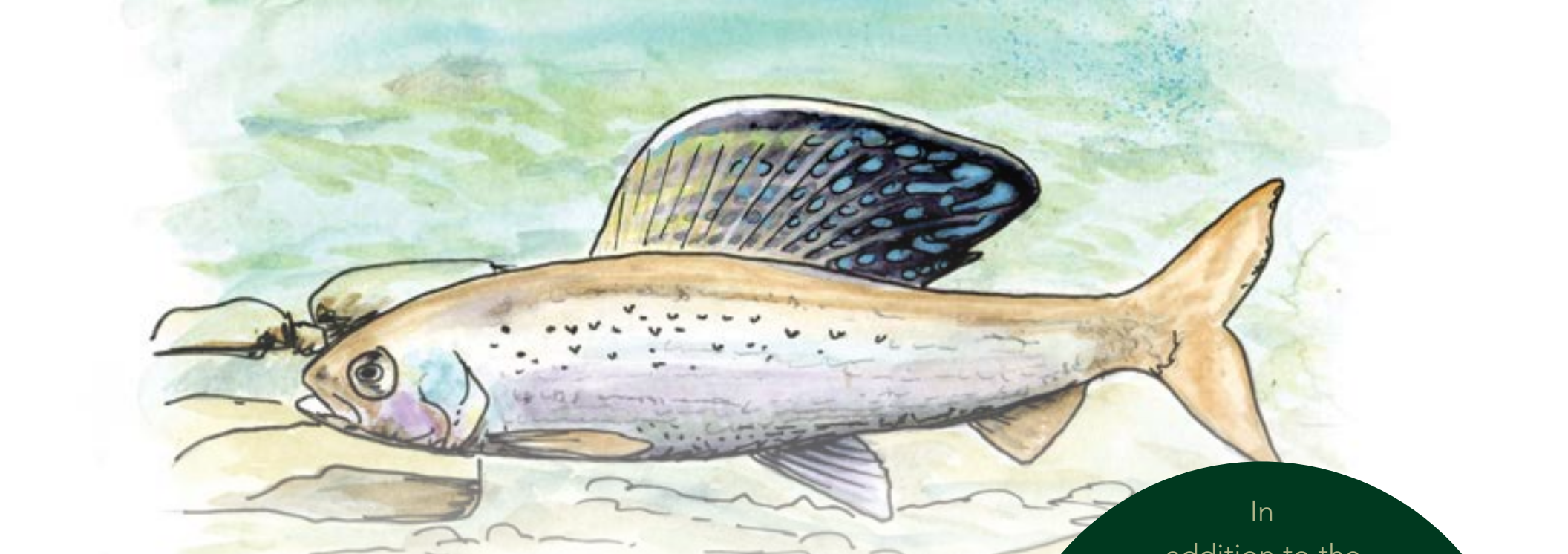
Wildlife Responses to Forest Stands Impacted by Mountain Pine Beetle in Western Canada

Led by Dr. Laura Finnegan, fRI Research

COMPLETE

Both the spread of mountain pine beetle and actions taken to slow its spread have wide ranging effects on wildlife, including species at risk such as caribou. This project provided land managers in government and industry with knowledge and tools to evaluate the consequences of MPB infestation and control actions.

Results, including an interactive planning tool, will support proactive planning and policy for areas where MPB do not yet occur, allowing land managers to mitigate the potential impact of MPB on ecological and economic values.



Water and Fish

Dr. Benjamin Kissinger took the lead on the Water and Fish Program in June 2023, bringing projects he designed with university labs, partnerships he built during his time in government, and a seemingly limitless store of energy.

The first year for any Program Lead is an extraordinarily busy time, as they make the program their own. That summer Kissinger was out in the wilderness with a backpack electrofisher and a crew from Fisheries and Oceans Canada. By the fall he had worked with governments and NGOs to bring together a huge dataset of stream temperatures and hired his first staff member to manage it. Over the winter, Kissinger secured 12 grants for more projects.

The rapid tempo of new projects speaks to Kissinger's skills as a scientist and leader, as well as the enthusiasm of our partners for this work. Stark declines in Alberta's native cold water fish species have no single cause and it will take a partnership of all sectors to conserve the province's aquatic ecosystems. Companies from the forestry and mining sectors, provincial and federal government regulators, NGOs, Indigenous groups, and academics are all eager to tackle these pressing issues, and fRI Research has been a hub to bring them all together.

In addition to the litany of research projects already underway this year, The Water and Fish Program is part of the Alberta Native Trout Collaborative, contributing behind the scenes and in communications alongside the Government of Alberta, and NGOs. Kissinger is also serving as President of the Mid-Canada Chapter of the American Fisheries Society which focuses on knowledge sharing and improved networking for people interested in fish ecology. He is also on university committees for grad students across western Canada, and is active presenting at workshops, seminars, and webinars.

In addition to the litany of research projects already underway this year, The Water and Fish Program is part of the Alberta Native Trout Collaborative, contributing behind the scenes and in communications alongside the Government of Alberta

Assessment of Forestry Stream Crossing Effects on Water Temperature

NEW

To access timber along the eastern slopes, forestry companies have installed tens of thousands of bridges and culverts across streams (see the Foothills Stream Crossing Partnership, page 34). As part of a broader need to characterize critical habitat for cold-water fish species, this project will give us a better understanding of how local temperatures are affected at these sites through shade, change in riparian habitat, and potential changes to stream flow. This project is being led by Dr. Dan Moore and Dr. Ryan MacDonald. The first temperature loggers will be installed in the spring of 2024.

Assessment of Potential Changes in Bull Trout within the Kakwa Watershed Over the Past 20+ Years: Influence of anthropogenic activities on fish occupancy

NEW

This is a re-assessment of a 2005 study that suggested a 24–43% decline in bull trout occurrence in the Kakwa Watershed due to forestry activities. Together with Dr. Neil Mochnacz at Fisheries and Oceans Canada, this multi-year project examines how different land-use activities in the past two decades have affected fish populations, in particular bull trout. These data represent a rare long-term spatially distributed dataset dating back to the late 1990s providing an opportunity to learn about change in fish and landscapes over more than 20 years.

The team are using backpack electrofishing to temporarily stun fish in order to count, measure, and quantify populations in each section. The study will also determine the best way to sample streams to assess long-term trends. To complete this sampling the team will rely on collaborations with Fisheries and Oceans Canada, Alberta Environment and Protected Areas, and the University of Calgary, and the University of Manitoba.

The Effect of Thermal Stress on the Physiology of Juvenile Bull Trout

NEW

This project was co-developed and now led by Dr. Analisa Lazaro-Côté in the Jeffries Lab at the University of Manitoba and supported through a Mitacs grant. In the lab, Dr. Analisa Lazaro-Côté's team swabbed the mucus of fish subjected to different temperature treatments to quantify stress based on concentrations of specific metabolites in the mucus. In the summer of 2024, they intend to test this method on fish captured in the Kakwa River watershed.

Previous research from the United States gave 15 degrees as an upper limit of optimal temperatures for bull trout; this project will determine if that is accurate for Alberta populations. This information will help stream temperature models being developed in other Water and Fish projects to be more predictive of bull trout habitat and will specifically help inform the Kakwa re-assessment of how fish are responding to over 20 years of changing climates and landscapes.

Using Remote Sensing Tools to Enhance the Recovery of Alberta's Native Trout in the Eastern Slopes

NEW

This project will take advantage of recent advances in remote sensing, in particular high-density lidar, to create a "virtual watershed". This approach is similar to the highly successful NetMap tool, which used an older – and lower resolution – generation of remote sensing data to estimate stream attributes and fish habitat. As with NetMap, this GIS tool will be developed in collaboration with Dr. Lee Benda of Terrainworks.

The goal is to identify small, potentially fish-bearing streams and channels and derive stream attributes including width, sinuosity, and gradients. These could then be used to understand which streams are physically suitable as fish habitat, and which are likely or unlikely to contain spawning, rearing, and accessible upstream areas. High resolution maps of ditches and other stream-adjacent features will also help estimate sedimentation.

There are two main study areas: the upper Athabasca watershed, home to bull and Athabasca rainbow trout, and southwest of Calgary where westslope cutthroat and bull trout are found. In addition, there is a pilot study underway in the Peace watershed with resident populations of bull trout and arctic grayling.

Water Temperature Monitoring in the Eastern Slopes to Aid in the Recovery of Native Trout Populations

NEW

The Water and Fish Program has taken the lead in collecting new, and collating existing water temperature data for the first stream temperature model covering Alberta's entire East Slopes. This will identify which watersheds have the most thermally suitable habitat for cold water species, in particular bull trout, westslope cutthroat trout, and Athabasca rainbow trout, which are federally listed under the Species-at-Risk Act. It will also help forecast which watersheds are most vulnerable to climate change and assist resource managers in selecting areas for recovery actions and protection.

In the spring of 2023, we worked with MacDonald Hydrology Consultants Ltd. to identify data gaps to set our priorities for an additional 400 temperature loggers that we deployed in the summer. In addition to identifying data gaps, MacHydro is taking the lead on the model creation and has developed a web-based platform for creating our models and outputs that, when finished, will be publicly accessible.

This work is highly collaborative. In just 2023, we received data from Alberta Environment and Protected Areas, Jasper National Park, Fisheries and Oceans Canada, the Alberta Conservation Association, Trout Unlimited Canada, and the Ghost Watershed Alliance Society. In the fall, we worked full time on quality control to ensure that all these sources came together into one dataset.

An Experimental Test of the Potential for Bull Trout Conservation Translocations, via Instream Incubation Capsules, in Alberta

ACTIVE

Kissinger helped develop, implement and is serving on the committee for a University of Calgary master's project led by Tara Lepine. Begun in fall 2022, members of the Vamosi lab are testing a new way to translocate bull trout. Instead of moving individual, live fish from one location to another, Lepine is planting capsules of fertilized bull trout eggs in the streambeds. The main goal is to find out how well this method works and see what factors impact embryo development and ultimately survival. The crew collected, fertilized, and deployed the capsules in the sediment in 2023 with retrieval slated for March 2024.

Impacts of Forest Management Practices and Severe Wildfire on Water Quality, Flow Regimes, Flooding and Aquatic Habitats

ACTIVE

This work contributes to, and builds on, the internationally acclaimed Southern Rockies Watershed Project led by Dr. Uldis Silins at the University of Alberta.

The first part of this project is watershed-scale data collection to document and compare the recovery of hydrology, water quality, and aquatic ecology from three different forest harvest strategies and the 2017 Kenow wildfire. There will also be a synthesis of research on impacts of forest harvest operations and severe natural disturbance from the 2003 Lost Creek wildfire and historic flooding in 2013.

A second component will study the impacts of these disturbances on stream water temperature, aquatic health, and evaluate cumulative watershed effects across multiple water values in a large river basin under significant development pressures from forestry, mining, recreation, agriculture, and municipal development.

This project is interdisciplinary, bringing together experts in headwater hydrology, disturbance ecology, large basin-scale river processes, water treatment engineering, and socio-economics.

Investigating the Extent of Hybridization between Native Bull Trout and Introduced Brook Trout in Alberta

ACTIVE

Hybridization between bull and brook trout has been documented in the eastern slopes, but the full impact on bull trout populations has not been quantified. Emily Franks' master's project aims to do just that. This study quantifies the extent of hybridization within an individual, within a watershed, and within the East Slopes. While at the University of Calgary, Kissinger helped design and find funding for the project and currently serves on Franks' committee.

Leading the Water and Fish Program

When Dr. Kissinger was hired, the Water and Fish Program had just relaunched under Dr. Barry White, now our Executive Director. White had brought together new partners to support an expanded program that addresses native fish species of concern and advances in remote sensing technology. He was shepherding several grants (including many of the above) during the handoff to Kissinger, but these were still pending. Additionally, Kissinger faced uncertainty about everything from which priorities partners would support to where he would store new gear.

"Having zero gear was actually a massive crux," says Kissinger. "Starting from scratch, there was so much to organize and so many logistics to handle. My program had a staff of one: me."

As grants came in and his budget took shape, he was able to bring on two great staff members to take care of some of these cares: "Claire and Sam are wonderful. Having them has allowed me to more effectively execute the projects we have created."

Though he didn't have any employees in the first half a year, he did have colleagues who were keen to continue projects that he had developed during his time at the University of Calgary. In the first summer Kissinger was on hand with Fisheries and Oceans Canada to kickstart fish surveys in the Kakwa River and assist with Lepine's master's project testing a new method for bull trout translocation.

At the same time, Kissinger found that he was suddenly able to achieve something he'd had in mind for years – bringing together stream temperature data from many different groups working in Alberta's east slopes.

"How smoothly it went getting the data was mind blowing. I had no idea how much data existed in the province outside of the Fish and Wildlife Information System," says Kissinger. "I'm fortunate to have the connections and knowledge to be able to work with both the Government of Alberta and other organizations collecting water temperature data."

Kissinger has found these willing partnerships to be something of a pattern. Although it's a huge task to build up his program, he's discovered real benefits of working at an independent research institute.

"I've found that I've had a lot more creative freedom and that it's much easier to collaborate," says Kissinger. "The relatively light bureaucracy here allows for more productive, efficient projects and the speed I can get things done, for example completing contracts, is so much faster."

The speed is certainly impressive. 12 new grants in one year, funding 13 researchers – staff, students, and post doctoral fellows – and nine distinct research projects. There is a long list of invited speaker presentations and partner meetings, and collaborations with provincial and federal governments.

Or, in Kissinger's words, "when I've needed to report on this work, it's been a good reminder that – wow! – the Water and Fish Program has accomplished a lot this year."

The Marten Habitat Project

Local trappers and forest managers have joined forces for a new project in the Slave Lake area. The Forest Resource Improvement Association of Alberta via Vanderwell Contractors is funding the work, and five local trappers are collecting important new data to learn about annual habitat use by marten on their traplines.

The classic description of American Martens (often called Pine Martens, after their European cousins) holds that they need mature forests to thrive. While martens do seem to prefer larger patches of mature conifer forests, studies of collared martens in BC show that they also use other types of habitat. There is very little research specifically for Alberta's boreal forest.

Gord Stenhouse helped the trappers and Vanderwell staff design the study and source the field equipment. He also meets with them regularly and provides ongoing advice, and will assist in analyzing and writing up the results. Rounding out the team is a local wildlife technician, who is overseeing the management and handling of data.

"It is great working with local trappers who are sharing their knowledge of an ecosystem that they understand very well," says Stenhouse. "This project is exciting because not only are we bringing together foresters and trappers, but we're enabling these groups to answer a question that matters to their communities."

The project will run for three years, and help answer questions that the trappers and Vanderwell have about which habitats and forest ages marten use in the non-trapping season, as well as how nearby forest harvesting can affect marten occupancy.

In December 2022, the trappers set up 90 trail cameras with a scent lure along five trap lines within the Vanderwell Forest Management Area. The high-resolution cameras quickly made many marten detections, as well as sightings of other species of interest including moose, deer, wolves, fishers, and lynx.

All told, there were 168 marten detections in 2023, with detection rates generally increasing when martens spend more time actively foraging, and waning during denning and mating months. Breaking the preliminary data out by habitat type, there are some expected trends as well as some interesting hints at more complicated habitat use than given in many field guides. For example, while the largest proportion of detections have come in older forests, it's clear that marten are able to take advantage of all forest types, especially mature deciduous stands.

These are only preliminary observations. We'll share more as each year's data comes in.

The classic description of American Martens holds that they need mature forests to thrive.

Associations

In 2023–2024, fRI Research served as the coordinating organization for five independent associations:

- Alberta Regional Caribou Knowledge Partnership,
- Foothills Landscape Management Forum and Caribou Patrol Program,
- Forest Growth Organization of Western Canada,
- Foothills Stream Crossing Partnership, and
- SERG-International

We help with common administrative functions such as human resources and information technology to avoid redundancy and reduce everyone's operational overhead. We also serve as a liaison to help connect these groups to our partners in academia, government, industry, and NGOs.

Beyond this assistance, each association conducts their activities independently to fulfill their separate mandates.

Alberta Regional Caribou Knowledge Partnership

Alberta's woodland caribou herds are classified as a threatened species. Their conservation requires science-based policies and the partnerships of all groups working in caribou habitat. To help address this challenge, a dozen forest companies created a $5-million fund in 2018, administered by the ARCKP.

Scientists from the forest industry, Alberta Government, and leading caribou scientists in the province have worked together to identify knowledge gaps and fund research projects. These studies explore a range of ideas that could benefit caribou, from changes to forestry practices to lichen transplantation. By March 2024, eight projects had been funded using approximately half of the alotted funds. Three projects are complete and planning is underway for selecting the next round of scientific projects.

As well as funding the creation of new knowledge, the second part of the ARCKP's misssion is to share tools and strategies for caribou conservation. To this end, the association creates infographics and summaries of research in a regular publication called The Exchange, which features results from ARCKP-funded projects as well as other research relevant to government and industry's caribou efforts. The ARCKP also shares the final reports and hosts webinars to discuss results.

In 2023–2024, there were five projects underway:

The application of quantitative metrics in forest management and caribou recovery: a jurisdictional scan of quantitative approaches to classifying 'undisturbed' caribou habitat

Evaluation of the feasibility of terrestrial lichen seeding and/or transplantations

Reconciling pre-industrial patterns, caribou habitat and management reality

Reducing the effects of non-permanent forestry roads on woodland caribou in Alberta

Study to advance harvest system and silviculture practices for improved woodland caribou and fibre outcomes

Learn more at **arckp.ca**

Three Caribou Conservation Initiatives

The Caribou Program is an fRI Research program that studies woodland caribou ecology, generating new knowledge and tools for their long-term conservation.

The ARCKP is government and industry –run, and acts as a forum and funding source for knowledge generation and mobilization.

The Caribou Patrol is an Indigenous-run program that reduces caribou mortality on highways through education, signage, and highway patrols.

Caribou Patrol Season 12

The Caribou Patrol has had something to be proud of each year, going back to their beginning in 2012. A new record number of collisions averted, thousands of people reached at a festival, the release of a documentary featuring the stories and wisdom of Aseniwuche Winewak elders, to name a few recent successes.

This year, the Patrol can celebrate the best news of all: another year with zero caribou mortalities on Highway 40.

It wasn't so long ago that the situation was very different. In the 90s, dozens of caribou from the A La Peche herd died during the annual migration between their summer refuge in the mountains west of the highway and their winter habitat to the east.

Unwilling to see the herds in their traditional territory vanish, the Aseniwuche Winewak Nation worked with the Foothills Landscape Management Forum to form the Caribou Patrol. Crews drive the highway during migration season and use stockmanship techniques to either help caribou safely cross, or drive the animals to a less dangerous location. Over the years, they've prevented accidents involving well over 1,000 caribou. There have been just seven mortalities since the Patrol began, and none have occurred while Patrollers were out.

However, this work is labour intensive; crews have put in nearly 2,000 person-days of patrolling. Preventing mortalities seconds before they occur is a last resort. These extraordinary efforts were recognized in June 2023, when the Caribou Patrol Program was awarded an Emerald Award in the category of Wildlife and Biodiversity.

The Patrol is also working to reduce the need for these efforts. Last year, they investigated strategies for deterring high risk crossings, including a virtual fence that automatically hazes caribou away from the road when there is traffic coming.

The Patrol has a longstanding relationship with Alberta Transportation, deploying special signs on the highway and adding an alert during migration season on 511. As the Caribou Patrol works toward a pilot project of the virtual fence and other strategies, they have been invited to contribute wildlife sightings and incidents to Alberta Transportation's internal database to help them better understand the situation in this corridor.

The program is also thinking longterm. All year long, the team goes to classrooms, festivals, and conferences to get more people aware of the need to conserve caribou in Alberta before it's too late. They traveled to Alaska for the North American Caribou Workshop, went to Edmonton for the Deep Freeze Festival and Zoominescence where they talked to thousands of people. They showed up for Parks Day near Hinton and National Indigenous People's Day close to home in Grande Cache.

There's a lot of reason for hope. While driving with her parents shortly after a Caribou Patrol presentation to the Susa Creek School, a student spotted three pregnant caribou and adamantly insisted that they had to report their sightings. Pregnant caribou are a very encouraging sign to everyone hoping for population recovery. A child who remembered the lesson and was excited to participate is another powerful reason to celebrate.

Learn more at **cariboupatrol.ca**

Foothills Landscape Management Forum

The FLMF is a group of forestry and energy industry companies working together to practice integrated land management. The independent association recently demonstrated the benefits of this collaborative approach in a pilot project and is consulting with the government on next steps. While that process is underway, the FLMF continues to support the Caribou Patrol Program and the Aseniwuche Winewak Nation that runs it.

Foothills Stream Crossing Partnership

Throughout the foothills of the Rocky Mountains, there are tens of thousands of points where roads cross watercourses. These stream crossings are the responsibility of resource companies, the government, and private landowners. Some were built to high standards, some weren't, some used to be good but haven't been maintained or inspected in a long time, and some are more or less completely unknown. This means that there are potentially thousands of structures – some estimates suggest 40% of legacy culverts – that are blocking fish passage or eroding copious sediment into streams.

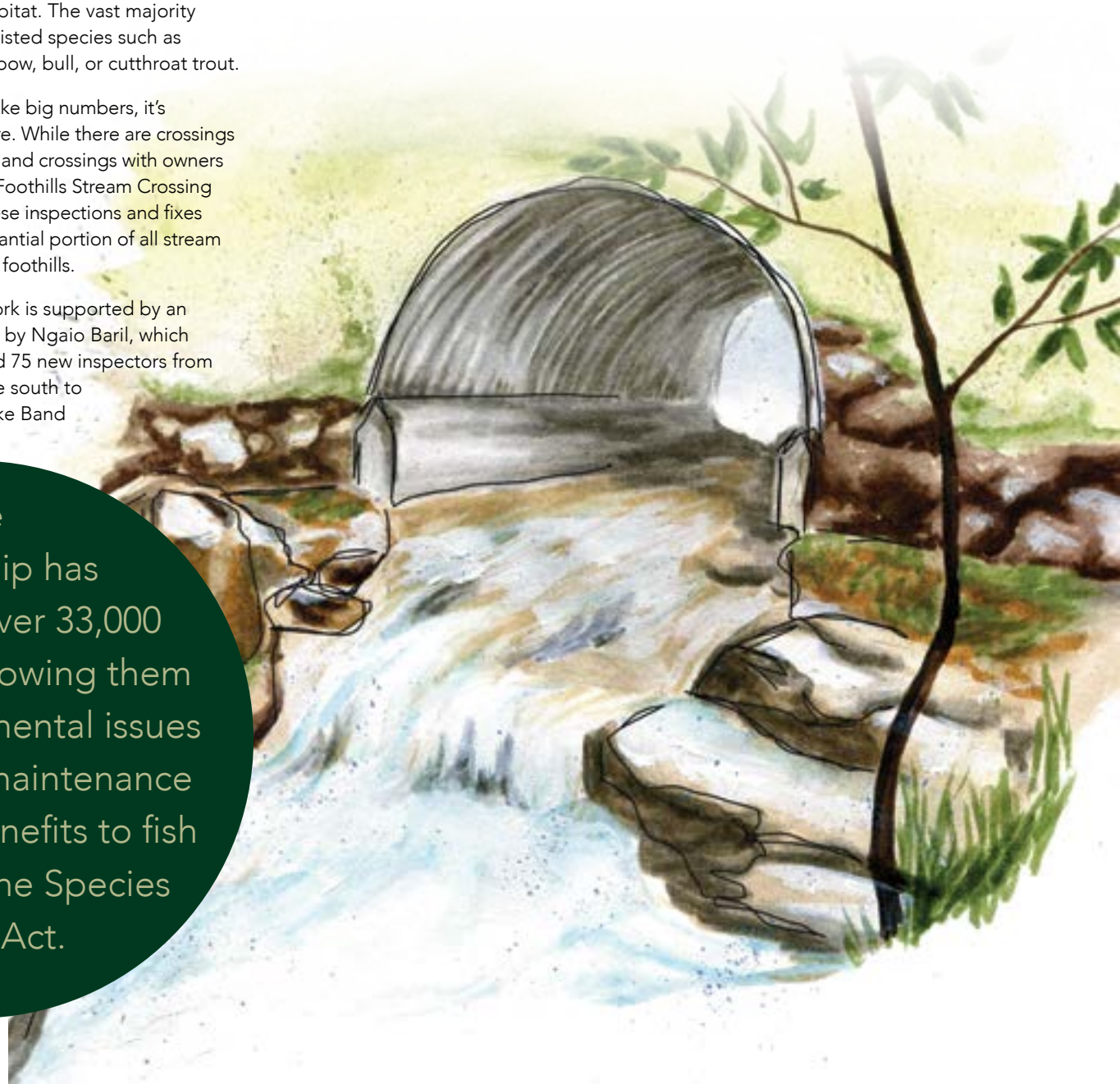
A handful of forestry and energy companies operating in the headwaters recognized 18 years ago the scale and urgency of the situation. They decided to coordinate efforts to inventory, monitor and repair stream crossings as a multi stakeholder industry group, forming the Foothills Stream Crossing Partnership.

Since then, the Partnership has grown steadily to meet the challenge. Now up to 31 members, the Partnership has completed over 33,000 inspections, allowing them to flag environmental issues and prioritize maintenance to maximize benefits to fish listed under the Species At Risk Act. To date, the group has repaired 740 crossings to re-establish fish passage to 1,855km of upstream habitat. The vast majority is habitat for a listed species such as Athabasca rainbow, bull, or cutthroat trout.

If these sound like big numbers, it's because they are. While there are crossings without owners and crossings with owners not part of the Foothills Stream Crossing Partnership, these inspections and fixes address a substantial portion of all stream crossings in the foothills.

This scale of work is supported by an active team led by Ngaio Baril, which this year trained 75 new inspectors from Cochrane in the south to the Lubicon Lake Band

The Partnership has completed over 33,000 inspections, allowing them to flag environmental issues and prioritize maintenance to maximize benefits to fish listed under the Species At Risk Act.



in the Peace watershed. Prompted by improvements in technology and the inspection protocol over the years, they have also released a substantial update to the Inspection Protocol Manual.

Despite these achievements, the mission of reconnecting watersheds in Alberta's headwaters is incomplete. But Baril and the Partnership have a plan to get closer, by recruiting more crossing owners as members, and building partnerships with other groups.

To help with this, the Foothills Stream Crossing Partnership has relaunched its website, expanded its social media presence, and has been attending and presenting at environmental and industry conferences. At the same time, Baril has been reaching out to First Nations communities to train their people in the inspection protocol and support them in getting contracts to do the work for crossing owners. She has also been working with the Orphan Wells Association to identify access roads that could be included in the program.

The landscape in Alberta is full of complex problems that can seem hopeless at the outset. This Partnership shows how collaboration can make even the biggest challenges possible.

Learn more at **fscp.ca**


Foothills Stream Crossing Partnership


Foothills Stream Crossing Partnership


Foothills Stream Crossing Partnership


Foothills Stream Crossing Partnership

Advisory, Support, and Collaborative Partners

Alberta Environment and Protected Areas

Alberta Energy Regulator

Fisheries and Oceans Canada

Alberta Conservation Association

Trout Unlimited

Aseniwuche Development Corporation

Swan River First Nation

Lac Ste. Anne Metis

Albert Backcountry Hunters and Anglers Association

2023–2024 FSCP Membership

Alberta Newsprint Company

Arc Resources

Athabasca Oil Corp

Baytex Energy

Canfor divisions

Canlin

Cardinal Energy

Chevron

Cenovus

Hawthorne Energy

Keyera

Millar Western

NuVista Energy

Outlier Resources

Paramount Resources

Pembina

Petrus

Peyto

Pieridae Energy

Shell Canada

Strathcona

Taqa

Tidewater Midstream

West Fraser Mills divisions

Weyerhaeuser

By facilitating cooperation and communication within the industry and with researchers and regulators, FGrOW is able to coordinate research efforts, improve efficiency, and make large collaborations possible.

Forest Growth Organization of Western Canada

FGrOW conducts much of the growth and yield research in western Canada by bringing together the forestry industry, the Governments of Alberta and Saskatchewan, the Canadian Forest Service and the University of Alberta. By facilitating cooperation and communication within the industry and with researchers and regulators, FGrOW is able to coordinate research efforts, improve efficiency, and make large collaborations possible.

The association also builds scientific and operational capacity among its members through training, field tours, webinars, and tech transfer. Under the FGrOW umbrella, the Foothills Pine Project Team, Mixedwood Project Team, Policy and Practice Project Team, and the Western Boreal Growth and Yield Association are becoming less siloed. While each still contributes unique expertise, association members can propose projects that draw on the strengths of more than one project team.

In June 2023, FGrOW and the Western Mensurationists co-sponsored the Growth and Yield Innovations Conference in Canmore. The 2-day event showcased new research and approaches to improving growth and yield, with topics including advances in precision forestry and remote sensing, the effects of climate change, taking lessons from different forest regions, and how to remove barriers to technology transfer. There was also an optional 1-day field tour to demonstrate some of the concepts discussed during the main conference, and have informal conversations.

Learn more at **fgrow.ca**

In 2023–2024 FGrOW started, continued or completed 12 projects:

Cooperative Management of Historic Research Trials

Enhanced Forest Management

Enhanced Forest Management Prediction

Long-term Study

Measurement of the Mountain Pine Beetle Permanent Sample Plot Network

Mixedwood Growth Model

Mixedwood Regeneration and Treatment Response

Provincial Growth and Yield Initiative

Realized Gain Trials

Regenerated Lodgepole Pine Trial

Strip Cut Understory Protection Trial

UPSTRT: Universal Protocol for Silviculture Treatment Research Trial

SERG International

SERG-I is a forest pest management consortium with the mission of improving pest management methods and technology. By bringing together land managers, regulators, researchers, and forest technology suppliers to coordinate their work, SERG-I makes research and collaboration more efficient and cost-effective. Their main activity areas are:

1. Testing the efficacy of pest management products
2. Improving application methods
3. Studying their environmental impacts
4. Developing practical strategies for pest management
5. Knowledge and technology transfer through workshops and meetings

SERG-I is directed by an Executive Steering Committee composed of representatives of the provincial governments of Alberta, BC, Saskatchewan, Manitoba, Ontario, Quebec, New Brunswick, Nova Scotia, and Newfoundland and Labrador, as well as the Canadian and US Forest Services.

In 2023–2024, SERG International had 25 active research projects:

Assessing the biology and geographic distribution of a new exotic species, the Elm zigzag sawfly, in Canada

Assessing forest vulnerability to climate-induced moisture stress and disturbance across the western boreal region

Climate change-mediated variation in diet for outbreaking forest defoliators – impacts on insect disease and implications for pest management

Cold tolerance and lower temperature limits of Spotted Lanternfly (Lycorma delicatula, Hemiptera: Fulgoridae)

Comparisons of Btk aerial spraying scenarios against the Eastern Spruce Budworm, based on protection timing and intensity during a complete outbreak episode

Development of detection strategies for evaluating natural enemy populations of the Hemlock Woolly Adelgid in Nova Scotia

Efficacy of FraxiProtecTM auto-dissemination of Beauveria bassiana tactic for control of Emerald Ash Borer in urban forests

Enhancing the efficacy of Btk against Spruce Budworm with RNA interference

Environmental drivers of parasitoid dynamics for a major forest insect pest during a management program

Field guides to Canadian forest insects (Bark and Ambrosia Beetles [Scolytinae], Powder–post and Death Watch Beetles [Brostrichidae], Sap-feeding Beetles [Nitidulidae], Lepidoptera larvae, Coleoptera larvae)

Field-tests of region-specific pheromone blends of spruce beetle, Dendroctonus rufipennis, for lure improvement

Flight behavior, degree day models, and identification of potential nitidulid beetle vectors of oak wilt along the northern range of oaks in Canada

Identification of Gypsy Moth natural enemies using a qpcr-based molecular tool: a proof-of-concept study

Improving monitoring tools to detect Mountain Pine Beetle at low and high densities in novel habitats: investigating the role of fungal volatiles in beetle attraction-field testing

Improvement of semiochemical-based trapping method for Whitemarked Tussock Moth, chronological year 5 of project, fiscal year 4 of project

Insecticides for protection of hemlocks from Hemlock Woolly Adelgid: efficacy and effects on non-target aquatic invertebrates

Linking bud-insect phenology and hydraulic traits for improved forest protection during Spruce Budworm Outbreaks

Monitoring Mountain Pine Beetle activity at low population densities using tree baiting and remote sensing

Mountain Pine Beetle in new and changing climates: Will prairie boreal summers be too warm?

Northward range expansion and mortality of boreal black spruce to Spruce Budworm defoliation under climate change

Optimization of intercept traps for the detection and management of forest Coleoptera

Outbreak potential of Spruce Beetle: dormancy and winter survival

Overwintering thermal means and extremes as components of Spruce Budworm performance and survival in management strategies

Rearing, release, and evaluation of exotic parasitoids for biological control of the Emerald Ash Borer in Canada

Uncontrolled vs. controlled Spruce Budworm (SBW) populations with increasing intensity of Btk applications: impact on non-target Lepidoptera, SBW parasitism and overall arthropod diversity


Learn
more at
serginternational.org


fRI
fRI Research
Informing Land & Resource Management