fRI Research
Informing Land & Resource Management

fRI Research

Annual Report 2022–2023

fRI Research is an independent, not-for-profit research institute focused on practical solution for better land management. We grow partnerships with governments, First Nations communities, industries, universities, environmental NGOs, and many other groups. The topics we tackle are driven by the issues facing policy-makers and practitioners, 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 across Canada and collaborations around the world. What unites all these efforts is the belief that great science can lead to better outcomes for people and all the other species we share this planet with.

Written by Ben Williamson
Art and design by Penny Snell, BubbleUp Marketing

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Message from Jesse Kirilo, President

Every so often I get the chance to express how truly amazed and proud I am of this organization and this annual report is one of those opportunities. I am particularly proud of how our administrative staff and all of our staff have persevered through the Board's search for an executive director. And on that note, I have the great pleasure that I get to introduce Dr. Barry White as fRI research's new Executive Director!

Barry will bring a fresh set of eyes to the organization and a passion to make fRI Research truly the best place to work for, and work with, in the coming years. In quick succession to Barry coming aboard he found some extremely talented program leads for the Grizzly Bear Monitoring program and the Water and Fish Program. The Grizzly Bear Monitoring program will be led by Dr. Darío Fernández-Bellon and the Water and Fish Program will be led by Dr. Benjamin Kissinger.

Along with these, our many other programs continue to work in some challenging conditions as they have had to adapt to the wildfire situation and floods that have hit the eastern slopes of the Rockies and other areas where they have been active. Our staff continues to work hard to reach the goals that our organization and our partners have set, and the Board is just as committed help them achieve these goals as ever.

Message from Terri McHugh, Interim General Manager

The 2022–2023 year was one of transition for many parts of fRI Research. We bid farewell to our General Manager Ryan Tew at the start of the fiscal year, and by the end we welcomed the new Executive Director, Dr. Barry White. In between those two events was my tenure as Interim General Manager.

As all the leaders before me have found, the strength of fRI Research continues to be its remarkable people. Everyone involved with the organization is committed to and passionate about the excellent work we do. I am personally grateful for the support they each provided to me during my time as Interim General Manager.

One of the unique characteristics of fRI Research has long been its ability to respond to the needs of our partners. In addition to the continued excellence of our long-running programs, this year saw the development of the first new projects in our relaunched Water & Fish Program, the kick-off of the Grizzly Bear Monitoring Project, and the start of a study on martens developed, run by, and benefiting a local community.

I would also like to recognize the time and effort put in by our partners this year – whether through participating on our board of directors or on program activity teams their insights and ideas are critical to our ability to provide useful science to answer important questions.

As we look to the future, these new ideas, new projects, and new people set us up many years of continued growth and success.

2022–2023 Board of Directors

Jesse Kirillo (Board President)
Repsol Oil & Gas Canada

Ken Greenway (Board Chair)
Alberta Forestry, Parks and Tourism

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

Allan Bell
Tolko Industries

Steve Blanton
Manning Forest Products

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, Parks and Tourism

Bob Mason
Canadian Forest Products

Fred Radersma
West Fraser

Travis Ripley
Alberta Environment and Protected Areas

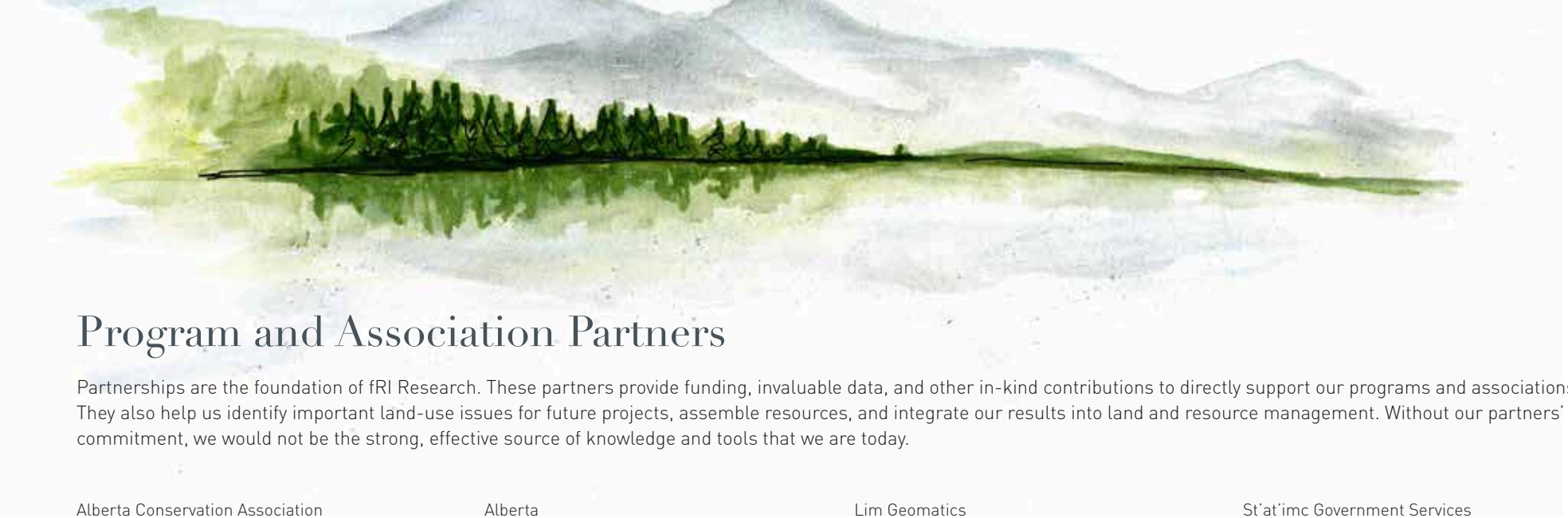
Karen Rosvold
Rural Municipalities of Alberta

Jon Taszlikowicz
Canadian Forest Products

Laura Trout
West Fraser

Matthew Wheatley
Canadian Forest Service

Current as of March 2023



Program and Association Partners

Partnerships are the foundation of fRI Research. These partners provide funding, invaluable data, 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 Forest Products Association
Alberta Innovates
Alberta Labour
Alberta Newsprint Company
Alberta-Pacific Forest Industries Inc.
ARC Resources
Aseniwuche Winewak Nation of Canada
Association of Alberta Forest Management Professionals
Athabasca Oil Corporation
Baytex Energy
Canadian Food Inspection Agency
Canadian Institute of Forestry
Canadian Natural Resources Limited
Canadian Wildlife Health Cooperative
Canfor Corporation divisions: Grande Prairie and Whitecourt (formerly Millar Western)
Canlin Resources Partnership
Cardinal Energy
Carleton University
Cenovus Energy Inc.
Chevron Canada Resources
County of Grande Prairie No. 1
Ducks Unlimited Canada
Environment and Climate Change Canada: Jasper National Park
FORCORP Solutions
Forest Resource Improvement Association of Alberta
Government of Alberta: Ministry of Agriculture, Forestry, and Rural Economic Development; Environment 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 Northwest Territories: Ministry of Environment and Natural Resources
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
Greenlink Forestry
Habitat Conservation Trust Foundation
Hammerhead Resources
Hawthorne Energy
Keyera Corporation
Lim Geomatics
Louisiana-Pacific Corporation
MacHydro
Mercer Peace River Pulp
Mitacs
Motion Industries
Municipality of Jasper
Natural Sciences and Engineering Council of Canada
NAIT Boreal Research Institute
Natural Resources Canada, Canadian Forest Service
Northland Forest Products
Norwegian University of Life Sciences
Norwegian Institute of Bioeconomy Research
Nuvista Energy
Outlier Resources
Paramount Resources
Petrus Resources
Peyto Exploration & Development Corporation
Pieridae Energy
Project Learning Tree Canada
Respsol Oil & Gas Canada
Sakâw Askiy Management
Scandinavian Brown Bear Research Project
Shell Canada
Silvacom
Société de protection des forêts contre les insectes et maladies
Spartan Delta
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
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) Ltd.
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
XTO Energy Inc.
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 shareholders 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.

REPSOL

Since 2007

When we transitioned from a Model Forest to a research institute, five companies called the Foothills Energy Partners stood behind us. In 2015 one of those partners, Talisman Energy, was purchased by Repsol and Repsol has maintained its shareholder contributions ever since. In such a volatile industry, Repsol's consistent support is all the more notable.

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 Program

The Caribou Program was created in 2013 to help government and industry reduce the impacts of their activity on caribou, effectively allocate restoration efforts, and better understand the interactions between caribou and the landscape. The overall goal is to find practical conservation solutions for a working landscape.

Over the last 10 years, Dr. Laura Finnegan's success in leading the program is in no small part due to productive collaborations with government, industry, the Aseniwuche Winewak Nation, and Canada's leading universities. The Government of Alberta and Weyerhaeuser have provided our researchers with invaluable location data of collared caribou. Many industry partners have shared company data and on-the-ground know-how for their forest management areas. Collaborations with scientists at universities in British Columbia, Alberta, and Ontario have ensured our group has been at the cutting edge of ecology research. And funding from many governments and industries have allowed the Caribou Program to make these advances for caribou conservation.

In 2022–2023, the Caribou Program was actively working on three research projects. In addition to publishing in peer-reviewed journals, the program devoted resources to communicating their results through reports and briefing notes for partners, presentations at scientific conferences, and creating infographics to make the science accessible to everyone.

The overall goal is to find practical conservation solutions for a working landscape.

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

Active

Cam McClelland

Cutting mature forest for timber, roads, or any other reason, converts caribou habitat into moose, deer, and elk habitat. The resulting influx of predators is driving the decline of Alberta's woodland caribou. This project looks for harvesting regimes and silviculture prescriptions that tilt the balance towards caribou.

We are looking at the effects of different silviculture techniques on characteristics important for caribou, such as the amount of lichen, other vegetation, and lateral cover. We will compare harvested areas to those disturbed by fire and areas with documented use by caribou. We will also assess cutblocks for their ability to become caribou habitat in the years ahead.

2022 was the second and final summer of fieldwork. Crews visited hundreds of sites in west-central Alberta to take vegetation inventories and collect a slew of fine-scale site data. This work is supported by the Alberta Regional Caribou Knowledge Partnership. We have partnered with Dr. Ian Best in Dr. Che Elkin and Dr. Chris Johnson's lab at the University of Northern British Columbia to work on the analysis of the field data we collected.

By the end of 2023, we will deliver results and an interactive GIS tool for land managers. This tool will show which areas are on course to become woodland caribou habitat and identify silviculture practices that could help with this.

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

Active

Mountain pine beetle outbreaks – and the management actions of government and industry to control the spread – have the potential to seriously impact caribou habitat throughout the western boreal forest. They could also affect other species like deer, moose, and elk. This project will use existing data to model wildlife response to various types of intact forest, MPB infestation, salvage logging, and single tree cut and burn. We will build interactive GIS tools that will allow government and industry to simulate the impacts of these scenarios on multiple wildlife species.

This project is supported by the Government of Canada and the Government of Alberta via the Mountain Pine Beetle Ecology Program (see page xx). It builds on previous work that investigated the response of grizzly bear and caribou foods to some of those scenarios. We're teeming up with Dr. Laura Griffin in Dr. Cole Burton's lab at the University of British Columbia, who is leading analysis for this project.

Mountain pine beetle outbreaks have the potential to seriously impact caribou habitat throughout the western boreal forest.

Claire Kelly

Response of Wildlife to Restored Wellsites

Active

There is significant oil and gas related development within the Redrock Prairie Creek and Narraway caribou ranges in west-central Alberta. Many abandoned and inactive oil and gas wellsites have been certified as reclaimed, while others have been additionally planted by Weyerhaeuser, the outcomes appear to vary considerably. We are setting up camera traps on wellsites to compare wildlife use of those designated as restored vs inactive but unrestored.

The results can help determine when and which treatments might be required to functionally restore wellsites, to benefit caribou and other boreal wildlife species. In 2022, we installed 72 trail cameras at wellsites in and around the Redrock Prairie Creek and Narraway caribou ranges. The following year we will retrieve the data and analyze it.

This project was supported by Weyerhaeuser and the Forest Resource Improvement Association of Alberta and is being done in collaboration with the NAIT Boreal Research Institute.

Selected Publications

Predator-prey Co-occurrence in Harvest Blocks: Implications for Caribou and Forestry

Paper

By Tracy McKay and Dr. Laura Finnegan

DOI: 10.1111/csp2.12847

The Impact of Mountain Pine Beetle Outbreaks and their Treatment Methods on the Abundance of Plant-foods Important to Caribou and Grizzly Bears

Paper

By Cameron McClelland, Barry Nobert, Terrence Larsen, Dr. Karine E. Pigeon, and Dr. Laura Finnegan

DOI: 10.1016/j.foreco.2023.120841

Walking the Line: Investigating Biophysical Characteristics Related to Wildlife Use of Linear Features

Paper

By Erin Tattersall, Dr. Karine Pigeon, Doug MacNearney, and Dr. Laura Finnegan

DOI: 10.1002/2688-8319.12219

10 years of Caribou Conservation

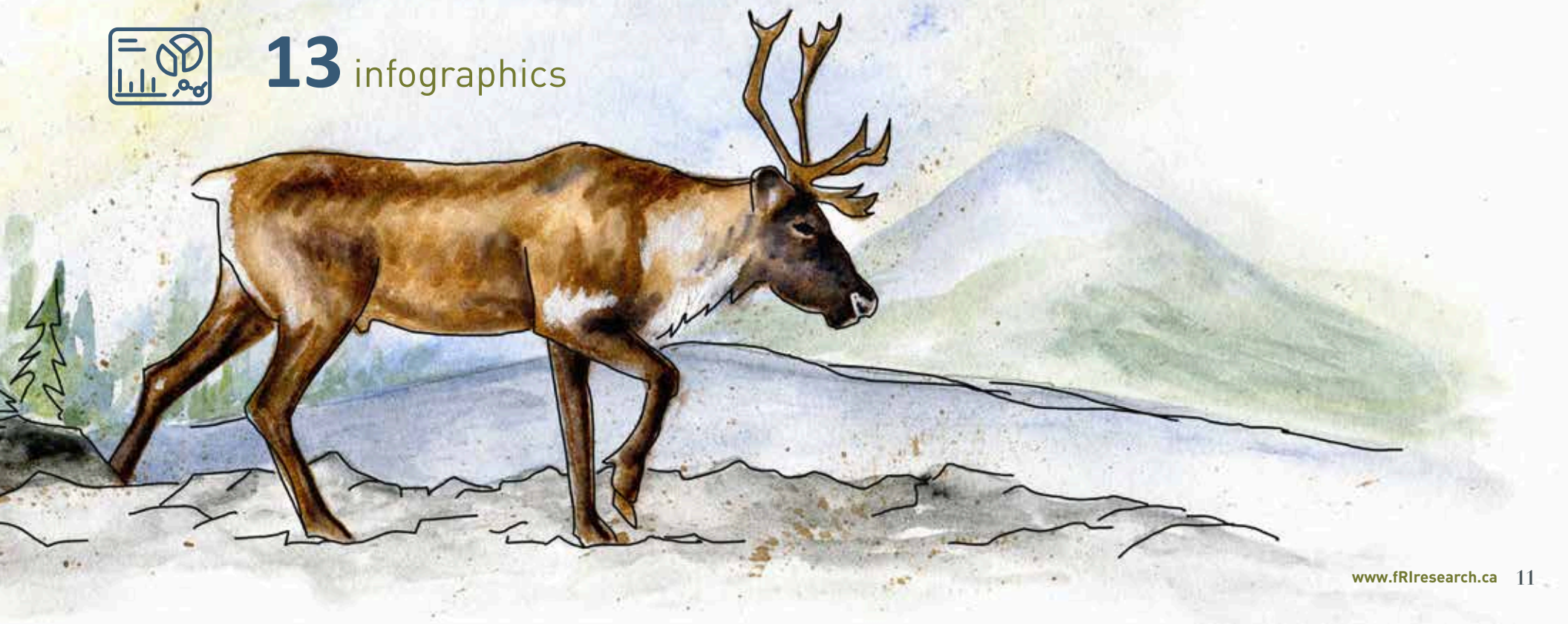
18 research projects

19 published papers

13 infographics

Key Questions Answered:

- Prioritized seismic lines for restoration to maximize benefit for caribou
- Which landscape features increase the risk of predation on caribou
- How mountain pine beetle is affecting caribou and caribou habitat
- Which forestry practices are relatively better for caribou
- How activity levels at oil and gas wells affect caribou
- How caribou predators are affected by linear features



Environmental Research Program

fRI Research prides itself on being responsive to our partners' needs. Our experience addressing practical land management issues with science and the relationships we have built with many different groups lets us quickly identify gaps in knowledge. This new program was launched in April 2022 to make us even more nimble and, where possible, proactive in bringing potential research projects to our partners.

Program Lead Gordon Stenhouse, one of our most experienced scientists and the former lead of the Grizzly Bear Program, meets with land managers and communities around the province to discover the emerging topics of interest and discuss ways that fRI Research might be able to deliver knowledge and tools that make an impact. This may result in a new project handled by one of our established research programs, a standalone project, or a whole new research program.

The program is guided by four principles designed to ensure that we:

1. Build upon previous investments in past and current research
2. Establish new partnerships, including local groups as appropriate
3. Strive to have strong indigenous involvement in project development, implementation, completion, and information dissemination
4. Focus on "operationalizing" results in the form of tools and applications for the end users

In 2022–2023, the Environmental Research Program already had one project underway and had secured generous support to fund another starting in April 2023.

Our experience addressing practical land management issues lets us quickly identify gaps in knowledge and knowledge mobilization.

The Marten Habitat Project

New

Martens are one of the most valuable animals still trapped in Alberta. The common description of American Martens (often called Pine Martens due to their similarity to their European cousins) says 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 do use other types of habitat. There is very little research specific to Alberta's boreal forest, especially outside the trapping season.

Local trappers and forest managers have joined forces for a new project. The Forest Resource Improvement Association of Alberta via Vanderwell Contractors (1971) is funding the work, and five local trappers in the Slave Lake region are collecting important new data to learn about annual habitat use by marten on their traplines. The management and handling of data from the project is being overseen by a local wildlife technician who is familiar with the study area and the data collection methods. Environmental Research Program Lead Gord Stenhouse helped the trappers and Vanderwell staff design the study and source the field equipment, and he provides ongoing advice. As data accumulates, he will also assist in data analysis and report preparation.

In December 2022, the trappers set up 90 trail cameras along five trap lines within the Vanderwell Forest Management Area. The trappers and Vanderwell are interested in learning which habitats and forest ages marten use in the non-trapping season, as well as how nearby forest harvesting can affect marten occupancy. Despite their small size and quick movement, the high-resolution cameras have already made many marten detections, as well as sightings of 10 other species of interest including moose, deer, wolves, fishers, and lynx. The project will run for three years.

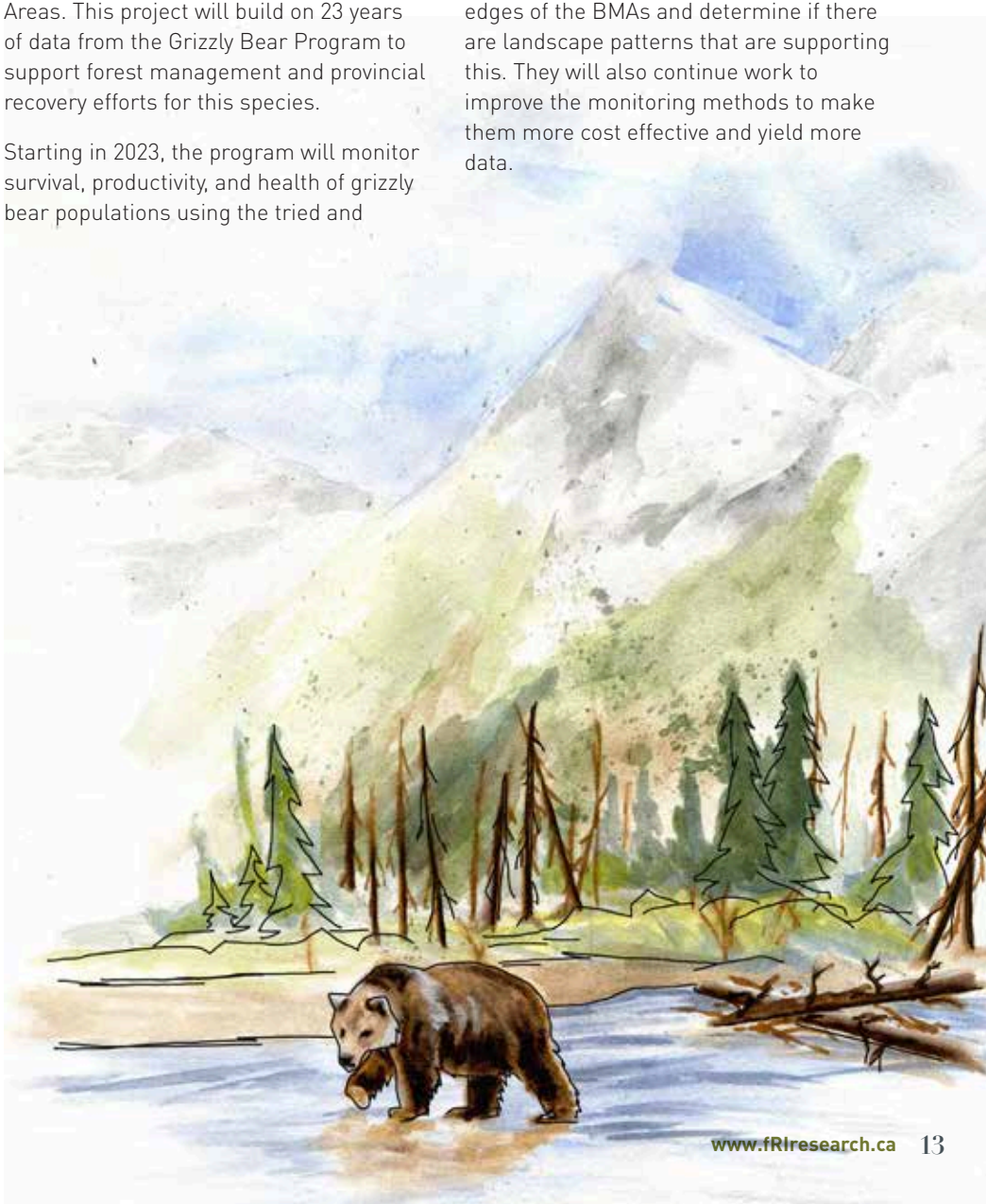
"Science doesn't always do a good job of listening to the local knowledge that is out there," says Stenhouse. "This project is exciting because not only are we bringing together foresters and trappers, but we're enabling these groups to answer a question that matters to their communities."

Grizzly Bear Monitoring Project

New

Previous research conducted by the Grizzly Bear Program and other groups have given encouraging signs about population numbers in some Bear Management Areas. This project will build on 23 years of data from the Grizzly Bear Program to support forest management and provincial recovery efforts for this species.

Starting in 2023, the program will monitor survival, productivity, and health of grizzly bear populations using the tried and tested method of collecting hair for genetic sampling. The project will also investigate questions such as if and where there is a possible range expansion at the eastern edges of the BMAs and determine if there are landscape patterns that are supporting this. They will also continue work to improve the monitoring methods to make them more cost effective and yield more data.



Grizzly Bear Program

24 years ago, the Grizzly Bear Program was launched to help answer practical questions about how humans and bears can co-exist on a working landscape. Since then, the program has helped train over 50 graduate students, published hundreds of papers, and pioneered new scientific methods in conservation biology.

This research made an impact. We were among the first groups to conduct scientific population inventories, and shortly after we completed our first population estimates, the provincial government ended licensed hunting. In 2010, following the surveys of most bear management areas, the province listed grizzly bears as a threatened species.

Our work on the effects of different human activities, such as forestry, oil and gas development, and recreation, has helped industry and government modify their practices to benefit bear habitat. In particular, our research on the connection between road density and grizzly bear mortality supported regulations on road density thresholds in grizzly bear recovery zones.

These are just some examples of how the Grizzly Bear Program's science has directly contributed to their long-term conservation in Alberta.

Our work on the effects of different human activities, such as forestry, oil and gas development, and recreation, has helped industry and government modify their practices to benefit bear habitat.

Since 2021, the program has been hibernating – not taking on new projects but maintaining our long-term database to make sure this invaluable trove of grizzly bear habitat, behaviour, genetic, and health data is available for scientists in governments and universities. This includes a searchable digital database as well as our physical repository of biological samples, which will enable scientists to answer questions long into the future.

The Grizzly Bear Program and GIS Services continues to update the GBTools and other products for partners. This suite of tools allows industry and government to simulate scenarios such as new roads or habitat restoration so they can understand how their activities will impact grizzly bear food supply and mortality risk.

Our collaboration with the University of Victoria-Genome BC Proteomics Centre, the Government of the Yukon, and the Government of Northwest Territories is making progress. The goal is to improve methods for extracting and interpreting hormone levels in grizzly bear hair to the point that we can learn about their health without needing invasive techniques.

We are also continuing to publish and share our research. We collaborated with a group at the University of Victoria on a paper about improving bear translocation success, and Dr. Abbey Wilson presented her proteomics work at both the Canadian Chapter of the Wildlife Society and the Polish Academy. Closer to home, West Fraser and Weyerhaeuser wanted advice on how they can minimize the risk of disturbing a denning grizzly bear during their winter operations. We synthesized Dr. Karine Pigeon's thesis and several papers into a report and brochure, and presented to their staff practical steps to take to keep people and bears safe during this sensitive time.

Selected Publications

Grizzly Bear Denning Ecology in West-Central Alberta

Report

By Karen Graham and Gordon Stenhouse

Evaluating the Role of Environmental Familiarity and Behaviour in the Success of Wildlife Translocation: A Grizzly Bear Case Study Using Agent-based Modelling

Paper

By Dr. Alejandra Zubiria Perez, Dr. Christopher Bone, Gordon Stenhouse

Healthy Landscapes Program

Since the 90s, Dr. David Andison has been focused on the big picture. Andison is interested in how the Canadian boreal forest varies in time and space, evolves, and, through wildfire, is renewed. His work shows just how far the post-industrial landscape is outside its natural range of variation. As the science progressed, policy makers and industry practitioners began to recognize the ecological benefits of using natural disturbance as a template for land management.

But to really take nature as a guide, the current way of managing the landscape will have to become more holistic. Managing individual issues in isolation leads to unintended cumulative effects. The alternative, ecosystem-based management, starts by defining the landscape we want to end up with, and using development, restoration, and fire as tools to get there. The program is increasingly focused on developing this kind of ecosystem-based management, and in 2022–2023, has a diverse slate of projects tackling this challenge.

The Healthy Landscapes Program has always worked with many academic disciplines, jurisdictions, and groups with diverse perspectives. With the addition of Dr. Vilbert Vabi to the team, the program has been able to build many new partnerships, in particular with Indigenous communities who are increasingly contributing their traditional ecological knowledge and values to research on ecosystem-based management. In order not to make the same mistakes as old land management paradigms, it's essential that the ecosystem-based management journey happen with full Indigenous participation.

ecosystem-based management starts by defining the landscape we want to end up with, and using development, restoration, and fire as tools to get there.

Benefits of Disturbance

New

The concept of treating fires, forest harvesting, and other industrial activities as tools for returning the landscape to its natural range of variation has been championed by many subject matter specialists. But a change from the status quo needs much broader buy-in from affected communities and the general public. Also, they are likely to have important perspectives that are not fully appreciated by experts.

To understand how non-experts view the different types of disturbance in order to focus future research and communication, Andison and a socio-economic team at the University of Alberta are working to perform an in-depth survey of Albertans. Design of the survey and ethics approval are underway.

Beyond the Trees

New

After a fire, berries and other medicinal plants important to Indigenous cultures 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 local forest companies to explore alternative harvesting techniques that could allow these plants to come back.

There will be field tours in Alberta and Saskatchewan, and groups in British Columbia, Manitoba, and Ontario have also expressed interest.

Ecosystem-based Management Tips and Techniques

New

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 and guidance 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.

Socioeconomics of Ecosystem-based Management

New

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 are using 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 will light up the path ahead so we can start working on solutions to potential pitfalls and develop critical partnerships for the journey.

We will identify the most critical socioeconomic aspects of ecosystem-based management

Comparing Fire and Harvest Patterns

Active

This is a research project building on more than 20 years of Healthy Landscapes Program research and GIS tools that aim 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 natural perimeter 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.

Exploring Aggregated Harvest in Woodland Caribou Ranges

Active

The Healthy Landscapes Program has teamed up with the Alberta Regional Caribou Knowledge Partnership to test whether aggregating forest harvests can benefit caribou habitat compared to business as usual. The project, which is conceptually related to the previous project, will also look at trade-offs with other ecological and socio-economic values. Finally, the team will investigate practical ways that aggregated harvesting can be part of forest planning. This project will use the Patchworks model on three areas in Alberta and one in Saskatchewan.

Next Steps with 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.

A user group of forest companies, the Government of Alberta, and the model's developers are working to make the model more useful and the outputs more reliable. The primary goals are to improve how it simulates fire spread and standardize the inputs and versions when used for forest management plans.

One of the essential tools GIS Services built for partners is GBTools, a suite of GIS applications that allow our partners to run scenarios such as new roads or restored habitat, and see the effects on grizzly bear food supply and mortality risk.

GIS Services

When our scientists publish results, they are supported by a small but mighty team. GIS Services gives fRI Research the capacity to take on complex land management questions, deliver accurate answers, and provide our partners with useful decision support tools. Led by Julie Duval, GIS Services is deeply integrated into our research efforts with a role at every step from project design to communicating the results.

A few examples: they ensure we have up-to-date GIS layers, design and manage databases, code automations to improve workflows, make maps for field crews, and build interactive web applications to share results. But because of their expertise in programming and data management, GIS Services also supports many of the core functions of fRI Research as a whole. Some roles Duval plays include leading our cybersecurity efforts, building and maintaining our administrative databases, and overseeing the whole organization's IT systems.

A handy tool that GIS Analyst Tanya Muswera built for our researchers makes use of a Canadian, Indigenous-led project called Native Land Digital. Our tool uses this online resource to identify how our study areas overlap with traditional Indigenous territories. It's important for us to educate ourselves, properly acknowledge this history, and we hope that it will also help us identify opportunities for Indigenous partnerships in the future.

One of the essential tools GIS Services built for partners is GBTools, a suite of GIS applications that allow our partners to run scenarios such as new roads or restored habitat, and see the effects on grizzly bear food supply and mortality risk. A big focus for 2022–2023 has been transforming the tool from the legacy GIS application ArcGIS Desktop to the modern ArcGIS Pro, ensuring that the tools continue to function well and can take advantage of new features. It's a big project, however. The syntax in the custom code needed to be updated, and it had to be adapted to the new user interfaces in ArcGIS Pro. Duval also supported our programs in transitioning to ArcGIS Pro with training and a remote workshop.

The GIS team also makes use of modern communication tools. As well as routinely making beautiful maps and other data visualization products, this year Duval created three StoryMaps. These are webpages that weave together data dashboards, interactive maps, photos, videos, and text. The first StoryMap gives a high-level overview of the Grizzly Bear Program's work over the past 25 years. The others were created for two FGrOW projects. This last component means that GIS Services gives us and our partners great tools every step of the way from study design to communicating results.

Mountain Pine Beetle Ecology Program

In the early 2000s, 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 2022–2023, 22 projects were underway.

In the 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.

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

Led by Dr. Rob Friberg

New

The purpose of this project is to assist First Nations and rural communities with developing road maps that support their resilience in the face of changes driven by pine beetle and 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 opportunities and gaps in knowledge and needs. This will set up phase two, which will continue to collaborate with communities to create an approach and identify actions for greater resilience.

Secondary bark and woodboring beetle species frequently attack dying and dead trees, but rarely attack healthy ones.

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

Led by Dr. Nadir Erbilgin, University of Alberta

New

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 will investigate how lodgepole pine mortality affects the abundance of three groups associated with MPB: bark beetles, woodboring beetles, and their predators in Alberta.

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

New

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 will quantify the hydrological response in parts of the McLeod watershed, a region that has seen extensive mountain pine beetle infestation.

Adam Sprot

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 Long-term Dynamics of MPB in Alberta Under Climate Change

Led by Dr. Mark Lewis, University of Victoria

New

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 and applies 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.

Forest stands in western Canada are subject to both mountain pine beetle and climate change

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

Led by Dr. Laura Chasmer, University of Lethbridge

New

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 will collect 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 will be able to test different management strategies such as stand thinning and removing fine woody debris.

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

New

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 will classify and georeference 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 chifts.

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

Led by Dr. Laura Finnegan, fRI Research

New

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. The goals of this project are to provide 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 mangers to mitigate the potential impact of MPB on ecological and economic values.

The University of Victoria's Mountain Legacy Project has digitized over 100,000 historical mountain photographs, many from over a century ago

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 will test whether flight changes the physical response of antennae to those chemicals and whether flight changes the MPB behavioural response to those chemicals. They will also use 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 effects 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

This project will create 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.

Dynamic Species Distribution Modelling to Predict MPB Boreal Invasion

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

Active

Detecting and acting early when MPB 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 MPB.

Dr. Carroll's team will develop both types of models based on data from vegetation inventories, remote sensing, climate, and previous dispersal models. These will project MPB distribution into the future, for Alberta and the rest of the western boreal and the models will be validated by data from MPB monitoring in Alberta and Saskatchewan. These models will predict where MPB currently occurs, and where there is a high risk of spread so that managers can better target their control efforts.

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

Led by Dr. Erbilgin, University of Alberta

Active

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 MPB 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 will develop an algorithm 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

Active

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.

This project will collect seeds from the northern whitebark pine range. At the same time, the Whitebark Pine Ecosystem Foundation of Canada will collect data on cone crop abundance and seed variability. This will allow the team to correlate the timing and abundance of seeds in these areas with stands in other areas, which can act as an indicator for 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

Active

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

Once verified, the researchers will create 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.

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 will look at stands that were attacked by MPB and subsequently burned by wildfire. It will relate the attack stage with the burn severity. This will be done for both mean burn severity of a fire, and for how MPB-kill affects severity within fires.

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.

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

Active

When MPB 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 province 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 will test out the compounds that trees release when stressed, and compounds released by fungal species that infect MPB-attacked trees.

This project will find new chemicals, test them in the field, and use the results 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 extirpations.

Modelling Eastern Spread Risk of MPB Using Host Genetic Ancestry

Led by Dr. Catherine Cullingham, Carleton University

Active

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

This project uses landscape genetics, creating predictive maps of the 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.

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 MPB, 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 will find out 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.

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 these to explore how the local environment, time since attack, and attack severity affect the stand structure and fuel connectivity.

During epidemics, MPB can mass attack healthy pines, but during endemic phases, the low-density populations are limited to attacking weak or dead trees.

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.

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

Led by Dr. Justine Karst, University of Alberta

Active

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 large effect on the complex carbon balance of forest soil.

This project compares the soil carbon stocks in undisturbed and MPB-attacked lodgepole pine stands. This will help 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

Active

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 will develop a model that predicts where endemic populations are persisting, by using stand density – more dense stands tend to have more suppressed, low-vigor trees. The researchers will ground-truth the model to see if it is correctly predicting stand structure, endemic suitability, and the actual presence of endemic populations.

If this works, the team will use LANDSAT-derived data to model the rest of the boreal.

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

MPB 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 will use 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 will allow the university and Parks researchers to quantify land cover changes over more than a century.

Water and Fish Program

In the previous fiscal year, the program partners supported the expansion of the Water Program's mission to include work on Alberta's fish species of special concern such as native trout and grayling. In 2022–2023, the relaunched Water and Fish Program took time to build a solid foundation, consulting deeply with longtime partners and reaching out to new groups whose perspectives can contribute to the program's success.

The program is guided by an activity team composed of representatives from the forest and energy industries, provincial and federal governments, academics from across Canada, grassroots groups such as watershed councils, environmental NGOs, and First Nations. These groups contribute to the program in different ways, but all provide their unique perspective on the issues facing Alberta's rivers and fish species of special concern.

As part of this process, the Water and Fish Program teamed up with the Government of Alberta's Office of the Chief Scientist to host a meeting at the University of Calgary's Barrier Lake Research Center in Kananaskis. A large group of native trout experts both from Alberta as well as south of the border gathered at the research station for three days packed with presentations and discussions about all aspects of trout science.

The goal was to get a broad awareness of what is and is not known about critical topics in trout monitoring and recovery such as disease, angling, climate impacts, invasive species, and cumulative effects. After the sessions, freewheeling discussions went for hours into the night and resulted in the development of new working groups. The event helped unite the partners around a common vision for what the Water and Fish Program.

The result is a suite of project proposals that were submitted to partners for review. These projects, ranging from stream temperature monitoring to remote sensing to trout population surveys to knowledge transfer initiatives were designed to respond to the specific needs of regulators and those using the landscape. As the needs on the landscape evolve, we will be able to quickly respond thanks to the groundwork of building relationships with such a broad cross-section of experts.

Associations

In 2022–2023, 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 new this year,**
- **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.

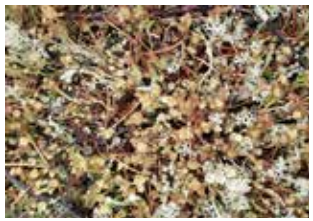
Alberta Regional Caribou Knowledge Partnership

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 research fund administered by the ARCKP, a collaboration between the forestry sector and the Government of Alberta.

The ARCKP has a two-part mission: fund essential caribou research and share tools and strategies for caribou conservation. On the knowledge sharing side, the association creates infographics and summaries of research in a regular publication called The Exchange, hosts webinars presenting important recent findings relevant to concerned stakeholders, and for those that want all the details, full scientific reports for all ARCKP projects.

The ARCKP has funded a suite of projects, five of which have already delivered reports. In 2022–2023, 6 projects were completed, launched, or continued to progress. These projects all address immediate and practical knowledge gaps related to woodland caribou ecology and forestry practices, and seek to inform policy and practices for improved habitat outcomes for woodland caribou.

Alberta's woodland caribou herds are classified as a threatened species.



The Application of Quantitative Metrics in Forest Management and Caribou Recovery: A Jurisdictional Scan of Quantitative Approaches to Classifying 'Undisturbed' Caribou Habitat

New

EcoLogic Research will start by determining what metrics other jurisdictions are using to show that they meet federal requirements for undisturbed caribou habitat. Some potential criteria include stand data, population variability, and timelines. The team will then do a literature review to understand how the criteria identified are related to caribou conservation and ecology. They will also explore related ecological processes important to positive caribou outcomes. The goal is to help identify and refine activities that can contribute to caribou conservation.

Reducing the Effects of Nonpermanent Forestry Roads on Woodland Caribou in Alberta

New

The goal of this project is to better understand what potential effect temporary roads are having on caribou so that better ways to plan, build, and reclaim them can be devised. There are two aspects to this research: looking at the ecological processes involved in caribou recovery in order to identify potential best practices in road management, and tailor these practices to different harvesting approaches with the goal of faster restoration of temporary forestry roads.

Exploring the Implementation of Aggregated Harvest in Woodland Caribou Ranges Compared to Current and Other Potential Harvesting Approaches

Completed

By harvesting fewer but larger patches of forest, it could be possible to maintain more undisturbed habitat for woodland caribou. In this project, FORCORP modeled many harvesting scenarios to understand the costs and benefits of this approach. Scenarios ranged from small patches to very large patches, and were tested in the northeast, northwest, and west-central regions of Alberta. They found that larger patches did disturb less caribou habitat, however it resulted in lower harvest volume.

Evaluation of the Feasibility of Terrestrial Lichen Seeding and/or Transplantations

Active

Lichen is a key winter caribou food typically found in old growth forest, and can take up to 100 years to recover after disturbance. Scientists from NAIT first finished a literature review synthesizing lichen transplantation and seeding, and a discussion on how possible and practical this might be. The authors found that there are many difficulties and unknowns, but that transplants can establish lichen growth.

Reconciling Pre-industrial Patterns, Caribou Habitat and Management Reality

Active

A Healthy Landscapes Program project is also exploring aggregated harvest, but through the lens of each area's natural range of variation (NRV) before industry and fire suppression altered the landscape. The goal is to understand how, and to what degree, clustering harvesting disturbance is possible on the landscape, and how it might vary under different conditions and policy scenarios. It also seeks to understand if NRV aligns with proposed aggregating harvesting patterns to improve woodland caribou habitat outcomes, and what the potential trade-offs are for other values of interest.

Study to Advance Harvest System and Silviculture Practices for Improved Woodland Caribou and Fibre Outcomes

Active

This project by the Caribou Program visited hundreds of cutblocks to relate stand characteristics with wildlife use. The goal is to understand which forestry practices are more effective at sustaining caribou or increase the likelihood of harvested areas becoming woodland caribou habitat. The team is analyzing data from the field work and has delivered a literature review on the topic.

Three Caribou Conservation Initiatives

The Caribou Program is an fRI Research run program that studies woodland caribou behaviour, habitat, health, and interactions with other wildlife.

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 11

The caribou herds in the Aseniwuche Winewak Nation's traditional territory are at risk. A century of industrial development has fragmented the boreal forest in western Alberta, constituting a long-term threat to these herds. Elders noticed the declining caribou population and voluntarily stopped hunting them nearly 50 years ago.

Then in the 90's, a more immediate danger to the A La Peche herd came into focus. Dozens of caribou were killed by vehicles on Highway 40, just south of the AWN's community around Grande Cache. This herd has to cross the highway twice per year on their annual migrations.

To prevent more needless deaths, the Nation started the Caribou Patrol Program in 2012. As the name suggests, crews drive the highway during migration season. When they see caribou near the road, they use stockmanship techniques to either help the caribou safely cross, or, if the location is too risky, drive the animals back from danger. These low stress techniques work to some extent on all herding animals.

Since it began, the Patrol has reduced total mortalities to just seven over the past 11 seasons. It wasn't easy. Crews have wracked up nearly 1,600 person-days of patrolling during migration seasons. Over that time, they have taken action to avert over 500 potential accidents involving more than 1,000 caribou.

The caribou herds in the Aseniwuche Winewak Nation's traditional territory are at risk. A century of industrial development has fragmented the boreal forest in western Alberta, constituting a long-term threat to these herds.

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.

Caribou Patrol

The Caribou Patrol works with Alberta Transportation to add signs on the highway and symbols on Alberta511. In May 2022, it wasn't enough. Two caribou were struck and killed on Highway 40. The team began searching for new ideas, commissioning a feasibility study to look at additional lights, speed limit changes, and new technologies such as a "virtual fence." The report was completed by Golder (now WSP) and the Patrol is working with fRI Research programs on a potential pilot project.

The program also has a big focus on education. They have developed and distributed educational material to students and the public; given formal presentations to over 2,000 students, industry employees, and the public; and had conversations with nearly 10,000 people about caribou at events such as the Edmonton Deep Freeze Festival and Jasper in January.

In September 2022, the Program took an opportunity to do some hands-on outreach with a local community school. Many partners pitched in to create a unique and fully-funded educational experience for students at Susa Creek School. The first day, the kids met with Caribou Program biologists, Caribou Patrol staff, and Calgary Zoo staff to collect lichen for the zoo's caribou. Weyerhaeuser helped select accessible sites with plenty of lichen, in areas that would soon be harvested and are outside caribou ranges, so the activity did not affect habitat. Then, with generous funding from Imperial Oil, the kids and chaperones bused down to Calgary to deliver the lichen and meet the caribou at the zoo's Wilder Institute.

The students, from grades one through nine, learned about caribou conservation and their habitat from several perspectives – our biologists, the zoo, and the AWN community. But the benefits go beyond just informing them about ecology. This was also about giving a community school more educational opportunities, and re-establishing links between the Nation, the land, and caribou.

Saving caribou is a long-term project. What the next generation does will be just as important as the Caribou Patrol's activities now.

Caribou Patrol

Caribou Patrol

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 individual Foothills Pine Project Team, Mixedwood Project Team, Policy and Practice Project Team, and the Western Boreal Growth and Yield Association have become 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 2022–2023 FGrOW had 14 active or completed projects.

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.

Enhanced Forest Management

New

This project addresses an increasing interest in density management in Alberta, with a focus on commercial thinning. These techniques have been more widely studied in other regions, so the first step was a literature review to learn from their experiences and help to design studies in Alberta to get local data with local species. This review was completed, and in 2022, Vanderwell Contractors (1971) cut 30%, 50%, and 0% (control) plots in 25–40 year old stands. This was the first of 10 installations planned around the province to build a commercial thinning research network.

In parallel, the team used data from the Provincial Growth and Yield Initiative to develop first approximations of stand density diagrams and guidelines, and on-the-ground tools for marking and thinning trees. These will allow foresters to include commercial and pre-commercial thinning in their crop plans.

Enhanced Forest Management Prediction

New

With both the Growth and Yield Projection System and Mixedwood Growth Model approved for use in Alberta, the question is: which one should forest planners use? This project will compare the models' performance in different settings to evaluate their ability to be used as planning tools and make recommendations as to which parts of the province, what stand history, and for which species one model might be better suited than the other. It will also inform improvements to the models in the future.

With both the Growth and Yield Projection System and Mixedwood Growth Model approved for use in Alberta, the question is: which one should forest planners use?

Development of a 64-bit Version of the Growth and Yield Projection System

Complete

The Province of Alberta's Growth and Yield Projection System currently runs on a 32-bit operating system. However, many organizations are now running modern 64-bit Windows operating systems. This project developed a Dynamic Link Library that will work with the projection system on both 64- and 32-bit systems.

Empirical Post-harvest Stand Assessment

Complete

Phase one of this study ran until 2013 and included data from as far back as the 1980s. The project has now also completed its second phase, where it followed stand development post-harvest. Specifically, it evaluated stand performance against expectations, and the relationship with planting density and site treatments.

Excel Toolbox for Foresters

Complete

FGrOW supported the development of a set of tools in Microsoft Excel. This provides easy access to useful models and equations and helps standardize and simplify certain planning and analysis functions in a forester's job. With delivery of the tools, a user guide, and a training webinar, this project is now complete.

Quantification of Herbicide Impacts on Timber and Non-timber Values

Complete

This project returned to harvest blocks treated with glyphosate in the 1990s. An earlier study had documented the effects in the first decade after treatment. By measuring plant communities 25 to 40 years after harvest, on treated and non-treated areas, researchers quantified the long-term impacts on biodiversity. The final measurements were taken in 2022 and the results were delivered in a webinar that spring and a paper in the fall. This follows on a field tour and other publications the previous year.

Cooperative Management of Historic Research Trials

Active

FGrOW members are pitching in with the Canadian Forest Service and the Province of Alberta to maintain and measure a series of historic lodgepole pine research trials. Some of the sites in this study were established in the 1950s and had been regularly measured for decades. This broad coalition will ensure that these irreplaceable trials will continue to produce knowledge of forest growth, yield, silviculture, and fibre qualities.

FGrOW members are pitching in with the Canadian Forest Service and the Province of Alberta and to maintain and measure a series of historic lodgepole pine research trials.

Long-term Study

Active

This study has several installations across western Canada established around 25 years ago. It is testing thinning in mixedwood aspen and white spruce stands in order to provide data for model development such as the Mixedwood Growth Model and is now also measuring impacts of climate change.

Measurement of the Mountain Pine Beetle Permanent Sample Plot Network

Active

After mountain pine beetle came to Alberta, and seeing what it had done in British Columbia, member companies decided to follow stand development on 236 permanent sample plots affected with low to high levels of beetle attack.

The members return regularly to quantify how these stands develop, including how the level of competing vegetation affects regeneration.

Measurements of all permanent sample plots have now been completed, and a University of Alberta group is collecting additional data using aerial and terrestrial lidar. The project is estimated to wrap up in 2025, and when complete, will also include an evaluation of the applicability and cost effectiveness of these additional methods.

Mixedwood Growth Model

Active

This model was created by the University of Alberta for pure or mixed stands of white spruce, lodgepole pine, trembling aspen, black spruce, and jack pine. Because it is an individual-tree model, it can handle both simple, even-aged stands as well as multi-age, multispecies stands such as those created by partial harvesting. FGrOW supported the latest update and documentation of the software, which was completed, and the model approved by the Government of Alberta in 2021. Some work continues to train users and create a new database that will allow the model to accept climate inputs.

Provincial Growth and Yield Initiative

Active

This is a collaborative data collection and management program. By pooling almost all Alberta permanent sample plot measurements, the industry has created a unique long-term dataset. Observations span thousands of locations, some going back to the 1960s. This allows FGrOW members to better develop, calibrate, and validate growth models for forest management.

Realized Gain Trials

Active

FGrOW members have spent decades selectively breeding trees to produce seeds that should grow better in Alberta. But until these seedlings are tested in real-world conditions, it is difficult to quantify the level of actual improvement. These trials follow stands of improved trees across over 150 locations comparing improved seed to wild sources. The measurements for the first 5-year cycle are currently underway.

Regenerated Lodgepole Pine Trial

Active

This project monitors how lodgepole pine stands develop in western Alberta with a network of over 100 locations. It has and will continue to give results on common treatments such as the impacts of herbicide, pre-commercial thinning, planting density, and their interactions. Despite the study's name, the stands have now outgrown the regeneration phase and the researchers have published papers, reports, manuals, and guides for this phase of the project. It now enters longterm monitoring.

The Foothills Reforestation Interactive Planning System, better known as FRIPSy, was developed using data from this study. This tool predicts stand development and links with the provincial Growth and Yield Projection System to forecast growth and yield.

FGrOW members have spent decades selectively breeding trees to produce seeds that should grow better in Alberta.

Strip Cut Understory Protection Trial

Active

Strip cut understory protection harvest is the removal of overstory aspen so that the spruce underneath can grow faster. This trial is designed to provide data on the effects of this treatment and fill an important information gap in growth and yield projection of aspen-dominated stands.

Foothills Stream Crossing Partnership

There are over 50,000 bridges, culverts, and fords where roads cross waterways in Alberta. Many of these crossings are owned by forestry and energy companies who use them to operate on the landscape. As the years and decades go by, these structures must be maintained so they don't become a source of sedimentation or block fish passage.

In 2005, a group of stream crossing owners and government agencies came together to create a plan to address this issue. The Foothills Stream Crossing Partnership developed an inspection protocol to catch problems with crossings and prioritize them for remediation. It created a tablet application and online database for companies to store and manage their crossing data, and it allowed the owners to work together on crossing fixes to restore critical freshwater habitat as efficiently as possible.

In its first 18 years, members have completed over 13,000 inspections, fixed 663 that were barriers to fish passage, and reconnected a total of 1,674 kilometers of upstream habitat to fish species of special concern, such as bull trout.

There are over 50,000 bridges, culverts, and fords where roads cross waterways in Alberta.

When the Foothills Stream Crossing Partnership first began its work, they knew the scale of the problem was enormous. Instead of being daunted, the group has built an effective program that grew to meet the challenge.

FSCP

FSCP

This growing success means that most members have inspected a large proportion of their crossings, scheduled re-inspections, prioritized maintenance, and completed high priority projects. For many members, the only crossings that they haven't been able to inspect are on temporary winter roads. However, since these are extremely remote and a stream's health can only be determined when it is thawed, the only way to access them is by helicopter. This year, two members completed hundreds of flying inspections, which use a necessarily simplified protocol that can identify the most important things, such as missing crossing structures, disconnected channels, obvious erosion, whether the site is stable, and if the stream could potentially be fish habitat.

When the Foothills Stream Crossing Partnership first began its work, they knew the scale of the problem was enormous. Instead of being daunted, the group has built an effective program that grew to meet the challenge. While never finished, it's worth celebrating the tremendous amount of fish habitat this partnership has already restored, one crossing at a time.

Advisory, Support, and Collaborative Partners

- Alberta Environment and Parks
- Alberta Energy Regulator
- Fisheries and Oceans Canada
- Alberta Conservation Association
- Trout Unlimited
- Aseniwuche Development Corporation
- Swan River First Nation
- Lac Ste. Anne Métis
- Albert Backcountry Hunters and Anglers Association

2022–2023 FSCP Membership

1. Arc Reources
2. Athabasca Oil Corp
3. Baytex Energy
4. Canfor
5. Cardinal Energy
6. Canlin
7. Chevron
8. Cenovus
9. Hammerhead Resources
10. Keyera
11. NuVista Energy
12. Outlier Resources
13. Paramount
14. Petrus
15. Peyto
16. Pieridae Energy
17. Repsol
18. Shell Canada
19. Spartan Delta - 2022
20. Strathcona
21. HWN Energy (Tangle Creek)
22. Taqa
23. Tidewater Midstream
24. West Fraser Mills:
    - Slave Lake Pulp
    - Blue Ridge
    - Hinton Wood Products
25. Weyerhaeuser

SERG International

The latest independent association to find a home with fRI Research is SERG-International. SERG-I is North America's leading 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

As an association of fRI Research, SERG-I receives administrative support, but its mandate and operations remain entirely independent. It 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 2022–2023, SERG International had 25 active research projects, listed below. For more detailed information, please visit serginternational.org.

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

Led by Dr. Joe Bowden, NRCan – AFC

New

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

Led by Dr. Sandrine Picq, NRCan – LFC

New

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

Led by Dr. Annie Deslauriers, UQAC

New

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

Led by Dr. Kathy Bleiker, NRCan – PFC

New

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

Led by Dr. Véronique Martel, NRCan – LFC

Active

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

Led by Dr. Mark Vanderwel, University of Regina

Active

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

Led by Dr. Leah Flaherty, MacEwan University

Active

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

Led by Dr. Amanda Roe, NRCan – GLFC

Active

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

Led by Dr. Richard Berthiaume, SOPFIM

Active

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

Led by Dr. Lucas Roscoe, NRCan – AFC

Active

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

Led by Dr. Jon Sweeney, NRCan – AFC

Active

Enhancing the efficacy of Btk against Spruce Budworm with RNA interference

Led by Dr. Christopher I. Keeling, NRCan – LFC

Active

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)

Led by David Dutkiewicz, Invasive Species Centre

Active

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

Led by Dr. Deepa Pureswaran, NRCan – AFC

Active

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

Led by Dr. Sharon Reed, OMNR

Active

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

Led by Dr. Nadir Erbilgin, University of Alberta

Active

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

Led by Dr. Peter Mayo, NRCan – AFC

Active

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

Led by Dr. Jon Sweeney, NRCan – AFC

Active

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

Led by Dr. Devin Goodsman, NRCan – NFC

Active

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

Led by Dr. Deepa Pureswaran, NRCan – AFC

Active

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

Led by Dr. Jeremy Allison, NRCan – GLFC

Active

Outbreak potential of Spruce Beetle: dormancy and winter survival

Led by Dr. Katherine Bleiker, NRCan – PFC

Active

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

Led by Dr. Eric Moise, NRCan – AFC

Active

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

Led by Dr. Chris J. K. MacQuarrie, NRCan – GLFC

Active

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

Led by Dr. Christian Hébert, NRCan – LFC

Active

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Informing Land & Resource Management