fRI Research
Informing Land & Resource Management

ANNUAL REPORT

2024-2025

The fRI Research office is on Treaty 6 territory, specifically, the traditional lands of the Anishnaabeg, Aseniwuche Winewak, Cree, Métis, Stoney, and Tsuu T'ina Nations. We also wish to gratefully acknowledge that in carrying out our research, we live, learn and work in the ancestral territories of many First Nations, Inuit, and Métis peoples.

fRI Research

answers scientific questions to support better land management. For over 30 years, we have been 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. In this annual report, you'll find 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 science can lead to better outcomes for species at risk and the land and water we all rely on.

Written and edited by
Ben Williamson and Fran Hanington
Design by Penny Snell

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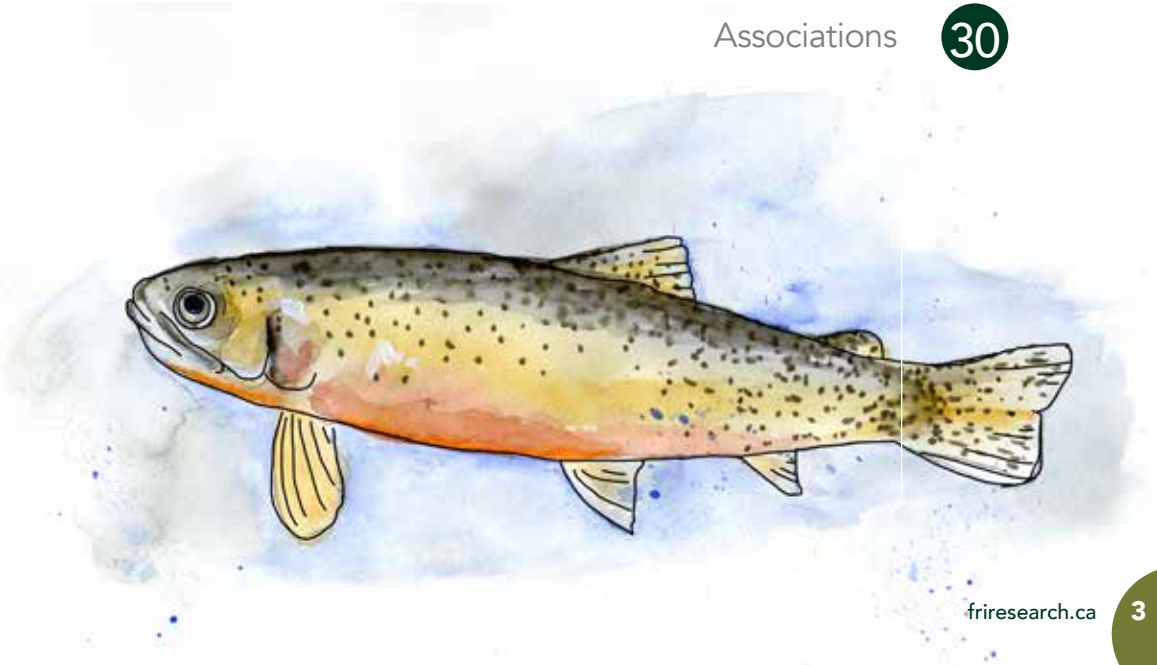


PRESIDENT'S MESSAGE
Rick Blackwood

I am very happy to say that my return in the role of President in 2024 has shown me that the spirit of collaboration and innovation is still very much alive within fRI Research after over 30 years of ongoing work with shareholders and partners.

To help guide us into the future, a new strategic plan was developed and approved by the Board of Directors and work is now underway to implement that strategy. In addition to the new strategy, our program leads and staff have worked hard to continue to identify key questions that our shareholders and partners need addressed to further advance the state of sustainable forest and resource management policy or practice. It has been very rewarding to see how many of our research programs have contributed to those advancements and I have every confidence that the work of fRI Research will continue to move the dial.

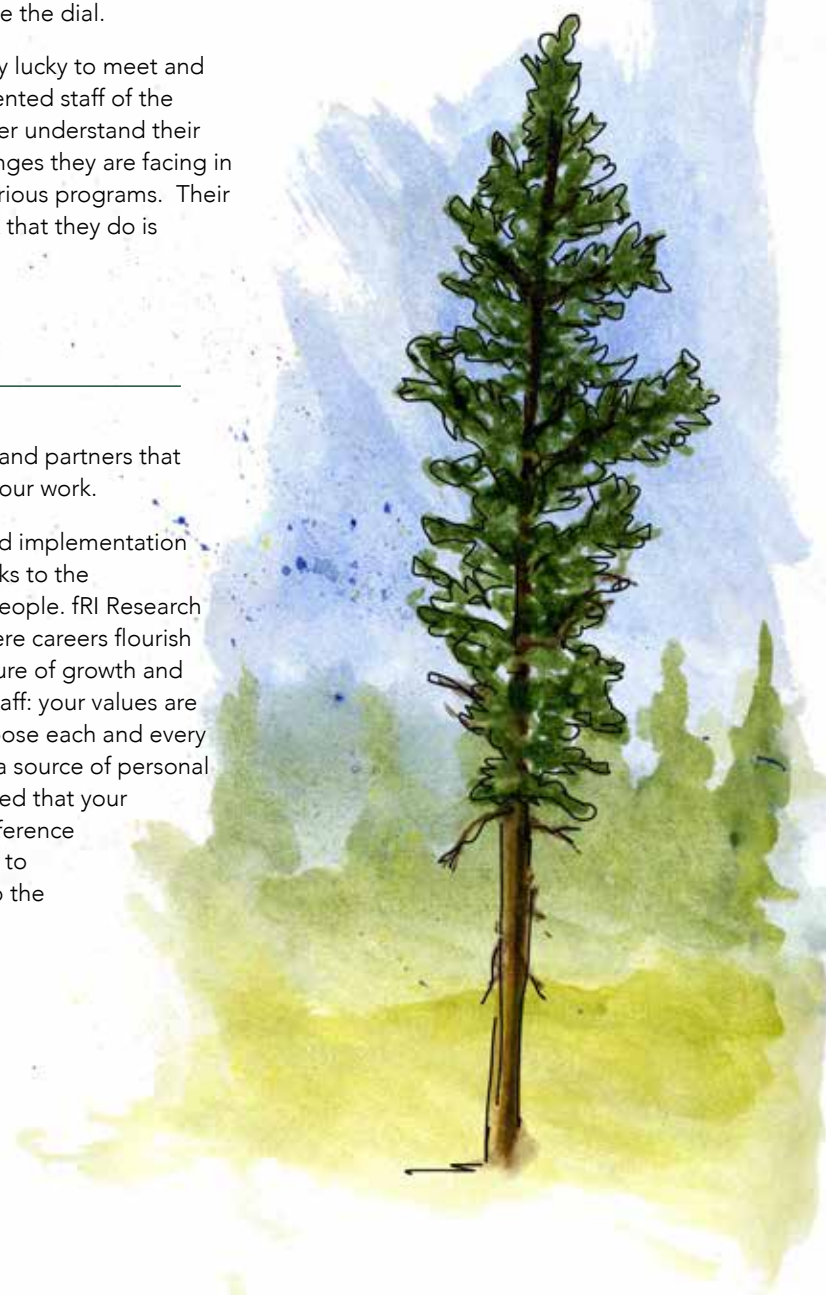
I have also been very lucky to meet and engage with the talented staff of the organization to better understand their work and the challenges they are facing in delivering on our various programs. Their passion for the work that they do is infectious and we are very thankful to have them on our team. I look forward to that continuing dialogue as we work to continue the long and successful work of fRI Research into the future.

EXECUTIVE DIRECTOR'S MESSAGE
Barry White

I have never been prouder of our team! Everyone at fRI Research brings passion, a strong sense of professionalism, extraordinary commitment to research excellence, and an unwavering dedication to safety. These values have informed our new strategic plan, which will guide our organization's efforts through to the end of the decade.

Strategy 2024–2029 keeps us focused on research that makes an impact by ensuring that the questions we investigate are driven by the needs of our shareholders and partners, our science remains high quality and independent, and we sharpen our knowledge mobilization efforts. By delivering results that support science-informed policy and practice, finding efficiencies, and leveraging new sources of funding, we will provide the best value to the shareholders and partners that generously support our work.

Finally, the continued implementation of our strategy speaks to the importance of our people. fRI Research must be a place where careers flourish and we foster a culture of growth and well being. To our staff: your values are on display with purpose each and every day and this is truly a source of personal inspiration. Be assured that your work is making a difference to our shareholders, to communities, and to the environment.



2024–2025

BOARD OF DIRECTORS

Learn more at **firesearch.ca**

Jesse Kirillo (Board President), Resigned October 15, 2024
Peyto Exploration & Development

Rick Blackwood (Board President), Appointed October 15, 2024

Ken Greenway (Board Chair)
Alberta Forestry and Parks

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

Allan Bell
Tolko Industries

Mark Boulton
Suncor Energy

Richard Briand
West Fraser

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Parks Canada

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Weyerhaeuser Company

Lyle Dechief
Weyerhaeuser Company

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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 2025

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 Biodiversity Monitoring Institute
Alberta Conservation Association
Alberta Newsprint Company
Alberta Forest Products Association
Alberta-Pacific Forest Industries
Alberta Wilderness Association
American Fisheries Society
ANC Timber
ARC Resources
Aseniwuche Winewak Nation
Athabasca Oil Corporation
Athabasca Watershed Alliance
Baytex Energy
Belchim Crop Protection Canada
Bighorn Wildlife Technologies
Boucher Brothers Lumber
Canadian Institute of Forestry
Canadian Parks and Wilderness Society
Canadian Wildlife Health Cooperative
Canfor Corporation Divisions: Grande Prairie; Whitecourt
Canlin Resources Partnership
Cardinal Energy
Carleton University
Cenovus Energy
Chevron Canada
Clayton T. Lamb Ecological Research
Colleges & Institutes Canada
County of Grande Prairie No. 1
Cows and Fish Riparian Management Society
Edfor Cooperative
Elk Valley Mine
Environment and Climate Change Canada
Fisheries and Oceans Canada; National Freshwater Conservation Canada
FORCORP Solutions
Foothills Forest Products
Forest Products Association of Canada
Forest Resource Improvement Association of Alberta
Fox Creek Development Association
Freshwater Conservation Canada
Government of Alberta: Ministry of Environment and Protected Areas; Ministry of Forestry and Parks; Office of Chief Scientist; Ministry of Indigenous Relations; Water Course Crossing Program
Government of British Columbia: Ministry of Forests; Ministry of Environment and Parks
Government of Manitoba: Department of Natural Resources and Indigenous Futures
Government of New Brunswick: Department of Natural Resources
Government of Newfoundland and Labrador: Department of Fisheries, Forestry, and Agriculture
Government of Northwest Territories: Department of Environment and Natural Resources
Government of Nova Scotia: Department of Natural Resources
Government of Ontario: Ministry of Natural Resources
Government of Québec: Ressources naturelles et Forêts; Environnement, Lutte contre les changements climatiques, Faune et Parcs
Government of Saskatchewan: Ministry of Environment
Government of Yukon: Department of Environment
Habitat Conservation Trust Foundation
HWN Energy
International Association for Bear Research and Management (IBA)
Île-à-la-Crosse
Joint Secretariat: Fisheries Joint Management Committee
Keyera Corporation
Loon Lake and Makwa Metis Local 32
Louisiana-Pacific Corporation
LP Building Solutions
MacHydro
Margo Supplies Wildlife Technology
Mercer Peace River Pulp
Millar Western Forest Products: Slave Lake Pulp
Mistik Management
Municipality of Jasper
National Conservation Plan
NAIT Centre for Boreal Research
Natural Resources Canada, Canadian Forest Service
Northland Forest Products
North Saskatchewan Watershed Alliance
Nova-Cast
NuVista Energy
Outlier Resources
Paramount Resources
Pembina Pipeline
Pieridae Energy (Cavvy Energy)
Petroleum Technology Alliance Canada
Petrus Resources
Peyto Exploration & Development
Repsol Oil & Gas Canada
Sakâw Askiy Management
Shell Canada
Silvacom
Société de Protection des forêts Contre les Insectes et Maladies
Spatial Planning Systems
Strathcona Resources
Sustainable Forestry Initiative
Swan River First Nation
Tallcree First Nation
TAQA North
Tidewater Midstream and Infrastructure
Tolko Industries
Toronto Zoo
Tourmaline Oil
Town of Hinton
United States Department of Agriculture: Forest Service
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
Valent BioSciences
Vanderwell Contractors (1971)
West Fraser Mills divisions: Alberta Plywood; Blue Ridge Lumber; Cochrane; Edson Forest Products; Grande Prairie; Manning Forest Products; North Central Woodlands; Sundre Forest Products
Weyerhaeuser Company
Wildlife Genetics International
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

Caribou herds across Canada have suffered from habitat loss and fragmentation for over half a century. Decade after decade, the large areas of undisturbed, old forest that woodland and southern mountain caribou need became fewer, smaller, and more disconnected. Generalists like moose and deer moved into the disturbed caribou ranges, bringing with them unnatural levels of predation. With a vast web of linear features slicing up the boreal, caribou were forced to spend more time in dangerous and unsuitable habitat, and many herds ceased to be self-sustaining.

In 2012, the Government of Canada released its recovery strategy for boreal caribou. It provided general targets but left specific actions to the provinces to implement on a range-by-range basis. The Caribou research program was formed in 2013 in response. Its purpose is to study the ecology of caribou in Alberta – how they respond to the disturbances specific to this landscape, and how their relationship to the mix of predators and prey is changing – so that recovery actions can be science-based and effective.

That work continues. As the program starts its second decade, we continue to discover creative solutions that could accelerate caribou recovery while managing trade-offs with other forest values. As a side benefit of the research that produced these practical results, we have made major contributions to understanding the ecological network that caribou exist in. This includes studying caribou's predators and apparent competitors for their effects on caribou recovery, but also as species with their own challenges and their own value.

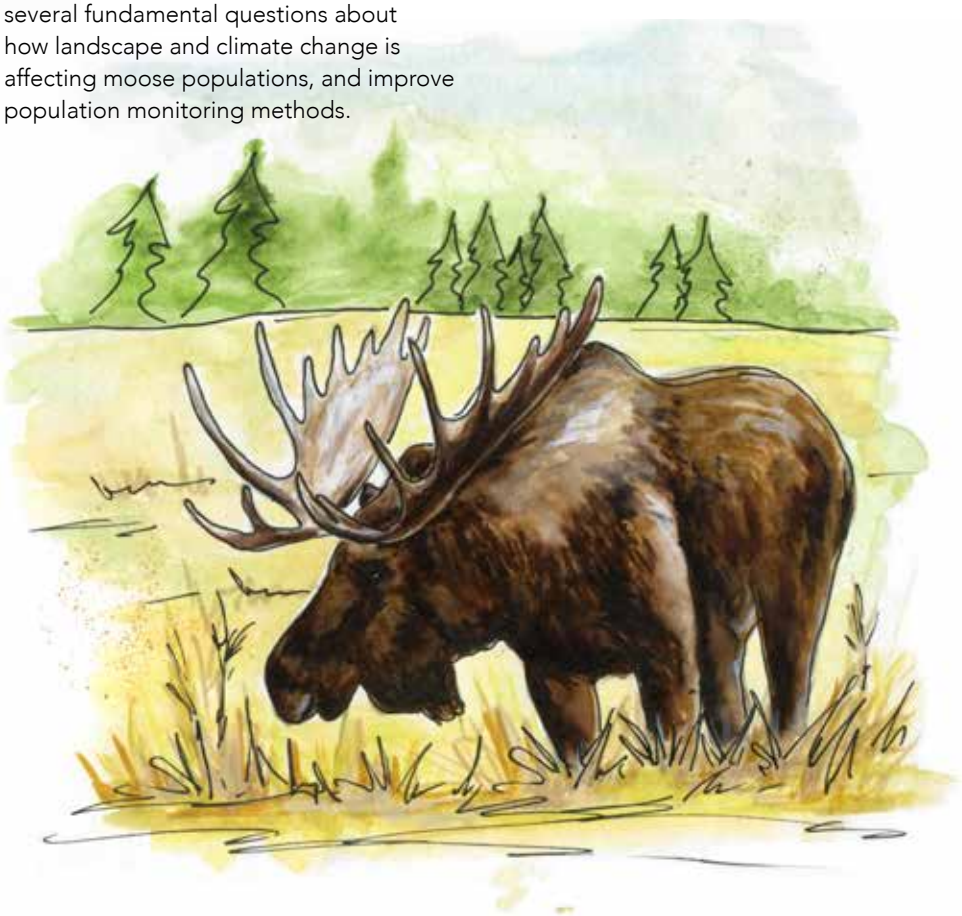
2024–2025 was a mix of ten years of work bearing fruit, and exciting new questions to set our course for the next decade.

Moose Research Initiative

NEW

Moose are culturally important, particularly to Indigenous traditions and treaty rights. This year marks the launch of the Moose Research Initiative, a major effort to answer some fundamental questions about moose in Alberta. To carry out this new work without slowing down our efforts on the program's original mission, our own team has grown, and we've partnered with Dr. Nicolas Coops' lab at the University of British Columbia.

The initiative has five themes that, together, will give land managers the ability to do a science-based cumulative effects assessment for moose, answer several fundamental questions about how landscape and climate change is affecting moose populations, and improve population monitoring methods.



Theme 1: Moose population size and trend relative to forest management activities and landscape conditions

The Government of Alberta has moose population size estimates from helicopter surveys, and our own past work (see next project) has found that moose use of areas following forestry operations depends on season and site conditions. This theme uses both sources of data together to understand how things like site specific forage abundance, silviculture practices, and the surrounding landscape are affecting moose population sizes and trends.

Arya Horon

Arya Horon

Theme 2: Moose summer and winter ranges in Alberta: Resource Selection Function models and connectivity

Our previous work used GPS collar data from moose to find out how they were responding to linear features in four caribou ranges between Hinton and Grande Cache. This project will contribute a new, more informative generation of models that will cover a much larger area of Alberta.

Theme 3: How forest management and climate factors impact boreal ungulates

Moose are a temperature-limited species that will be affected by climate change, however this effect may be stronger or weaker depending on how other activities change the landscape. Untangling this relationship will contribute to best forest management practices for moose.

Theme 4: Practicality and potential of copter and fixed-wing remotely piloted airborne systems for wildlife surveys compared to current methods

This theme is led by the Integrated Remote Sensing Studio at the University of British Columbia.

This theme will develop and demonstrate procedures for doing moose surveys with drones, and compare them to the conventional method of using biologists in helicopters. The ultimate goal is to determine if drones can offer an improvement on cost, safety, accuracy, and impact on wildlife.

Theme 5: How forest management strategies impact ungulate populations and habitat supply over time

Alberta and British Columbia are implementing new forest management strategies designed to benefit caribou, but it's unclear what the unintended effects there may be on other ungulate species. The goal is to synthesize available research to provide recommendations and identify knowledge gaps.

The Effects of Oil and Gas and Forestry on the Occupancy, Reproduction Status, and Reproductive Rates of Prey Species within Caribou Ranges

NEW

In the decades after industrial activity – forests harvested, or natural gas wells decommissioned – the disturbed area will generally have more grasses, shrubs, and young deciduous trees than the surrounding forest. Our previous research shows that these forage plants draw in more prey species and their predators: moose, deer, and elk, bears, and wolves. In threatened caribou ranges, this, in turn, raises mortality rates of caribou.

However, there is still something fundamental about this ecological relationship that we don't understand: the reproductive rates of the prey species in caribou ranges, and how industrial activity is changing them. Knowing these basic population parameters will improve predictions of these prey populations under different management scenarios, providing a scientific basis managing economically and culturally important species like deer, moose, and caribou.

Because of the limits of aerial surveys in forest habitats, we're using a network of over 150 trail cameras in harvest blocks, well sites, and pipelines throughout the Redrock Prairie Creek, A La Peche, Narraway, and Little Smoky caribou ranges. The camera data comes from several projects, and has been collected between 2018 and 2024. By looking at the relative frequency of detecting adults, subadults, and adults with calves, we can estimate the calf recruitment rate (which accounts for both calf survival and reproductive rates) for each species.

We will test how characteristics at each camera, such as different forage abundances or terrain types, are affecting reproduction numbers and rates. We'll also look at the surrounding landscape. So we could, for example, see if calf recruitment is higher near roads, or in areas with more deciduous forest.

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 potential 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 forest harvest 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 km^2, 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. Since 2023, Dr. Ian Best at the University of Northern British Columbia has been doing the data analysis, and, along with the team, publishing papers, Quicknotes, and reports.

Arya Horon

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.

Courtney Burk

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 do to poor sightability. Recent advances in analysis methods of camera trap studies have eliminated many problems for estimating population densities.

This project has three goals: estimate the density and demographics of ungulates, test several methods simultaneously to determine the best, and refine the use of new technology to make future studies more resource-efficient.

We set up a grid of camera traps in the wildlife management unit north of Hinton in 2023. 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. This generated over 3 million images which we collected and began processing in 2024. We ran a subset through a wildlife image recognition program to detect and label species, then reclassified them with traditional methods by trained biologists. This taught us how to use these programs to massively reduce the time to classify the millions of remaining images on this project, without significant loss of accuracy.

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

COMPLETE

Both 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 uses Government of Alberta GPS data from collared caribou and moose, and vegetation data collected by the Caribou Program and the University of Montana, and the analysis was led by a postdoc at the University of British Columbia.

We found that, 3–5 years after MPB arrival, caribou started avoiding more heavily impacted areas in the winter, but selected for them in the summer. Moose selected for them in both seasons. If MPB-infestation is limiting caribou winter range, MPB-control activities that are relatively low-impact could be a net benefit for caribou habitat while also reducing apparent competition with moose.

Grizzly Bear

Despite the bright sun, there was a skiff of snow covering the moss and needles Darío and I were walking on. Back in town, most houses were sporting their Halloween decorations, but the Grizzly Bear Monitoring Project was still collecting data, pushing deeper into autumn than we'd ever gone in 20 years of population studies.

Darío crouches suddenly. Fresh coyote tracks have joined our game trail and are heading towards the hair snag site we're about to check. "We'll probably see it on the trail camera," he said.

This is Dr. Darío Fernández-Bellon's second year running the monitoring project. The first required all of his energy and adaptability as he had to learn the area, learn the species, and learn the protocol all at the same time as he was hiring and training a field crew and setting up dozens of hair snag sites throughout Bear Management Area 3.

One of a thousand things he learned last year was that, after a mid-summer lull, there was a definite spike in grizzly bear activity at hair snag sites in the fall. The timing corresponds to hyperphagy, when bears tunnel vision in on gobbling as many calories as possible before winter. Although most of the field crew had finished their seasons, Darío and a few others were still checking sites to collect as many hair samples as possible, and see just how late the spike in activity lasts.

We passed a battered yellow sign on a tree cautioning people that they are approaching a bear research area, and Darío called out, "don't think we'll get any." The scent lure pile was still intact, its faint aroma of rot wafting towards us. Still, he dropped his pack and walked around the hair snag site, stooping over the strand of barbed wire and examining each barb carefully for a tuft of hair. He was right: no hair this time.

"Let's check the camera."

Darío unlocked the case on a trail camera screwed to a nearby tree and popped out the memory card to download onto a tablet. As he scrolled through the pictures, he bent over the screen to block the bright sun streaming through the pines. The tops of the trees bent in a gust of wind, and then the air was full of glittering ice crystals shaken from the boughs.

"There's the coyote!" he said. Sure enough, a couple nights earlier it had crept through, pausing only for a quick sniff of the stinking pile of branches in the centre of the barbed wire ring. The camera confirmed that no bears had visited. Installing trail cameras at every hair snag site is a new addition to the monitoring protocol. Aside from generating incredible footage for Instagram, the cameras are paying for themselves in reduced lab costs and a higher rate of successful individual identifications.

Every tuft of hair is collected in its own little paper envelope. In our previous, massive population surveys without cameras, we only knew which barb the tuft was caught on, and in which shift the hair was collected. This meant we didn't have a good way of knowing which hair samples to analyze, because we had no idea which were from the same bear on the same visit, or which contained hair from multiple bears and would therefore fail to give an identification.

Imagine that during one shift, three bears visit a hair snag site. The first bear enters the corral from the east and exits the west side. The second enters on the west side, rolls around in the scent lure pile, rubs up against the strand on the north side, and finally leaves on the south side. The last bear sniffs a strand and leaves without

Year 2 Stats

Hair snag sites

BMA 3: 42

BMA 4: 32

Private landowner: 10

Data collected

Total hair samples: 1039

Total camera images: 300,000

Bears detected

Males: 46

Females: 39 (8 accompanying one or more cubs)

Darío Fernández-Bellon

crossing the wire, perhaps disturbed by the scent markings of the second bear.

Previously, we might have had to send in a dozen samples, and the samples from the west strand would have failed if they were a mix of hair from two bears. We also would have had no idea about the third bear that visited without leaving a good hair sample. Today, in a couple minutes of looking at the camera footage, we can choose a few of the best samples to send to the lab, and know about the third visitor, even without a genetic ID. Knowing that several samples come from the same bear could also unlock a new method of population monitoring that we're still developing with our university lab partners: hormone analysis.

Since 2004, we've extracted DNA from the hair we collect, which lets us identify individual bears, their sex, and family relationships to any other bears already in our database. This gives us a population size estimate and a little bit of insight into the population's demographics. However, for the past decade, we've been gradually working out how to get more nuanced insights into bear populations by taking advantage of two facts about mammals. Hormone levels fluctuate based on what is happening with an individual – stress, starvation, pregnancy, lactation, growth, etc., and they are deposited in the non-living parts of the body. Each hair contains a hormone record of what the bear was going through while the hair was growing, if we can just learn to decode it.

By working with the Proteomics Centre at the University of Victoria, we have determined which hormones to extract from hair and effective procedures for doing so. Currently, we have a proof of concept that we can relate hormone levels to some population parameters, like whether the bear is a subadult or an adult. However that was with a small number of captured bears, and required a relatively large hair sample. As we push the technique to become field-ready, the trail cameras give us a way to verify that several hair samples came from the same bear and can be combined to give enough material for hormone analysis.

None of this high-tech sophistication is obvious as Darío and I walked back to the truck leaving behind one strand of barbed wire stapled to some trees, a pile of branches, the beat up warning sign, and a camera secured to a tree with a bike lock. The simplicity of the hair collection setup makes our seasonal field techs efficient and reliable, and once collected, we leverage those hair samples for all they're worth. But even that protocol is being tested and refined. Should the barbed wire be a little higher or lower? What scent lures get the most grizzly bears (and the fewest other animals who mess up the site)? How well do rub trees work?

The Grizzly Bear Program has a decades-long track record of not just studying bears, but studying how to study bears. There aren't the resources to do full population inventories for the whole province every five, or even ten years. So how do we manage this keystone species at risk? That's a primary goal of the current monitoring work: answer the practical questions with fewer and fewer resources.

One big question arising from our previous population inventories, which found increases in two bear management

Darío Fernández-Bellon

areas, is what is happening on the eastern edge of the foothills where there are more people, farming, and ranching. Over the years the program's science has helped find ways to improve co-existence between bears and activities like forestry and mining that take place in core grizzly habitat. Darío worked with cattle ranchers to set up monitoring sites on their land in 2023, and expanded these efforts in 2024. Understanding where grizzly bear occurrence is increasing and likely to result in conflict will be useful for focusing preventative efforts such as education and more resources for bear smart work including safe disposal of animal remains.

By the time we got back at the office, the snow had melted off our boots. Cam McClelland, who was snug at his desk that shift gave us an enthusiastic welcome. The irrepressible former grizzly bear tech got his master's degree and returned to help Darío run the project. Having a lieutenant to do a bunch of the day-to-day problem solving allowed Darío to devote more time to analysis and long-term planning. While Darío backs up the trail camera photos he collected, Cam showed me what he'd been working on.

On his computer screen were the GBTools, a suit of GIS tools developed in-house. Our partners use them to test the effects of different management scenarios on grizzly bear habitat. Forestry planners can, for example, see how grizzly bear habitat is affected depending where they choose to place harvesting roads, or see how habitat quality changes with different harvest block placements. Julie Duval, the GIS Services lead, had just rolled out a major upgrade to the tools, so Cam was making a set of instructional videos to help the partners feel comfortable using the updated version.

The tools are based on 25 years of data and published science from our team. In fact, one of our earliest projects was with a young grad student named Scott Nielsen, one of 52 students who have done their graduate thesis with the program. He noticed grizzly bears were using harvest blocks and quickly realized that they were taking advantage of the abundance of forage offered in a young, regenerating forest. Now a U of A professor, Scott returned a little over 20 years later, to take the research one step further and look at how climate is driving abundance of those plants with nutritious roots and berries that bears are using. Part of our field crew put out climate sensors and sampled vegetation for this project, comparing habitat in the harvest block against the surrounding forest.

Looking out the back door of the office, the sun had gone down and the wind had picked up. We would soon stop checking the hair snag sites since it wouldn't be long before the bears have to dig a den for the winter. There's some debate among biologists about whether bears are true hibernators because they move around a fair bit, even leaving their dens briefly. There's no such debate about bear biologists. The trucks may be parked, but everything else was in high gear. A thousand envelopes of hair samples, hundreds of thousands of trail camera images, GIS tools, hormone papers, and a dozen other things to work on before field season number three.

Healthy Landscapes

For decades, land managers in Alberta have understood that development and environmental issues cannot be treated in isolation. For example, when forest companies seek approval to harvest timber, they must consider how they will regrow the forest to its prior state, minimize roads in grizzly bear habitat, protect wet areas and the nests of migratory birds, and so much more. And of course, forestry is just one of many user groups having an impact on the land, from recreational anglers and OHV-riders to oil and gas. Even with increasingly sophisticated regulations and more careful operations, these pressures can create cumulative effects.

Dr. David Andison's Healthy Landscapes Program has been exploring an alternative approach called ecosystem-based management. Essentially, it takes the pre-industrial state of the boreal as a guide and uses development, restoration, and fire as tools to get there.

Policy-makers have been gradually adopting some of the ideas that underpin ecosystem-based management, including using wildfire patterns as a template for industrial disturbance, and trying to bring the landscape closer to its natural (pre-industrial) distribution of forest age classes.

However, these are only the first steps on a journey that may require profound changes to the status quo. And if environmental issues cannot be effectively tackled in isolation, neither can overcoming the barriers to more holistic land management. To that end, Andison's leadership has increasingly focused on building partnerships, while his suite of projects has become more interdisciplinary each year.

Beyond the Trees

ACTIVE

A lot of attention is paid to the overstory, but the shrubs, forbs, lichen, and mosses are also critical for the people and animals using a forest. In particular, Indigenous practices make use of many understory plants for nutritional, medicinal, spiritual, and economic purposes. The goal of this project is to identify which plant species are culturally significant and understand how fire and forestry practices are impacting them.

The first stage was to reach out to communities to find those that were interested in participating in the project. We developed new data-sharing agreements with the communities to make clear that the information generated by the project was theirs, for their benefit. Since 2023, we have been visiting Ahtahkakoop Cree Nation and Ile-à-la Crosse in Saskatchewan, where we began building relationships and heard the community's perspectives.

The meetings with the knowledge keepers and their communities demonstrated why it is essential to take this careful approach of building trust and spending time to understand each community's unique situation. There were major differences in priorities between the two communities, their level of trust in forestry companies, and their view of wildfire. To be meaningful, the field trials and recommendations must be developed cooperatively with each community individually.

We will continue building relationships with Ahtahkakoop Cree Nation and Ile-à-la Crosse, as well as the forest companies working in their traditional territories as we move toward research trials about their priority species. Two Indigenous communities in Alberta are also joining the project, and we are exploring relationships in British Columbia, Manitoba, and Ontario.

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.

Fire-Harvest Blueprint

ACTIVE

This project lays the groundwork for a future bold, experiment: 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.

Fire Risk and Forest Management

ACTIVE

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 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 PhD project aims to characterize additional slash fuel types to more accurately model fire behaviour.

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 integration with Traditional Ecological Knowledge.

Post-Disturbance Stand Type Shifts

ACTIVE

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 occasionally, 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 is exploring these factors to unpick when and why fires cause a shift on the landscape.

In 2024, Dr. Ghehi analyzed how composition and structure changed decades after a fire, finding that while areas with lots of aspen tended to return to the way they were, other forest types ended up with a different mix of species to one degree or another. For example, pine and black spruce tended to return or even expand in extent. The next phase of research will focus on the influence of climate and weather variability.

Whole Landscape Approach to EBM

ACTIVE

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, a collaboration with Ducks Unlimited Canada, begins to invest in a real understanding of fire behaviour in wetlands in order to update models. The team completed a literature review in 2024 that brought together research on how vegetation and hydrology influence fire behaviour in wetlands, and found significant knowledge gaps, especially outside of treed and deep peatlands. Other recommendations ranged from improving inventories of wetlands, studying the effects of climate change, and identifying policy, social, and economic considerations to better fire management in wetlands.

Benefits of Disturbance

COMPLETE

Experts may tout the advantages of "putting fire back on the landscape" and returning to a pre-industrial range of forest age classes. 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, a socio-economics team at the University of Alberta led by Dr. John Parkins have surveyed 8,000 people in Alberta, Saskatchewan, and Manitoba.

What they are frequently seeing is skepticism toward new policies that differ from the kind of fire suppression practiced throughout the 20th century, as well as the idea that forest harvesting can contribute to social and ecological values. The full results were delivered to project partners and publications are underway.

Comparing Fire and Harvest Patterns

COMPLETE

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 a few larger patches, leaving much larger areas of interior forest undisturbed.

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

Socioeconomics of EBM

COMPLETE

In 2017, the Healthy Landscapes 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 principles of 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.

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 illuminated pitfalls and critical partnerships for the journey ahead.

Mountain Pine Beetle

Mountain pine beetle occasionally rode the wind over the Rocky Mountains into Alberta, but historically, they weren't able to establish a lasting, endemic population. In the early 2000's, it was quickly apparent that the latest overflight was different. The climate had changed, and a string of warm winters allowed the beetle to reproduce exponentially, erupting in massive epidemics all down the foothills and further east into the Boreal each year. This was a range expansion, and over two million hectares of lodgepole pine forest would be attacked before the epidemic slowed.

Today they are endemic in Alberta, and while the potential will always exist for new outbreaks, we are better prepared thanks to nearly 20 years of work by the Mountain Pine Beetle Ecology Program and our research partners. We have answered basic questions about the beetle's biology, how it disperses, what winter weather conditions favour an epidemic, how it can be detected and the best way to control beetle populations. Beyond the beetle itself, we have also learned about its effects on other values from changes to the hydrology of a beetle-attacked area to the social and economic wellbeing of communities to species at risk that rely on the kinds of mature pine forest that mountain pine beetle kill. We've also developed a sophisticated understanding of how a beetle-killed stand changes the wildfire risk over time.

This year, the final projects delivered their findings. But the program will leave behind a legacy besides scientific results: it has also demonstrated a remarkable collaboration. Researchers stepped up and delivered a leap in practical knowledge and tools, government policy makers showed an incredible nimbleness in their response, and the forestry industry shared data and funding generously. These sectors of society proved the strength that comes from partnering on tough issues, and created a model we can look to when the next crisis comes, no matter what form it takes.

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

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

COMPLETE

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 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. To test this, the group used a combination of in-lab flight mills and direct observations of the body condition of wild mountain pine beetles across their expanded range.

The lab found that mountain pine beetles do, in fact, become more responsive to host tree chemicals as they deplete their energy stores. They also found that beetles disperse less far in areas with lower population densities, and beetles at the leading edge of their expansion had physical traits that allow them to fly further, such as larger wings. These findings can help model future spread.

Assessment of Risk Factors Influencing Landscape Level Fire in MPB Forests

Led by Dr. Christopher Bone, University of Victoria

COMPLETE

This project investigated the relationship between wildfire and mountain pine beetle attack, while considering fire weather, geography, vegetation, and other relevant factors. The researchers found no significant change in human-caused fires in beetle-attacked areas, and a small decrease in the occurrence of lightning-caused fires. However, mountain pine beetle attack increased the occurrence of large lightning-caused fires – suggesting that outbreaks may increase the severity of such fires. They also found that harvesting after a mountain pine beetle attack can reduce the likelihood of wildfire occurrence. This information can be used to help communities plan and protect themselves from wildfire risk.

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

Led by Dr. Rob Friberg

COMPLETE

First Nations and rural communities face changes driven by mountain pine beetle and other landscape-level impacts. These include events caused 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.

During 2023 and 2024, the Phase 2 goal was to work with the communities on an approach to greater resilience. Together, they identified three critical areas to focus action on, complete with objectives, indicators, and concrete next steps. Additionally, the framework adopted by the community can be extended in the future to address new challenges that arise.

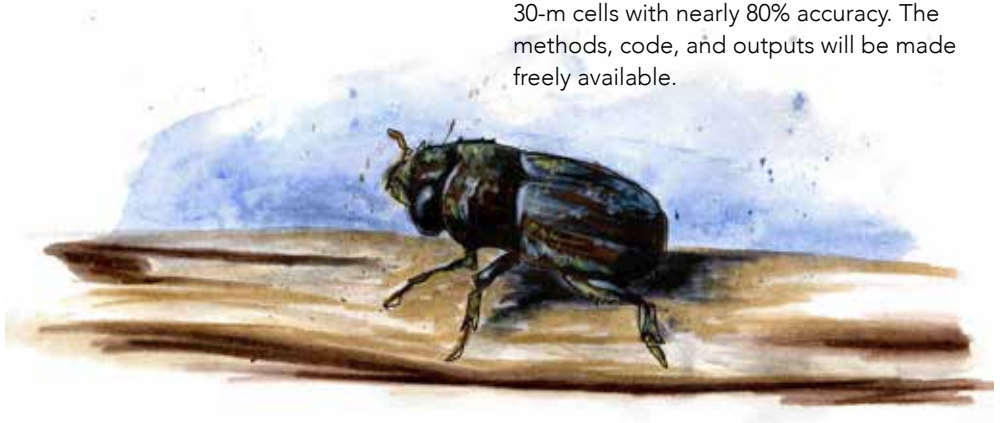
Development of Fine Spatial Resolution Tree Species Information for MPB-impacted Ecosystems for Species-at-Risk Habitat Assessment

Led by Dr. Nicholas Coops, University of British Columbia

COMPLETE

Maps of tree cover are critical for managing mountain pine beetle control efforts, particularly in caribou habitat. However, boots-on-the-ground surveys are resource intensive and cannot scale to every stand in western Canada. Satellite imagery, if it can be correctly interpreted, might be a means to having accurate, up-to-date, boreal-wide spatially explicit maps on which to base management decisions for mountain pine beetle and species at risk.

This research team created maps of predicted tree species covering Alberta, BC, and the Yukon, based on readily-available medium resolution satellite imagery. Using 31 predictive variables such as elevation, latitude, climate, and greenness in the satellite imagery, they predicted the leading tree species in 30-m cells with nearly 80% accuracy. The methods, code, and outputs will be made freely available.



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's aerial surveys look for red-attack trees (those that were killed some years ago and whose needles have turned red), followed by ground surveys to spot pitch tubes on nearby green-attack trees (infected but not yet dead). These can then be cut and burned before the mountain pine beetle can emerge. This project tested whether a more efficient method is possible using new technology to directly identify green-attack trees from the air.

The original hypothesis was that because a healthy, green-, and red-attacked tree will have different transpiration rates and therefore different evaporative cooling after a warm day, beetle attack may be detected early using thermal imaging and deep learning algorithms. The team developed new algorithms and methods and pushed the technology forward. While both thermal sensors flown at low altitude and visible light sensors looking at a tree's "greenness" showed promise for identifying the green attack stage, more work is required before these methods can be used operationally.

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

COMPLETE

The literature has found inconsistent correlations between mountain pine beetle and wildfire. This meta-analysis looked at the reasons for the confusion and provided clarity on what we do and do not know about this complex relationship.

The researcher's own modeling found that wildfires in red-attack stands were of higher severity, while later stage stands were less severe due to fewer fine fuels. However, the authors note that during high and extreme fire weather, stands are less sensitive to mountain pine beetle influence.

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

COMPLETE

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

The researchers found that while a mountain pine beetle attack resulting in 30% tree mortality did not have much impact, stands with 90% mortality had very severe changes, including to discharge volume in the summer peak flow, increased runoff, and soil moisture. This suggests that the more severe a mountain pine beetle attack, the greater the risk of extreme flooding.

Modelling Eastern Spread Risk of MPB Using Host Genetic Ancestry

Led by Dr. Catherine Cullingham, Carleton University

COMPLETE

Alberta's boreal pine forest gradually fades from lodgepole pine in the west to jack pine in the east. A major concern for all provinces eats of Alberta 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 used landscape genetics to predict pure and hybrid zones and then verified these models by sampling trees in less certain areas. This allowed 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.

What they confirmed was that either pure jack pine stands – or the environment in which those stands tend to be – are unsuitable for mountain pine beetle epidemics, and so a continued eastward

expansion is less likely. This finding allows Alberta forest managers to have confidence in focusing their monitoring on pure lodgepole and hybrid zones.

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

Led by Dr. Mark Lewis, University of Victoria

COMPLETE

This project developed two types of models to forecast the long-term future of mountain pine beetle in Alberta under different climate change scenarios, and explore which factors have the most drastic consequences for the beetle's population equilibrium.

By the end of the century, there will be greater overwinter survival of bark beetle larvae, and a greater number of outbreaks. Under plausible climate change scenarios, outbreaks will become frequent and widespread. The mechanistic model also demonstrated how three parameter changes that are likely under climate change push beetles from low level endemic infestation to epidemic outbreaks: higher brood size due to warmer winters, drought stress weakening tree defenses, and forest degradation.

The Physiological Costs and Consequences of Overwintering in Mountain Pine Beetle

Led by Dr. Heath MacMillan, Carleton University

COMPLETE

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 deepened our understanding of mountain pine beetle winter biology, by measuring the extent to which the beetle suffers tissue damage, ion regulatory collapse, or simply consumes excess energy in different overwintering conditions.

In response to cold temperatures, the team recorded mountain pine beetles rapidly converting their stored energy into "antifreeze" molecules to protect themselves. Time, as well as temperature, matters for depleting the beetle's energy stores and making them more susceptible to future cold snaps, as well as suppressing their reproductive capacity. This data on the relationship between temperature and reproduction enables better predictions about year-to-year population growth and the potential to 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

COMPLETE

Dr. Chasmer and colleagues tested ground, quadcopter, and fixed-wing lidar for measuring forest fuels in Jasper National Park, in forests experiencing green, red, and gray mountain pine beetle attack stages. They found these systems more accurately measured canopy height, diameter, and understory vegetation volumes than traditional surveys in a fraction of the time. However, they were not able to replace manual duff layer and surface fuel measurements.

The data collected show that after mountain pine beetle attack, the volume of dry ladder fuels increase, raising the risk of a fire moving from ground to canopy and higher wind speed. Grey attack trees had reduced fine canopy fuels and tended to be more clumped together, and stands with a high mortality had the fewest canopy fuels and the most downed woody debris.

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

Led by Dr. Laura Chasmer, University of Lethbridge

COMPLETE

Mountain pine beetle-disturbed forests have altered fuel structures. Physics-based models may be useful for understanding fire spread in these areas with atypical fuels but requires 3D data of the trees. Focussing on the gray-attack stage, generally 4–10 years after mountain pine beetle outbreaks, the researchers collected ground and airborne lidar data to feed into a state-of-the-art physics-based model called FIRETEC.

Mountain pine beetle attacks cause fuels to move over time from the canopy to the forest floor. How this affects fire spread depends on how heavily impacted a stand was, the time since attack, and the time since a fuel reduction was carried out. The models suggest that during high fire weather scenarios, fire spread was highest for red attack, followed by gray attack, and lowest for undisturbed forest.

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

COMPLETE

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, creating 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.

The team was able to develop and validate a workflow that classifies landscape cover in oblique photos with little human resources, to an accuracy comparable to aerial photography. Using these methods, the researchers found that mature conifer forest increasingly came to dominate the park since 1915, and that the mountain pine beetle outbreak had restored some of the heterogeneity present before government management.

The Marten Habitat Project

Gordon Stenhouse

The prevailing wisdom is that American martens need mature forests to thrive. While they certainly do seem to prefer larger patches of mature conifer forests, marten that were fitted with GPS collars in British Columbia used other types of habitat. This, combined with the lack of research in Alberta's boreal forest drove interest from two different groups that share the landscape.

Local trappers and forest managers have joined forces to learn about annual habitat use by marten 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 new data on their traplines.

Two of the three years of data collection are complete. The hope is that once all the data is in, they will have a much more complete understanding of how marten select and use habitat at different times of day and seasons, and how it relates to nearby forest harvesting.

Gord Stenhouse, who led our grizzly bear work until 2023, helped the trappers and Vanderwell staff design the study and source the field equipment. He also meets with them regularly to advise, and will assist in analyzing 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."

At the beginning of the project, trappers put out 90 high resolution trail cameras on traplines so as to observe the full diversity of forest types and ages. They visit the cameras each month to change batteries and SD cards. So far, there have been hundreds of marten detections, but they are also gaining useful insights into the other species that make up the ecological communities in the area. Data about marten size and body condition that the trappers are uniquely able to contribute may give additional insight into how habitat use is linked to animal growth.

So far, the team is seeing marten use a complex mix of habitat. 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. The full analysis will be done in early 2026.

Water and Fish

In the second year since its relaunch under the leadership of Dr. Benjamin Kissinger, the Water and Fish Program has scaled up. More proposals and funded projects, more partnerships, more knowledge sharing, and two more staff members to keep everything flowing smoothly.

Kissinger's energy has been matched by our partner's enthusiasm for this research, which is chasing answers to critical questions at the same time new technology is maturing. Governments, industry, NGOs, and Indigenous communities are eager to get a handle on the causes of the declines in Alberta's native trout populations, and start working together toward solutions.

Our program brings these groups together in several ways: in collaborations such as the remote sensing, stream temperature, Southern Rockies, and Swan River projects, and, more literally, at a workshop that we helped host in February. Over 160 experts and representatives of those concerned groups attended the 3 days of presentations and discussion. As well as scientific talks sharing the latest information about topics like the impacts to fish of climate change, angling, genetics, habitat, forest hydrology, there were also interactive breakout sessions on the topics of cumulative effects, Nehiyaw understanding of natural law, improved stream mapping, and challenges and questions faced by Fisheries and Oceans Canada and the forest industry working in trout critical habitat.

The Water and Fish Program is also part of the Alberta Native Trout Collaborative, and Kissinger serves as the President of the Mid-Canada Chapter of the American Fisheries Society, both of which share knowledge with people interested in fish ecology. Finally, Kissinger is collaborating with several university labs, on projects with post-docs as well as co-supervisor on graduate projects. These include the Universities of Alberta, Calgary, British Columbia, Manitoba, and Laval. Kissinger is an Adjunct Professor at both the University of Calgary and University of Laval.

Synthesizing Available Data and Traditional Knowledge into Recommendations for Arctic Grayling Recovery

NEW

Angling, climate change, and habitat fragmentation has caused a 70% decline in Arctic grayling since the 1960s. Continued degradation and fragmentation of the Swan River watershed, with limited consultation of Swan River First Nation, led to the closure of Arctic grayling harvesting and the loss of this treaty right.

For the past decade, the community has been monitoring the watershed with eDNA sampling, stream temperature loggers, and water crossing assessments. This project pulls these data sources and the Nation's traditional knowledge together to identify next steps toward recovering Arctic grayling populations. The project began with a ceremony in the community in the fall of 2024. Our report was presented and discussed with

members of the community at a meeting five months later. We are continuing to support the Swan River First Nation – the stewards of this watershed – as they decide on the next steps.

Assessment of Forestry Stream Crossing Effects on Water Temperature

ACTIVE

This project is part of a broader effort to identify and characterize habitat for cold-water fish species (see "Water Temperature Monitoring" below). It focusses on the effect of bridges and culverts on local stream temperatures. There are tens of thousands of these stream crossings along the eastern slopes, with potentially important changes to the amount of shade a stream has, its flow, and changes to the streamside vegetation.

In the spring of 2024, all temperature loggers were deployed; the data was retrieved that fall for analysis, which will be primarily performed by Dr. Dan Moore and Dr. Ryan MacDonald.

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

ACTIVE

A 2005 study found a 24–43% decline in bull trout occurrence in the Kakwa Watershed, and attributed it to forestry activities, however there are other important landscape changes that were occurring at the same time, and might have contributed to bull trout distribution, as well as the natural ecological distribution of the species. This multi-year project examines how all the different land-use activities in the past two decades have affected fish populations, in particular bull trout.

In 2023 and 2024 our team, together with scientists from Fisheries and Oceans Canada, Alberta Environment and Protected Areas, the University of Calgary, and the University of Manitoba re-visited all 172 sites to quantify the populations in each section of the watershed. 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 Effect of Thermal Stress on the Physiology of Juvenile Bull Trout

ACTIVE

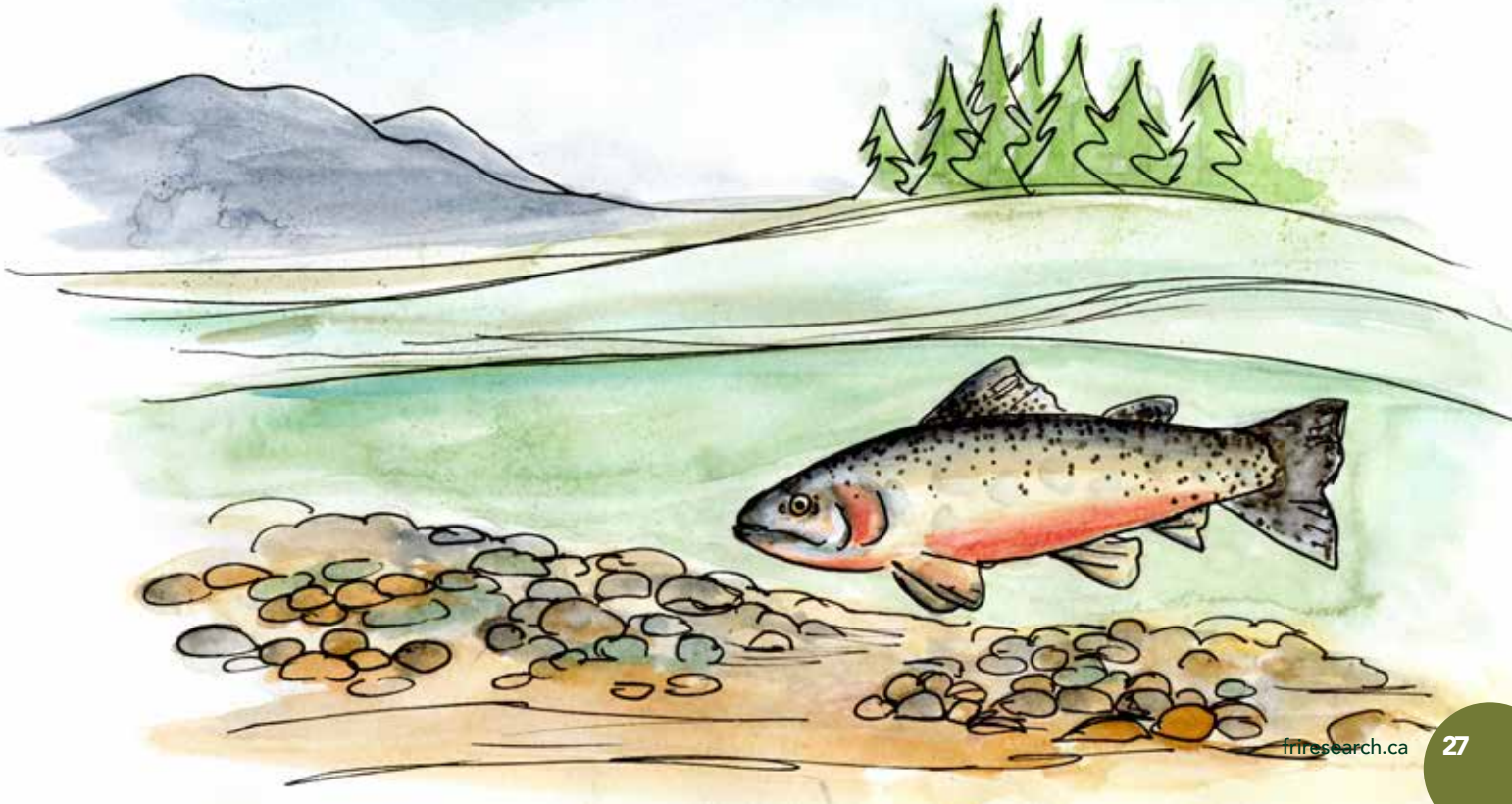
To accurately model bull trout habitat, we need to know what temperatures they need to thrive. research from the United States found that temperatures should be below 15 degrees to be optimal for bull trout; this project will determine if that is accurate for Alberta populations.

Dr. Analisa Lazaro-Côté at the University of Manitoba had previously determined thermal stress levels of fish kept at different temperatures in the lab. They did this by swabbing the fish's mucous layer and measuring the levels of molecules that are produced in response to thermal stress. The method is now being tested on fish sampled during our Kakwa survey (see previous project) as well as samples from the Nahanni River in the NWT.

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

ACTIVE

Forestry companies have surveyed their management areas with lidar, and use the data to try to predict the location of streams so they can design harvesting with accurate buffers around watercourses and avoid disturbing critical habitat. However, only about half of Alberta's eastern slopes have been modeled, and many areas have not been surveyed with high resolution sensors.



Claire Allore

This project will take advantage of recent advances in remote sensing to create much better predictions of the locations and attributes of streams. This modeled stream network will be developed in collaboration with Dr. Lee Benda of Terrainworks, the creator of the NetMap GIS product. An improved "virtual watershed" will allow for better operations and management around Alberta's streams and enable research to answer more complex questions.

The first fieldwork began in the summer of 2024 when teams from UBC and Laval tested the lidar and thermal imaging sensors on several different landscapes. With the technology and protocols refined and validated, full scale data collection can proceed.

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

ACTIVE

The Water and Fish Program has created a stream temperature monitoring network capable, for the first time, of modeling Alberta's entire eastern slopes. This will identify which watersheds have the most thermally-suitable habitat for species such as bull trout, Arctic grayling, westslope cutthroat trout, and Athabasca rainbow trout. 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 Dr. Ryan MacDonald to identify data gaps and set our priorities for the summer. By the fall of 2023 we had added data from about 1,000 new sites, a little over one third of which were completed by our crews and the rest contributed by enthusiastic collaborators. That fall and winter we quality controlled every data point, reran the models with MacHydro, and planned for the next campaign. Through more hard work and collaboration, we collected new location data in 2024, bringing the total to over 2,600 locations spanning 30 years, which we again quality-controlled and fed into MacHydro's model. To date, we have received data from 15 different organizations.

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

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.

While the Silins lab continues to collect data from long-term sites, publication of results is a greater focus of the project.

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

COMPLETE

Kissinger helped develop, implement, and served on the committee for a University of Calgary master's project led by Tara Lepine. It's a test of a new method of translocating bull trout: instead of moving 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, and collected them in spring 2024. Lepine found the method to be quite successful. The main factor reducing survival of the eggs was the number of days that the eggs went below freezing. Lepine successfully defended her thesis in the fall of 2024.

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

COMPLETE

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. Franks also assessed the genetic structure of populations in the East Slopes to aid in determining population boundaries. While at the University of Calgary, Kissinger helped design and find funding for the project and served on Franks' committee.

Some key takeaways from this project were that, while hybridization is ubiquitous all along bull trout habitat in Alberta, first-generation hybrids tended not to be successful in reproducing. Franks' analysis also found clear genetic differences between bull trout populations in Arctic-draining watersheds versus Saskatchewan watersheds, as well as genetic diversity within watersheds, suggesting the need to keep any planned translocation actions local. In 2024, Franks successfully defended her thesis.

Associations

fRI Research serves as the coordinating organization for five associations. 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

Since 2020, the ARCKP is funded by the Forest Resource Improvement Association of Alberta (FRIAA) through the support of forestry companies in Alberta to address region-specific knowledge gaps in woodland caribou ecology. The ARCKP is governed by a steering committee of government and industry representatives who oversee the allocation of ARCKP funds and guide the operation of the partnership. Their goals include:

- creating a forum for discussion and identification of woodland caribou issues and solutions
- providing industry with science-based recommendations that can be tailored to their region
- funding research advances in Alberta's forestry practices and woodland caribou management
- facilitating the implementation of science-based caribou habitat management solutions through knowledge exchange

For more information, visit arckp.ca

Foothills Landscape Management Forum

Over the past 20 years, the FLMF provides the governance structure for energy and forestry companies and government to reduce industrial impacts through integrated land management. The Aseniwuche Winewak Nation is also a member of the FLMF and through the forum, manages:

- The Caribou Patrol Program, which works to reduce caribou mortality in the AWN's traditional territory through highway patrols and education.
- Traditional land use studies that formally document the AWN's culturally significant sites to preserve them from future disturbance.
- Participation in the INOQOM Education Project, an Indigenous education program for local schools.

For more information, visit flmf.ca and caribouparol.ca

Foothills Streamcrossing Partnership

Established in 2006, the FSCP consists of 25 industry partners that coordinate efforts to inventory, monitor and repair stream crossings across Alberta. This has resulted in an online database of over 33,000 inspections of 13,500 industry owned stream crossings. Through collaboration with other crossing owners in the watershed FSCP members can plan to fix fish barriers in a sequential order moving up the watershed and address sedimentation problems from the top of the watershed down. The result is efficient use of resources while encouraging dialogue between stakeholders and regulators so that surrounding concerns in the watershed are taken into consideration.

The FSCP has reconnected over 1,855 kilometres of fish habitat through the inventory and remediation of 740 stream crossings. 75% of the barriers mitigated were in watersheds with Critical Habitat for SARA listed fish species.

For more information, visit fscp.ca

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.

FGrOW 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 contribute unique expertise, while drawing on the strengths of the other project teams.

For more information, visit fgrow.ca

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:

- Testing the efficacy of pest management products
- Improving application methods
- Studying their environmental impacts
- Developing practical strategies for pest management
- Knowledge and technology transfer through workshops and meetings

For more information, visit serginternational.org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