fRI Research
Informing Land & Resource Management

2016–2017 **Annual Report**

TABLE OF CONTENTS

MESSAGE

FROM THE PRESIDENT

Jesse Kirillo

Many times when people reminisce about the start of non-profits, they talk about its humble beginnings. Well, there was nothing humble about the ambitions of that first group of foresters, biologists, and GIS specialists, nor the following 25 years of research.

fRI Research began out of a need for practical science on a working landscape and to this day we continue that mission. The 25 years of achievement is due to the dedication and hard work of hundreds of individuals over the years, and the steadfast support of partners that are committed to sound research.

This was no ordinary year here at fRI Research. The pages in this annual report show just some of the exciting results that showcase the incredible passion of our researchers.

Thank you all for your support of fRI Research over the past quarter century. There will be no shortage of new challenges and opportunities in the years to come, but I am confident that, as an organization and with your support, we will continue to find innovative, collaborative, and scientifically supported outcomes to those challenges.

FROM THE GENERAL MANAGER

Ryan Tew

We are celebrating a major milestone with the 2016–17 edition of the Annual Report: our 25th Anniversary. Throughout the past 25 years—from the Foothills Model Forest to fRI Research—this organization has succeeded at providing excellent applied research to help answer our partners' questions. For that success, I want to thank all the dedicated, talented people who have given their time and effort to fRI Research. Our staff have always shown the highest levels of integrity and diligence, and I sincerely appreciate their efforts.

Thank you also to our shareholders and partners who continue to value both the opportunities for collaborative research that our programs and associations provide, and ultimately the results that ensure our natural resources are managed responsibly.

The other milestone we have recognized in this Annual Report is the completion of our 2012–2017 business cycle, and the 5-year business strategy "Moving Research Into Practice." This ambitious document helped guide us through the sometimes murky waters of an economic downturn, rapidly changing technology, and changing partner priorities.

We are now preparing a new 5-year business strategy to take us on the next stage of our organization's path. This time we have gone through a substantial consultation process with staff, board members, and other partners. The new fRI Research business strategy will act as a roadmap for our continued success.

FRI RESEARCH BOARD OF DIRECTORS 2016–2017

Dr. Rick Bonar[1], Chief Biologist – Hinton Wood Products, a division of West Fraser Mills Ltd.

Mark Boulton[2], Senior Environmental Advisor – Suncor Energy

Tom Burton[3], Director, District 4 – Alberta Association of Municipal Districts and Counties

Mark Cookson, Woodlands Manager – Blue Ridge Lumber Inc., a division of West Fraser Mills Ltd.

Wendy Crosina, Manager – Wildlife Ecology, Weyerhaeuser Company Limited

Garth Davis, Senior Coordinator – Land Management, ConocoPhillips Canada

Steve Donelon[4], Assistant Deputy Minister – Parks Division, Alberta Environment and Parks

John Doornbos, Manager – Operational Programs, Northern Forestry Centre, Canadian Forest Service, Natural Resources Canada

Cory Enns[5], Director – Policy and Capacity, Alberta Indigenous Relations

Alan Fehr, Superintendent – Jasper National Park, Parks Canada

Earl Graham[6], Director – District 2, Alberta Association of Municipal Districts and Counties

Dr. Ken Greenway, Director – Strategic Forestry Initiatives Section, Alberta Agriculture and Forestry

Dawna Harden[7], Director, Stewardship – Alberta Aboriginal Relations

Stan Holmes, General Manager – Alberta Timberlands, Weyerhaeuser Company Ltd.

John Kerkhoven[8], Senior Advisor – Foothills Gas, Suncor Energy Inc.

Jesse Kirillo, External Relations – Repsol Oil and Gas Canada Inc.

Dr. Vic Lieffers[9], Department Chair and Professor – Department of Renewable Resources, University of Alberta

Dr. Ellen MacDonald[10], Department Chair and Professor – Department of Renewable Resources, University of Alberta

Bruce Mayer, Assistant Deputy Minister – Forestry Division, Alberta Agriculture and Forestry

Fred Radersma, Manager – Woodlands Alberta, Norbord Inc.

Salman Rasheed, Manager – Resource Conservation, Jasper National Park, Parks Canada

Travis Ripley, Executive Director – Fish and Wildlife Policy Branch, Alberta Environment and Parks

Noel Roberts, General Manager – Woodlands Alberta and British Columbia, Norbord Inc.

Gordon Sanders, Chief Forester, Alberta – West Fraser Mills Ltd.

Darren Tapp, Executive Director – Forest Management Branch, Alberta Agriculture and Forestry

Jon Taszlikowicz, Woodlands Manager – Alberta Fibre, Canfor Corporation

Dwight Weeks (Alternate), Planning Coordinator – Canfor Corporation

fRI Research Officers 2016–2017

Dr. Rick Bonar[11], President– fRI Research; Chief Biologist – Hinton Wood Products, a division of West Fraser Mills Ltd.

Jesse Kirillo[12], President– fRI Research; External Relations – Repsol Oil and Gas Canada Inc.

Erica Sivell, Treasurer – fRI Research; Divisional Controller - Hinton Wood Products, a division of West Fraser Mills Ltd.

Garry Power, Divisional Controller – Hinton Pulp, a division of West Fraser Mills Ltd.

Bill Tinge[13], General Manager – fRI Research

Ryan Tew[14], General Manager – fRI Research

1. Resigned January 2017
2. Appointed June 2016
3. Appointed January 2017
4. Resigned September 2016
5. Resigned January 2017
6. Resigned January 2017
7. Appointed January 2017
8. Resigned June 2016
9. Resigned June 2016
10. Appointed June 2016
11. Resigned January 2017
12. Appointed January 2017
13. Resigned June 2016
14. Appointed June 2016

PARTNERS

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

Shareholders

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

** Companies are shareholders through the Foothills Energy Partners*

Program and Project Partners

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

Alberta Indigenous Relations
Alberta Agriculture and Forestry (Hinton Training Centre)
Alberta Biodiversity Monitoring Institute
Alberta Conservation Association
Alberta Energy Regulator
Alberta Environment and Parks (Parks Division, Land Use Secretariat; William A. Switzer Provincial Park)
Alberta Fish & Game Association
Alberta Institute of Agrologists
Alberta Innovates
Alberta Newsprint Company
Alberta-Pacific Forest Industries Inc.
Alberta Plywood, a division of West Fraser Mills Ltd.
Alberta Professional Planners Institute
Alberta Riparian Habitat Management Society (Cows and Fish)
Alberta Upstream Petroleum Research Fund
Apache Canada Ltd.
Arctos Ecological Consulting
Aseniwuche Winewak Nation of Canada
Athabasca Watershed Council
Bandaloop Landscape-Ecosystem Services
Battle River Watershed Alliance
BC Oil and Gas Commission
BC Oil and Gas Research and Innovation Society
Beaver River Watershed Alliance
Blue Ridge Lumber, a division of West Fraser Mills Ltd.
Borealis Ecology Wildlife Research
Bow River Basin Council
Canadian Association of Petroleum Producers
Canadian Boreal Forest Agreement
Canadian Institute of Forestry (Rocky Mountain Section)
Canadian International Oil Corp.
Canadian Natural Resources Limited
Canadian Wildlife Health Cooperative
Cenovus Energy Inc.
City of Grande Prairie (Tourism Centre)
County of Grande Prairie No. 1
Cumulative Environmental Management Association

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

Alignment Partners

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

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

1992

Foothills Forest Begins

President Bob Udell

GM Rick Blackwood

2000

Premier's Award

GM Mark Storie

2004

Emerald Award

ABORIGINAL INVOLVEMENT PROGR

HARLEQUIN DUCK PROGRAM

LOCAL LEVEL INDICATORS PROGRAM

FOREST WILDLIFE AND ECOLOGY PROGRAM

GRIZZLY BEAR PROGRAM

DIGITAL INVENTORY & ECOLOGICAL CLASSIFICATION PROGRAM

HABITAT SUITABILITY INDEX PROGRAM

WOODLAND CARIBOU PROGRAM

1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004

ADAPTIVE FOREST MANAGEMENT HISTORY PROGRAM

WATERSHED PROGRAM

FISH AND WATERSHED PROGRAM

COMMUNICATIONS PROGRAM

GIS PROGRAM

SOCIO-ECONOMIC PROGRAM

NATURAL DISTURBANCE PROGRAM

ALBERTA FOREST BIODIVERSITY MONITORING PROJECT

FIRESMART & WILDFIRE RESEARCH PROGRAM

FORESTRY RESEARCH PROGRAM

FOOTHILLS GROWTH AND YIELD ASSOCIATION

1994

Foothills Model Forest

2002

GM Don Podlubny

2007

foothills RESEARCH INSTITUTE
Research Growing Into Practice

Foothills Research Institute

CFS Team Merit Award

2010

President Rick Bonar

CIF Forest Management Group Achievement Award

2013

GM Bill Tinge

2015

fRI Research
Informing Land & Resource Management

fRI Research

ALBERTA LAND-USE KNOWLEDGE NETWORK

AM

CARIBOU PROGRAM

2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017

FOREST HISTORY PROGRAM

WATER PROGRAM

HEALTHY LANDSCAPES PROGRAM

MOUNTAIN PINE BEETLE ECOLOGY PROGRAM

FOOTHILLS STREAM CROSSING PARTNERSHIP

CARIBOU LANDSCAPE MANAGEMENT ASSOCIATION

FOOTHILLS LANDSCAPE MANAGEMENT FORUM

FOREST GROWTH ORGANIZATION OF WESTERN CANADA

ALBERTA FOREST GROWTH ORGANIZATION

TREE IMPROVEMENT ALBERTA

2005

President Jim LeLacheur

2008

Tom Archibald

2014

Alberta Chamber of Resources Environmental Award

2016

President Jesse Kirillo

GM Ryan Tew

ALBERTA LAND-USE KNOWLEDGE NETWORK

460 LAND USE RESOURCES AT LANDUSEKN.CA AND 72 VIDEOS ON YOUTUBE

LAUNCHED AN ONLINE URBAN AGRICULTURE COURSE

TERRI MCHUGH TAKES OVER FROM KIRBY WRIGHT AS PROGRAM LEAD

CARIBOU PROGRAM

A STAKEHOLDER WORKSHOP DETERMINED THAT A PROGRAM IS NEEDED TO TACKLE CRITICAL KNOWLEDGE GAPS

FIRST FULL YEAR OF OPERATION FOCUSED ON THE EFFECT ON CARIBOU OF LINEAR FEATURES AND MPB

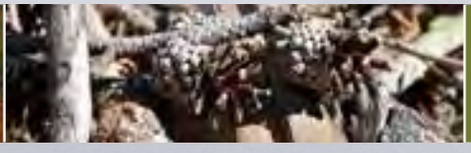
FOOTHILLS LANDSCAPE MANAGEMENT FORUM

LAUNCHED THE CARIBOU PATROL PROGRAM

RECEIVED THE "SHARED FOOTPRINTS" EMERALD AWARD

FOOTHILLS STREAM CROSSING PARTNERSHIP

2,000+ TOTAL CROSSINGS INSPECTED; 46 CROSSINGS REPAIRED



FOREST GROWTH ORGANIZATION

2012

2013

2014

FOREST HISTORY PROGRAM

PUBLISHED TRANSCANADA ECOTOURS NORTHERN ROCKIES HIGHWAY GUIDE

PUBLISHED A 50-YEAR HISTORY OF SILVICULTURE ON THE HINTON FOREST

E-BOOK VERSIONS RELEASED FOR MOUNTAIN TRAILS, LEARNING FROM THE FOREST, AND OTHER PUBLICATIONS

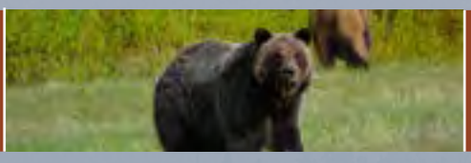
GIS PROGRAM

TIME DEVOTED TO DATA ENTRY, GPS EQUIPMENT, AND MAPPING

STARTED USING ARCGIS ONLINE TO FOCUS MORE ON CUSTOMIZATIONS AND HIGHER ANALYSIS

GRIZZLY BEAR PROGRAM

STENHOUSE RECEIVES THE J. DEWEY SOPER AWARD FROM THE ALBERTA SOCIETY OF PROFESSIONAL BIOLOGISTS



DID THE FIRST EVER REPEAT INVENTORY OF GRIZZLY BEARS IN THE YELLOWHEAD

LAUNCHED THE GRIZZLY SCAT APP

HEALTHY LANDSCAPES PROGRAM

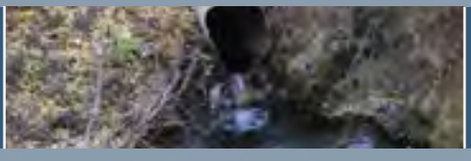
CREATED A BLUEPRINT FOR THE NEXT PHASE OF THE HLP ADDING MORE KNOWLEDGE SHARING

MOUNTAIN PINE BEETLE ECOLOGY PROGRAM

KEITH MCCLAIN TAKES THE LEAD, REFOCUSING THE RESEARCH PROGRAM AND EMPHASISING COMMUNICATION OF RESULTS

WATER PROGRAM

FIRST FULL YEAR OF OPERATIONS; LED BY AXEL ANDERSON, THE PROGRAM IS FOCUSED ON HYDROLOGY



AGREEMENT BETWEEN THE PROVINCE AND THE U OF A ALLOWS THE PROGRAM TO ADD 2 POST-DOCS, 3 PHD STUDENTS, AND 1 MSC STUDENT

LAUNCHED AN ONLINE COURSE TO HELP MUNICIPALITIES IMPLEMENT THEIR REGIONAL LAND USE PLAN

LIBRARY HAS EXPANDED TO 1250 RESOURCES AND 782 VIDEOS

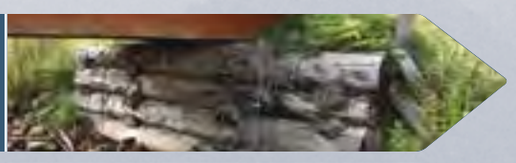
PROGRAM ADDS PROJECTS ON WELL SITES, FORESTRY, AND CARIBOU HEALTH

WITH THE GIS PROGRAM, LAUNCHED THE CARIBOU FOODS DECISION SUPPORT TOOL

COMPLETED AN INVENTORY OF SEISMIC LINES FOR RESTORATION

COLLABORATED ON THE ROADWAY WATERCOURSE CROSSINGS REMEDIATION DIRECTIVE

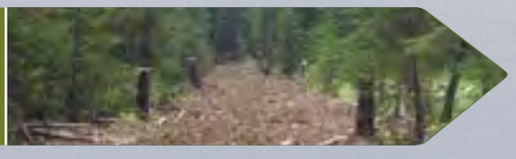
16,000+ CROSSINGS INSPECTED; 210 CROSSINGS REPAIRED



OF WESTERN CANADA

AFGO, FGYA, MWMA, WESBOGY AMALGAMATE TO CREATE FGROW

TIA JOINS, BRINGING TOGETHER GROWTH AND YIELD WITH TREE IMPROVEMENT RESEARCHERS



2015

2016

2017

NORTHERN ROCKIES ECOTOUR APP RELEASED

PUBLICATION OF A 25-YEAR HISTORY OF FRI RESEARCH

TIME DEVOTED TO DATA ARCHITECTURE, TRAINING PROGRAMS ON GIS BEST PRACTICES, AUTOMATION, AND TOOL MAKING

SCAT SEEKERS: A CITIZEN SCIENCE EFFORT WITH PARKS CANADA

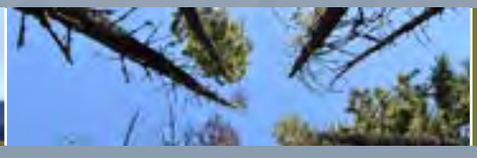
STENHOUSE RECEIVES THE TREE OF LIFE AWARD FROM THE CANADIAN INSTITUTE OF FORESTRY

$1.4M NSERC GRANT FOR A GRIZZLY BEAR PROGRAM PARTNERSHIP TO STUDY BEARS IN THE YELLOWHEAD

DEMONSTRATION OF THE HEALTHY LANDSCAPES APPROACH COMPLETED IN NORTHEAST ALBERTA

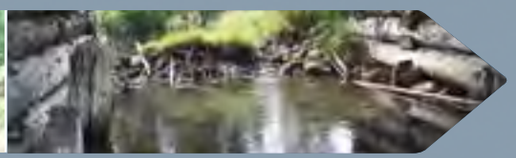
LAUNCHED LESSONSFROMNATURE.CA

SERIES OF DIALOGUE SESSIONS HELD ACROSS ALBERTA TO BUILD ACCEPTANCE OF THE SCIENCE AMONG LAND MANAGERS



ANNUAL INFORMATION FORUM ADDS A FIELD TOUR COMPONENT
LAUNCHED THE CITIZEN SCIENCE PINE BEETLE APP

JOINED THE PROVINCIAL WATERSHED RESILIENCY AND RESTORATION PROJECT



3-IN-1

When the Caribou Program launched in 2013, one of its first big projects brought together some of the most significant environmental challenges in the foothills. Mountain pine beetle was invading over the Rockies, and both the infestations themselves and the control efforts of government and industry were new for the area. And that area happens to be habitat for two threatened species: caribou and grizzly bear.

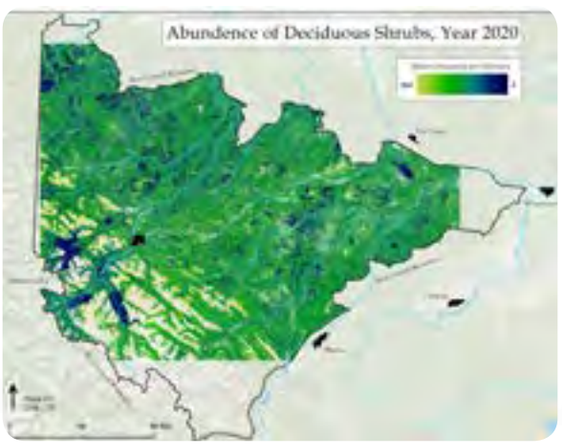
"Managing one affects them all. And that's tricky, because they want different things," says Barry Nobert, wildlife biologist.

The project untangles these issues by seeing what happens to the amount of caribou and grizzly bear foods after four types of disturbance: MPB-killed stands, cut and burn control efforts, forest harvesting, and wildfire.

In the summers of 2014 and 2015, field crews surveyed the 34 most important foods for caribou and grizzly bears—key species such as lichen, berries, and clover. All told, they went to over 700 locations, chosen so that they got data from sites that had a range of time to recover from those events; some locations had just recently been hit by mountain pine beetle, for example, while others had seen wildfire decades ago.

In 2016, Nobert began analyzing the food data. For each species of food, he worked out the mathematical equation that predicts how abundant it will be after any given year following each disturbance scenario.

Over the winter, the GIS Program took those equations and built a tool that simulates all these foods for a given scenario. Forestry companies can draw the shape of a proposed MPB control area or cut block, and the tool will tell them how that will change the abundance of caribou and grizzly bear foods in that area.



"I hope it'll be used to make decisions about managing MPB in a way that minimizes impact on caribou and grizzly bear. However food abundance is only one aspect of habitat," cautions Nobert. "In isolation, it's not holistic enough to tell us how to conserve the species."

That's why the Caribou and GIS Programs are hard at work to expand the tool to simulate mortality risk and other key parts of the story.

Does this ring a bell?

This project builds on research Terry Larsen of the Grizzly Bear Program completed in 2012.

Conceptually similar and narrower in scope, that work focused on the effects of surge harvesting—a way to mitigate MPB's impact by reducing the amount of lodgepole pine in the foothills—on 15 grizzly bear food species.

WHAT WILL MPB DO TO STREAMS?

University of Alberta PhD student Amy Goodbrand is investigating whether disturbance, human-caused or natural, can lead to changes in an area's hydrology.

It stands to reason that it would, since trees regulate the water balance in an area. They intercept rain and snow, reducing and slowing the amount that reaches the ground; they breathe out water and oxygen; and they decrease snowmelt and evaporation by shading the ground. It could be that without a forest canopy, more water will hit streams faster resulting in higher peak flows. This could mean flooding and damaged infrastructure.

In 2008, researchers set up a site in the pine forests of the foothills south of Hinton to test this. They set up four test plots, each with a different treatment. Two were experimental plots simulating severe and moderate MPB attack by injecting all the trees or half the trees, respectively, with herbicide. One plot they logged, to see what salvage harvesting would do, and the final plot was left alone, as a control. Then they recorded a suite of hydrological data such as: weather, precipitation, soil moisture, water table, and volume of intercepted by the trees.

In phase one, the needles of the herbicide-killed trees turned red, and gradually began to drop off, as they would in the red attack phase of a mountain pine beetle infestation. By 2012, the trees killed by herbicide had lost their needles, entering the grey attack phase. Goodbrand took up this second phase of the project, which will have its final field season in 2017.

So far, the results are surprising. Even during dry years when the canopy in the control plots should be intercepting a larger proportion of precipitation, the MPB-attacked plots are not showing a large change. One reason might be that without a canopy, more water evaporates, cancelling out some of the effect.

Goodbrand is also working on a nearby project at the tri-creeks area, which is examining questions of the effects of harvesting on the hydrology of streams.


WARNING

KNOWLEDGE SHARING:
FORUM AND FIELD TOUR

Perhaps the most important counter to the spread of mountain pine beetle is the spread of information. That's why, for the MPBEP, publishing research is only the halfway point; the next crucial stage is getting that research in front of policy makers and practitioners who can put it to work. That's when our science has an impact. The primary venue for making that happen is at the annual MPB Information Forum, which brings together everyone with an interest in mountain pine beetle.

"We can't be on the sidelines. Research has to influence and inform at the practitioner level," said Derek Sidders of Natural Resources Canada's Wood Fibre Centre.

As always, the 2016 forum was well attended by researchers from universities across Canada, elected officials, government scientists, and foresters. The researchers involved in the MPBEP's suite of research presented their progress and led discussions among all the stakeholders.

And for the 2016 event, McClain took this to the next level by holding it in Grande Prairie, rather than Edmonton, in order to add a field tour to the agenda. The bus took the whole gathering out into a Canadian Wood Fiber Centre stand regeneration trial, led by Sidders and in collaboration with University of Alberta scientists.

"It was Keith McClain's idea. At the last forum, he asked if it would be logistically possible to go to our site and see some regeneration practices in a real field setting. I said of course." Sidders added, "seeing it visually, on the ground, rather than a PowerPoint 500km away brings some reality to it and makes it much clearer."

The trial is testing different site preparations so that replanting can be as effective as possible after the beetle has moved through, speeding up regeneration and improving forest health. It's a strong example of the MPBEP expanding beyond research on the beetle's biology and ecology, and starting to answer the crucial questions: What happens after the beetle has gone through a stand? How should land managers respond?

"We really wanted to get through to the forest companies and provincial government staff in charge of establishing operating standards. We wanted them to see that although it takes a bit more effort, the approach we're testing is really just tweaking current operations. That was very successful."

KNOWLEDGE SHARING:
LESSONSFROMNATURE.CA

The Healthy Landscapes approach is a fresh take on reducing the cumulative effects that can arise from multiple pressures on the landscape. Instead of regulating each individual value—timber volume, caribou, recreation, etc.—piecemeal, the Healthy Landscapes approach sets the desired end state of the entire landscape at the beginning, and uses natural and human disturbance as a tool to achieve that. Though now backed by a decade of science, it is not as well understood by land-use practitioners and policy makers as the status quo.

To help make these new ideas accessible, the Healthy Landscapes Program (HLP) has launched lessonsfromnature.ca, an interactive website packed with information delivered through video, text, animation, and maps. The site is designed to allow users to freely explore concepts such as wildfire, resilience, old growth forest, or cumulative effects in any order and at any pace. It was launched in July 2016.

Another outreach effort of the program is a short online course, in partnership with the Woodland Operations Learning Foundation. The course is delivered in the "live online" format, where students log on remotely, participate in real time with instructors and other students. The first run of the course took place in February 2017, with more planned.

The ultimate goal is not merely to deliver facts, but to spark a conversation about the merits of the Healthy Landscapes approach. Managing the land with the entire ecosystem in mind is a complicated task, but with engagement and dialogue, improvement is possible.

GRIZZLY PAW

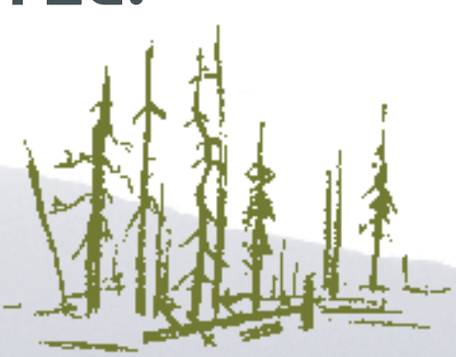
A new $1.4M collaboration is large even by the standards of the Grizzly Bear Program, which has for nearly two decades been forging partnerships with research groups around the world. The Grizzly-PAW project brings together Grizzly Bear Program researchers with a team from four Canadian universities with a range of specialties (see sidebar).

The Yellowhead region of Alberta, also called Bear Management Area 3, comprises the population of grizzly bears in west-central Alberta between Highways 11 and 16. This area has both the relatively undisturbed Jasper National Park and the foothills to the east, with active forestry and energy development. The Grizzly-PAW project will study the effects of development on the habitat, behaviour, and health of grizzly bears.

The project will employ the latest methods, many tested and improved in recent years by the Grizzly Bear Program. For example, using scat and hair for non-invasive DNA sampling, and capturing and collaring bears to assess movement and habitat selection. The data generated by these approaches complements, for example, the remote sensing expertise at UBC, and the veterinary experience at the U of S.

What we learn from this project will improve recovery strategies and contribute to the longterm conservation of grizzly bears.

MOUNTAIN PINE BEETLE: THE RED SPREAD



As the mountain pine beetle (MPB) spreads east through Alberta, it will reach "naïve" pine forests—trees that are not adapted to resisting the insect. This sounds like bad news, but what will happen is still an open question that Allan Carroll of UBC is investigating.

The MPB's preferred host species is lodgepole pine, however they can attack mixed stands of lodgepole pine and jack pine. By the time they reach the Saskatchewan border, they will be into pure jack pine stands and may become epidemic. On the other hand, Carroll and his collaborators have discovered that they are running into other insects that are out-competing and even eating MPB.

But maybe the biggest factor driving the spread east (and north) is climate. The recent string of warm winters has boosted MPB populations and driven their range expansion. It may turn out that climate change will decide the question.

The last two years of research have revealed these key factors, and the next step for Carroll and the Mountain Pine Beetle Ecology Program (MPBEP) is to put it all together and model where MPB populations on the leading edge will stall out or continue their destructive march.

Governments and industry in Saskatchewan, Manitoba, and Ontario will be very interested in knowing the answer.

Research Collaborators

Nicholas Coops
University of British Columbia
Specialty: remote sensing

Gordon Stenhouse
fRI Research
Specialty: grizzly bear biology

Scott Nielsen
University of Alberta
Specialty: ecology

David Janz
University of Saskatchewan
Specialty: conservation physiology

Chris Darimont
University of Victoria
Specialty: conservation

And at least 13 graduate students.

The $1.4M NSERC CRD grant matches contributions from 11 industry partners:

- Canfor
- Conoco-Phillips
- FRIAA
- Seven Generations Energy
- Shell Canada
- Repsol
- Teck Coal
- TransCanada Pipelines
- West Fraser Ltd.
- Westmoreland Coal
- Weyerhauser

FOOTHILLS REFORESTATION INTERACTIVE PLANNING SYSTEM (FRIPSY)

To ensure Alberta's forests are managed sustainably, the amount that forestry companies can harvest each year depends in large part on how much grows back. Getting that number right is important to everyone. Crucial to the companies, who are charged with the responsibility of reforestation after harvest, is understanding how the number is influenced by their reforestation practices. So they are working together under the FGrOW umbrella on FRIPSY, a model that will let them know ahead of time if their regrowth is on track.

The model takes real data from another FGrOW project called the Regenerated Lodgepole Pine (RLP) trial to model growth of pine for the first 14 years after harvest. Planners can see how factors like planting effort, site preparation, site conditions, and climate will affect the growth and survival, allowing them to weigh the costs and benefits of different reforestation strategies. The next release of FRIPSY will integrate with the Alberta Government's growth model, allowing projection to stand maturity and prediction of a key measure of reforestation success, mean annual increment).

Ongoing measurements from the RLP trial will be used to update FRIPSY and allow it to model beyond 14 years. Because FRIPSY was developed using data from the RLP, it only predicts lodgepole pine and aspen regeneration. An important enhancement is to add other species to the model. The data for that will come from other FGrOW projects, including the Provincial Growth and Yield Initiative (PGYI; see sidebar) and the EPH Project.

PGYI is a provincial initiative to pool data from the government and all FMA holders in Alberta, so that everyone can benefit from better growth and yield models.

This data comes mostly from industry and government permanent sample plots, which are repeatedly measured to assess stand and tree level growth.

THE EMPIRICAL POST HARVEST STAND ASSESSMENT PROJECT (EPH)

Experienced foresters have a pretty good feel for how stands will grow back after harvest, based on their personal observations. Handy though this has been, forest companies needed to move beyond anecdote and intuition and plan more scientifically.

The first stage, EPH I, in this effort gathered regeneration survey data collected from the mid-1980s to present from across the province and returned to 58 cutblocks to re-measure the current stand conditions. This was completed in 2012. However, because there are so many ecological regions and treatment options, a far more comprehensive dataset was needed.

The second stage, EPH II, is now re-measuring an additional 36 cutblocks. Along with more regeneration survey data, EPH II has gathered data from a host of other projects, including PGYI, the WESBOGY Long-term Study, the Alberta Reforestation Information System, and other permanent sample plot trials. The effort started in 2015, and will give the forest industry a much better idea of how silviculture treatments will affect the long-term growth of different stands.

TURNAROUND

Federal recovery strategies mandate that 65% of caribou habitat be undisturbed; given the amount of disturbance in caribou range and the slow paced regrowth of the boreal forest, it will be a while before Alberta hits that target. Since all habitat can't be restored immediately, a major focus of conservation is prioritizing the efforts that will help the most. The race is on to identify the most important areas for protection and restoration, and to make sure they are connected by suitable habitat.

Karine Pigeon and Tracy McKay, Caribou Program wildlife biologists, developed a method for identifying high quality habitat patches, areas where caribou spend a significant amount of time. This was done by mapping years of caribou movement data and looking for spots where caribou tarried, places where caribou zig-zagged and circled back rather than traveling in a straight line.

"It's cool, because when we mapped out the caribou movement paths, we could see a story from those patterns," says McKay.

To make the identification process objective, McKay ran a computer script that analyzes each caribou's movement paths to look for sections where it was moving slower and turning a lot. These movements define places within the caribou's home range where they spent more time, and we assume that there is something there that provides the caribou with a benefit, either food or safety from predators.

With a map of high quality habitat patches in hand, the next step was to learn everything we can about these areas that caribou seem to favour.

We only have information for caribou that were fitted with a GPS collar, so the team compiled information for those caribou locations, such as elevation, slope, distance from roads, and other information on anthropogenic disturbances. By learning about the patches we've observed, we'll be able to predict and map patches for places where we don't have data. Field crews have also started bushwhacking out to the patches to get fine scale information such as which plants are growing there and how much hiding cover there is.

The next step was to map out these patches on the landscape, and look at how high quality habitat patches have changed over the years. The team discovered that the number and total area of these patches has decreased between 1998 and 2016. Industrial development now occurs within some of the former patches, which may explain the decline. With the publication of the team's results and the ability to predict patches on the landscape, land managers will be equipped to avoid more industrial overlap with areas of high quality habitat for caribou.

As well as protecting and restoring known and predicted high quality habitat patches, we hope it will be possible to test new forestry practices—stand thinning, for example—which may create the conditions for more patches. Another important step is to look at the caribou locations that aren't in high occupancy habitat to identify and characterise movement corridors. After all, focusing conservation efforts on small, isolated patches that caribou can't get to would be a mistake.

What we're finding should help government and industry set priorities for conservation, and set caribou in Alberta on a path to recovery.

Photos by Adam Sprott

STREAM CROSSING PARTNERSHIP IN FULL FLOW

The Foothills Stream Crossing Partnership (FSCP) is a growing group of stream crossing owners who came together to meet a big need. There are approximately 50,000 stream crossings in Alberta and the condition of most is completely unknown. Complicating matters is the fact that the responsibility for them lies with no small number of stakeholders, including governments, companies, and private land owners.

Many stream crossings don't meet regulatory requirements because they impede fish passage back upstream to critical habitat, or because they are shedding too much sediment into the watercourse, causing real problems to the health of streams throughout Alberta.

To get a handle on the problem, the first task is to actually go out to those thousands of stream crossings and determine which are satisfactory and which are priorities for remediation. To that end, FSCP has built a database of 16,000 inspections that they have carried out over the last decade. A stream crossing inventory of this scale, with the cooperation of competing companies and industries is both unprecedented and invaluable.

With an expanding database, the FSCP worked with the Government of Alberta on their 2015 Roadway Watercourse Crossings Remediation Directive, and helped regulators pick priority watersheds for remediation so that efforts will deliver the biggest ecological benefit. In 2016, they focused on 10 watersheds (up from five the previous year), each with several stream crossings to inspect and repair.

With this work in full flow, the FSCP has ramped up stream crossing remediation. Each crossing repair requires significant expertise, planning, and approval. Nevertheless, in 2016 the FSCP repaired more stream crossings than ever before.

The challenge is big, but the FSCP continues to build capacity to meet it. It has added three new members this fiscal year and work has begun on an updated inspection manual that will help with training and carrying out inspections.

FSCP Members

- Paramount
- Canfor
- Cenovus
- Millar Western
- Repsol
- Shell Canada
- West Fraser
- Weyerhaeuser

New in '16–17

- Canadian International Oil Corporation
- Devon
- Seven Generations Energy
- Taqa North


Crossings Repaired
2011: 17
2012: 29
2013: 25
2014: 22
2015: 48
2016: 69
0
10
20
30
40
50
60
70

EXPLORING 1920S TIE LOGGING IN THE WHIRLPOOL VALLEY

Peter Murphy has a mission to uncover the history of forestry in Alberta. One of his current projects has him investigating a seemingly unlikely place: Jasper National Park.

"The first archival evidence I had of the Whirlpool logging was this map," says Murphy.

Sifting through the archives at the Jasper Yellowhead Museum, he found a compass survey map from 1919 titled Whirlpool River Timber Limits made by the resident engineer, a fellow named J. Grant MacGregor.

In the early 20th century, Canada was stitching itself together with railroads. Tracks need over 3,000 wooden crossties every mile, and the line being built through Jasper was no exception. So, in the 1920s, a local outfit set up a tie logging camp in the Whirlpool valley, about 20 kilometers south of the Jasper townsite.

There isn't much left of the three tie camps—a rotting section of a log wall, a few nails, some sawdust—but through years of expeditions, Murphy and his partners Tom Peterson and Mike Dillon, have pieced together many of the details: how the camps were supplied, how the ties were hand hewn with a broad axe the first two years before a sawmill was set up, and even how the forest got started.

"My hypothesis is that there was a fire in the valley in 1760 that created this landscape, and it was that crop of pine that was seeded in and grew to what we see today."

There were riddles; the 1919 map wasn't perfect, and in 90 years, things change—the size of lakes, the course of rivers.

"This was unsurveyed terrain at the time. He found a big boulder from which he could get bearings on two peaks and establish that on maps."

So the first step was to find MacGregor's boulder and get the GPS coordinates for it. With the starting location of the 1919 survey fixed, Josh Crough of the GIS Program used a method called rubber sheeting to "stretch" the old map so that it lines up with modern aerial and satellite imagery, correcting the old inaccuracies and showing where the tie camps and timber limits actually were.

But there were still some loose ends. They have an idea about how the ties were floated from the camps to where the jackladder pulled them out. To know for sure, they returned to the park and crossed to an island in the Athabasca River at low water. They were right—there was a rock-filled crib for an anchor on the island for the booms that caught the ties as they came downstream.

In case more proof was needed, Murphy and Dillon later found, waterlogged and lodged in 90 years of mud at an old landing up the Whirlpool, a hand-hewed railway tie, perfectly preserved.

The fRI Research Autobiography

In November 1992, Foothills Model Forest became one of the ten members of the new Canadian Model Forest Network. All were "living laboratories" for developing new and innovative sustainable forest management approaches across Canada.

Bob Udell, our first President (1992-2004), along with writer Bob Bott, is chronicling our 25-year history as we grew into a full research institute with a broad scientific and geographic scope. The book will be completed in the winter of 2017 and will mark the end of the 20-year Forest History Program at fRI Research.

SEISMIC LINE RESTORATION

Thousands of kilometers of seismic lines criss-cross caribou habitat in west-central Alberta. Many legacy lines that were cut decades ago have been slow to regenerate naturally. This is a problem for Alberta's caribou herds, which are declining where seismic line densities are high. The consensus is that this is because seismic lines are good habitat for moose, deer, and elk, whose abundance, in turn, draws more predators into caribou ranges.

Restoring these lines has increasingly become the focus of caribou conservation. In 2010, the FLMF began compiling an inventory of the condition of seismic lines in caribou habitat, and in 2013, they began incorporating provincial LiDAR imagery to estimate vegetation levels.

With a comprehensive inventory of 12,000 km of seismic lines within the Little Smoky and A La Peche caribou ranges, the FLMF then turned to the task of planning for their restoration. The idea was to start with seismic lines whose restoration will provide the greatest benefit to caribou. Seismic lines that are very inaccessible, are likely to restore naturally, or where a forest company will harvest in the near future were winnowed out. During the first half of 2016, the FLMF worked with the Government of Alberta to narrow the inventory down to 4,000km of priority seismic lines. As the government finalizes and implements caribou range plans, FLMF will continue to provide input.

Foothills Landscape Management Forum

The FLMF is a group of companies from the forestry and energy industries practicing integrated land management.

Instead of everyone planning activities in isolation, the FLMF uses research done by the Caribou Program and other academic groups, collaborates with government, and creates an integrated industrial access plan that will have less environmental impact, especially on caribou.

CARIBOU PATROL: SEASON FIVE

Photo by Michael Merriam

The Caribou Patrol boosted its twin missions—reducing caribou mortalities on Highway 40 and public education—by expanding its partnerships.

They are working with Alberta Transportation to replace, improve, and increase the number of signs along Highway 40 to alert drivers that caribou may cross the road during migrations. Alberta Transportation will also add an icon on Alberta 511's driving conditions map during the bi-annual migrations.

On top of their usual tour of public education to classrooms around the province, Caribou Patrol were invited to attend the 2017 Jasper in January event, where they talked to over 300 people about the threatened species. They also joined Parks Canada at TELUS World of Science – Edmonton's Arctic Day event in February, where they passed out information at a booth and put on classroom activities.

The AWN Partnership

The Caribou Patrol is an Aseniwuche Winewak Nation of Canada (AWN) program that FLMF runs on their behalf, and employs AWN field technicians.

The AWN is based near Grande Cache, midway between Hinton and Grande Prairie along Highway 40, a major transportation corridor that migratory caribou herds must cross twice a year.

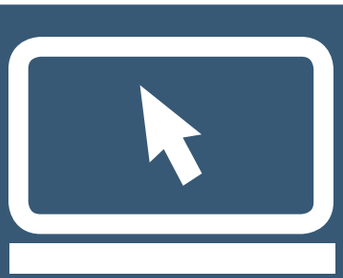
AWN field techs are also hired by the Caribou Program to help conduct research such as the lichen survey work described on the previous page.

THE ALBERTA LAND-USE KNOWLEDGE NETWORK

ALuKN continues to work towards being widely known as the information hub for any land-use question in Alberta. Land use is a broad topic, and that's reflected in the content that landusekn.ca curates. The website has grown to contain over 3000 resources on topics ranging from species at risk to water to communities to forestry.

Alongside this, their YouTube channel added more than 150 videos of presentations from conferences across the province in order to make them available to everyone who wasn't able to attend in person.

While the Knowledge Network has been building this library, they have also been working with the Land Use Secretariat to find new ways to help with the regional planning process. The regional plans set land use priorities, guide development, and establish environmental thresholds around Alberta. As the regional plans began to roll out—as of this publication, two are completed—the secretariat needed a way to give help and guidance to those responsible for implementing and complying with the plans. ALuKN has helped develop one solution, with the design of an online course to help municipalities navigate this new process. Through clear written summaries, videos, and graphics, it provides the basics of the regional plans, how to use them, and opportunities for users to dig deeper into the legislation. The course will be formally launched in fall 2017.



1250 resources in the library

782 publicly available videos on youtube

49,913 views on youtube this year

235,328 minutes viewed this year

6108 users on landusekn.ca this year

WATERSHED RESILIENCY AND RESTORATION PROJECT (WRRP)

In the wake of the 2013 floods in southern Alberta, the province launched the WRRP with the aim of getting a handle on the health of Alberta's watersheds. A healthy watershed provides many ecosystem services. It moderates water flow to reduce the risks of floods or droughts, protecting communities downstream, and it provides good habitat for fish and other species in and along streams.

The Water Program joined the WRRP in 2015 and took on the task of figuring out how to assess the health of watersheds and prioritize them for restoration.

"This has been a highly watched project," says Axel Anderson, Water Program lead. "Some of these methods may find their way into assessments of the condition of watersheds with SARA-listed Westslope Cutthroat Trout."

Researchers are collecting data to determine their condition and identify watersheds that aren't providing the full range of ecosystem services.

"We are presently focussing on sites in the headwaters of the Elbow Watershed, which is important for Calgary's drinking water supply, the upper Oldman, and the Castle Provincial and Wildland parks," says Michael Wagner, the field supervisor on the project.

The project wraps up in 2017.

TOOL TESTING

In the summer of 2016, Jared Fath began scouting locations and setting up silt fences along roads in the Simonette watershed near Grande Prairie. He's measuring how much sediment is coming off the roads to test a computer model called NetMap.

"I'm hoping the tool can be used to target environmental liabilities," says Fath. "It's huge because there is no made-in-Canada model to apply to roads."

NetMap, developed in the US, can identify trouble spots on roads that are likely to be shedding a lot of sediment into streams. The only problem: it wasn't calibrated for the soft, deep prairie soils found in Alberta. By gathering basic information like surface erosion rates off roads, Fath will be able to put NetMap to the test, and fine tune its algorithms so it is accurate for Alberta.

"Over the next two years, two graduate students a field crew will provide regional data and science," says Anderson. The goal is for users of the tools to be able to predict road and trail segments that are likely contributing the most sediment in streams identified by the Fisheries staff. This can then be used to guide Bull Trout rehabilitation and maintenance efforts in the eastslopes."

NetMap is also being tested near Sundre. "The idea is to gather data in different settings to get confidence in the model," says Water Program Lead Axel Anderson.

The Water Program is also looking to evaluate similar tools to help manage for drinking water.

SPADES: THE LANDWEB MODULE

Computer modeling is a key tool for scientists and land managers. Research groups often make big investments of time and money into developing models for specific needs. These models tend to be tailored for a specific purpose and aren't usually designed to integrate with the models from other research groups.

SpaDES, short for Spatially Discrete Event Simulator, is an open source modelling platform built to host any number of modules, such as climate, fire, or forest succession. As other research groups contribute modules relating to their own questions, everyone using the platform can benefit. This lets scientists extend their research into related or larger questions without starting from scratch.

The Healthy Landscapes Program has been backing SpaDES from the start, and is developing a suite of modules, collectively called Landscape dynamics of the Western Boreal, or LandWeB for short. These include vegetation data layers, forest succession, fire spread, and RSF layers for grizzly bears and caribou. Together, these modules will simulate scenarios at the massive scale of the western Canadian boreal.

The model outputs will allow land managers in government and industry to compare the pre-industrial range of landscape patterns such as old forest levels to those of today, and the future.

A beta version of the LandWeB suite was demonstrated in February 2017, where partners took it for a test drive to see what it could do. Model outputs are expected in the fall of 2017. These outputs highlight another benefit of SpaDES—web application interfaces can be easily created that are end-user customized. This will help make the results accessible to non-programmers, whether they are other scientists, policy makers, industry planners, or the general public.

SPADES: THE MPB MODULE

The Mountain Pine Beetle Ecology Program will be among the first research groups to make use of the SpaDES platform. Chubaty is developing an insect spread module for it (working title: MPB Boreal) that predicts the MPB expansion risks under different scenarios.

"Though the focus is on insect spread, I automatically have access to other modules to see the influence of fire or climate for example. This holistic approach really shows the power of the platform," says Chubaty.

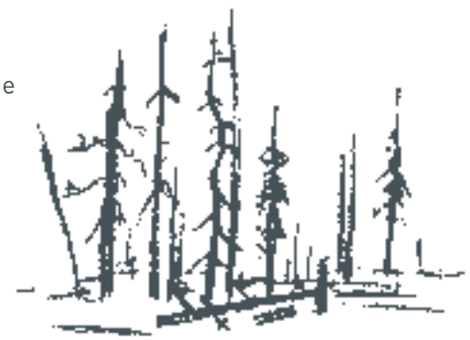
Depending on how much warmer the climate in western Canada gets over the coming decades, the MPB range is expected to expand at different rates and to different extents. Another key component that Chubaty is bringing into the model is the different control efforts government and industry are using to slow the spread.

Simulating this will give industry and government a guide for their control efforts—where to harvest, how much to focus on detection and single tree removal, and how intensely to pursue these activities. They will be able to see how different management strategies could play out under a variety of climate scenarios.

This approach is complimentary to Allan Carroll's efforts (page 12). Carroll's research will provide inputs to the SpaDES module such as "R-values", which are important for estimating how many MPB survive the winter and therefore how likely they are to start an outbreak. His modelling efforts will also help to validate this parallel approach.

In April 2017, Chubaty will demo his work at the MPB Forum. His final results due to be published in early 2018.

FIRE NORTH OF 60



Fire has been the dominant force shaping the boreal since the glaciers, renewing old growth forest and driving the cycle of succession. This makes understanding historical wildfire patterns—their size, frequency, intensity, and location—the cornerstone of understanding what land managers from provincial governments, forest companies, and signatories of the Canadian Boreal Forest Agreement should aim for.

The Healthy Landscapes Program used high quality aerial photographs of the landscape from before and after fires to build a database of 129 natural fires throughout Alberta and Saskatchewan. This was a precise, but expensive method of documenting the size and severity of fires, providing critical data for figuring out the natural range of variation of fires in the western boreal.

It would take a lot of resources to extend this data set with the same methods, and for other areas, it would be simply impossible because there aren't suitable aerial photos.

For his PhD, Ignacio San Miguel developed another method. His goal was to develop a new predictive model of fire mortality using Landsat imagery, which is freely available and has decades of coverage for the entire planet. Until now, Landsat-based models have not predicted fire mortality patterns very well. This study had the unique advantage of having the existing, very precise wildfire dataset with which to train and test a new predictive model using Landsat.

Miguel has developed an image processing procedure, and the HLP is now testing it out for the government of the Northwest Territories. If it is successful, the database of 129 fires will grow to 500, with the ability to keep expanding using this massively cheaper method. A side benefit of testing this model in the NT is that the Healthy Landscapes Program will be simultaneously getting data on how fires behave in a landscape with low forest cover and permafrost.

If the project remains on track, the fire database will not only quadruple in size, but we'll have the ability to expand it even further using inexpensive techniques and free data. This could revolutionize our understanding of wildfire, and therefore the boreal forest's natural range of variation.

DRILLING DOWN ON CARIBOU AND DISTURBANCE

"We know how caribou respond to different disturbances. We have lots of data for roads and pipelines and cutblocks. But what about different phases of development at a single site?" asks Doug MacNearney, a Caribou Program wildlife biologist.

Activity isn't constant at oil and gas wells, so maybe the effect any given well has on caribou changes over time. There's an initial flurry of activity at well sites as they're set up and drilling begins. But after a month or two, when the wells are producing, things quiet down with someone driving out to check on things every few days. Will less activity mean less caribou avoidance? And once the well stops producing and the site is decommissioned, at some point, will it once again become caribou habitat?

Put another way, even though the footprint of the disturbance is the same, the impact might change.

MacNearney used GPS collar data for caribou in boreal and southern mountain herds in Alberta and BC to see which areas they were staying away from. He then compared that with well site activity phases based on data the operators provide to the Alberta Energy Regulator and the BC Oil and Gas Commission.

The final results will not come out until fall 2017, but an interim report explains that with one interesting exception, caribou show more avoidance of more active well sites in all seasons. But in late winter, caribou actually use decommissioned well sites. We don't know why, but one hypothesis is that snow conditions and vegetation communities at these sites are similar to other open sites used by caribou in the winter, and they may provide caribou with opportunities to forage for food. However, if that's the case, it's not clear how other factors like predation risk might impact caribou given the road and pipeline network linking well sites.

Measuring how avoidance changes at different stages of a well's life will allow land managers to establish buffers that take into account how the real impact is varying over time. Instead of assuming that all disturbances are equal, this work will give us a more realistic picture.

"Because of the volume of disturbance out there, there really needs to be some precision about what features have a higher impact on caribou, and what sorts of disturbance get a higher priority for restoration," MacNearney says.

GIS PROGRAM: THE TOOL MAKERS

Since fRI Research (nee Foothills Model Forest) began in 1992, GIS has been the foundation of our research. Embracing what was, at the time, cutting edge technology has paid off for our science both for its quality and for its applicability. Land managers aren't just getting abstract results, but practical knowledge and tools tied to real places on the landscape.

Of course, as our programs have grown, so too have the spatial data sets that the GIS Program manages. It may not sound like the most glamorous work, but data management is the heartbeat of a research organization. Should the databases fall into disrepair, our science would soon stall.

However, the GIS Program does more than just keep the data safe and organized. They are also continually improving access and streamlining researcher workflows by building tools, including several just this year.

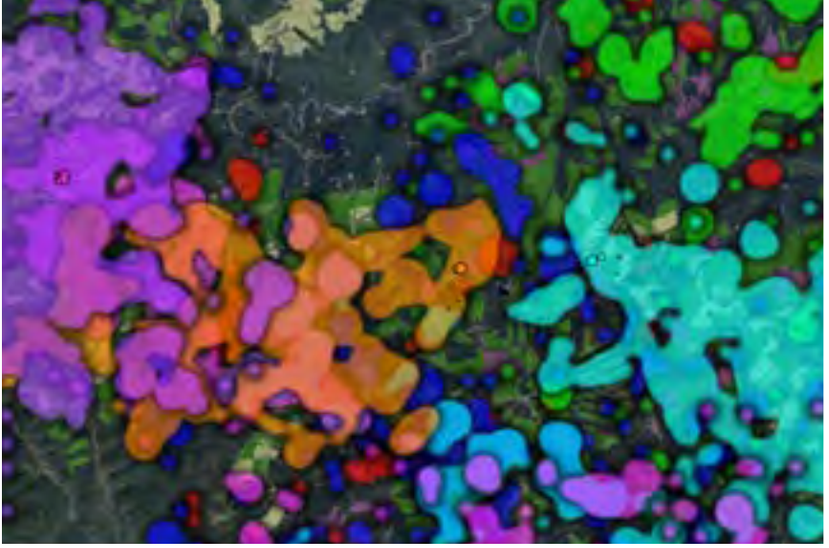
- Time of Day automatically looks up whether it was day, night, dawn, or dusk for thousands of Grizzly Bear GPS collar points, which is useful for studies of animal behaviour and habitat selection.
- The Caribou Program wanted to know what explained the use of ATVs on seismic lines. Shortest Travel calculates the actual travel distance to any given point in Alberta from the nearest population centre via roads and seismic lines to give a measure of how accessible various locations are, which was one possible factor.
- The Caribou Program enters thousands of camera trap images into the database each year. A third GIS Program tool automates this process to massively speed up workflow and

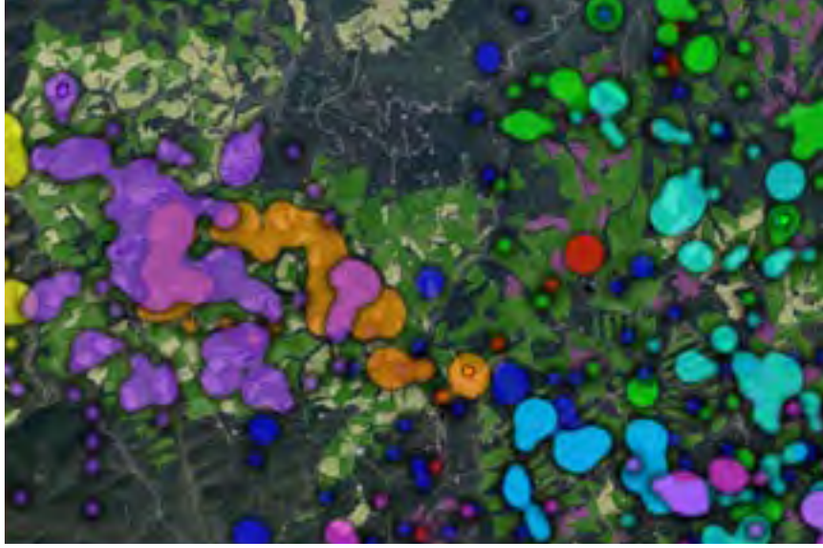
Perhaps the largest product is GBTools, a 23 GB package given to Grizzly Bear Program partners. A single interface allows users to run models for grizzly bear RSFs, mortality risk, road densities, and habitat states. It also bundles in relevant reports and papers. The package was first created in 2006, but it has been expanded and optimized enormously since then.

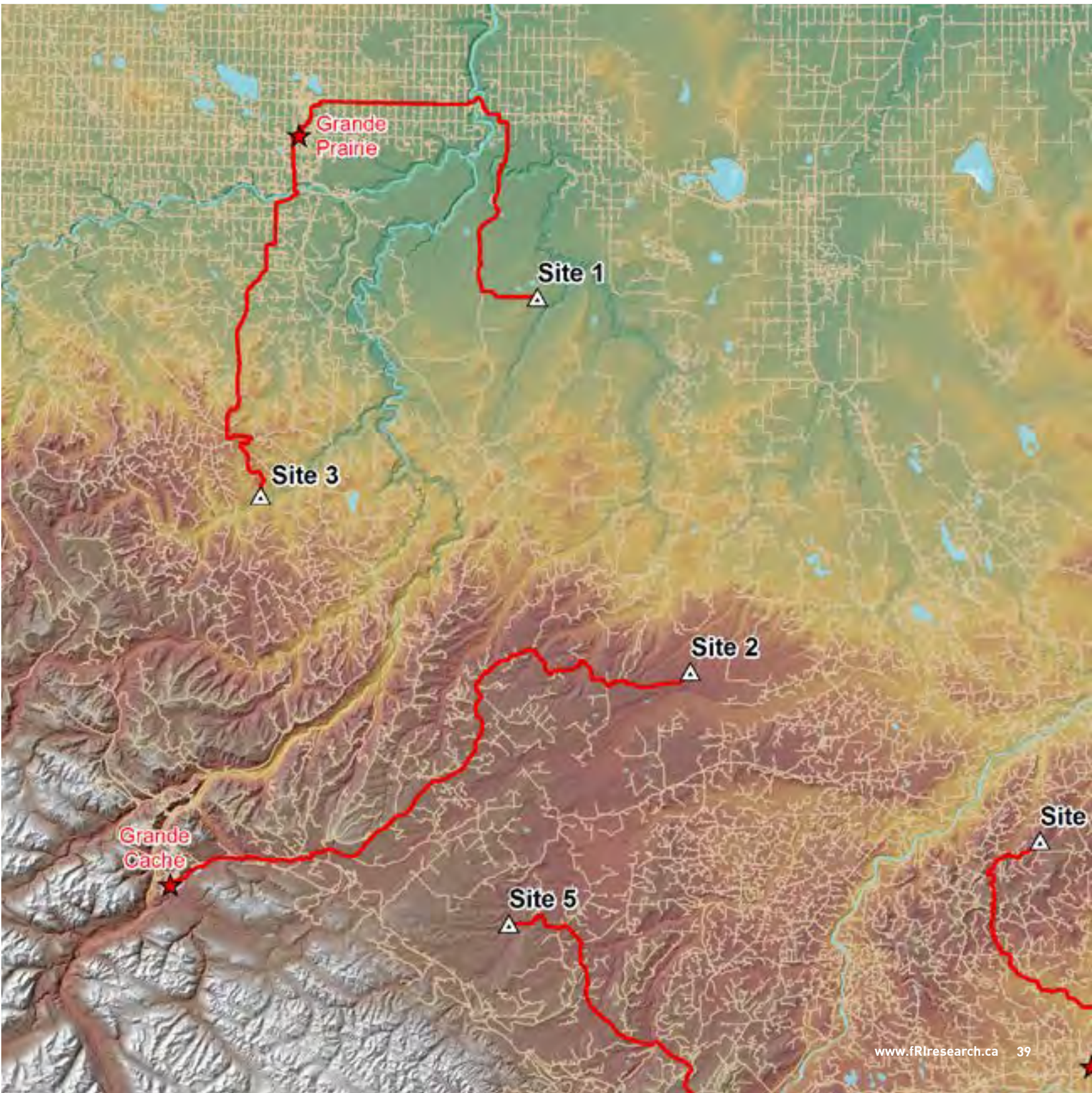
A Caribou Tool is in the works too. The first version, models the abundance of dozens of caribou foods based on MPB infestation, MPB management, wildfire, and cutblocks. This was released in early 2017 with another module for caribou RSFs already in development for the next fiscal year.

The GIS Program is also increasingly using data visualizations to add impact to results. These include animations of animal movements developed for the AFPA and Jasper National Park, and interactive maps using the Google Maps API.

The GIS Program isn't just dealing with exponentially growing datasets; it's capitalizing on them.

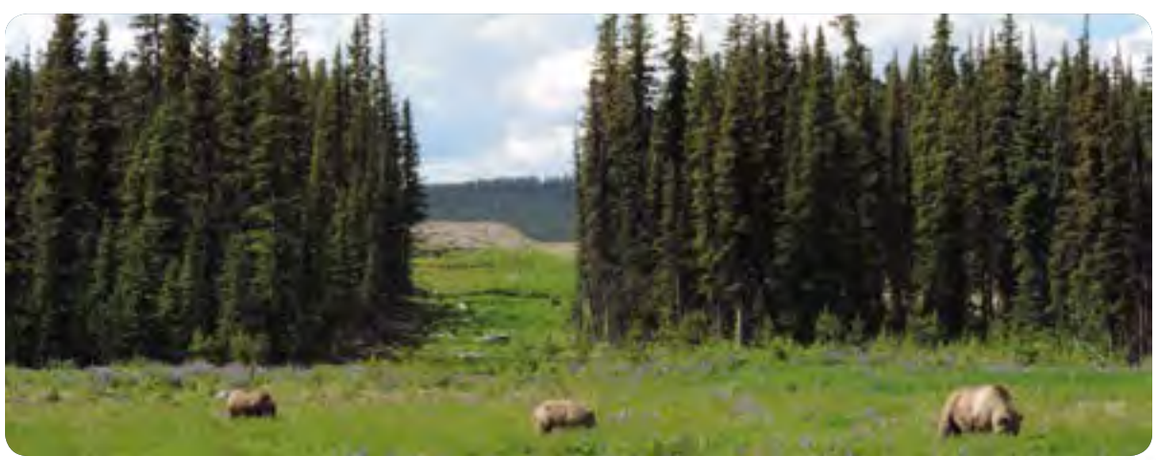





Grande Prairie
Site 1
Site 3
Site 2
Grande Cache
Site 5
Site

THE SCAT AND THE APP

There are a few different ways to study grizzly bears. Live capture, the most demanding, lets us get direct health information about an individual and fit it with a GPS collar to monitor movement, behaviour, and habitat selection remotely. To get information on entire populations, the Grizzly Bear Program uses non-invasive methods.



For the population censuses we conducted in 2004 and 2014, we collected hair by setting up hundreds of lures in often very remote locations and collecting tufts of hair that visiting bears left behind. This approach yields data on population size and some insight into demographics—DNA lets us count individuals and identify sex and family relationships, and progesterone levels in the hair tells us which females are pregnant. Powerful though this method is, the size of the operation required is too expensive to do continuously.

So, the Grizzly Bear Program has been using scat collection to supplement monitoring efforts between full population inventories. Even small scat samples will contain cells from the bear's digestive tract. We send the scat to our partners in Scandinavia, who extract DNA from the cells, yielding information similar to hair samples.

"One use is to monitor for scat in previously unoccupied areas, which would indicate population growth," says Gordon Stenhouse, the Grizzly Bear Program lead. "We can also use it to find nearby hair, from which we can get hormone levels and know if bears are having cubs."

In 2014, fRI Research released the Grizzly Scat App, which our biologists and citizen scientists have used since. We give out collection kits that have a vial with a barcode on it. The app lets users take a picture of the site and scan the barcode of the vial, linking the GPS location to the scat sample. The data and picture are automatically uploaded to our server and the collector can drop off the scat sample with us for processing.

This is not only a low-cost way of keeping tabs on grizzly bear populations, but it also—through one more partnership—gets the public involved in conservation.

SUMMARY OF

FINANCIAL STATEMENTS

REVENUES $4,827,039

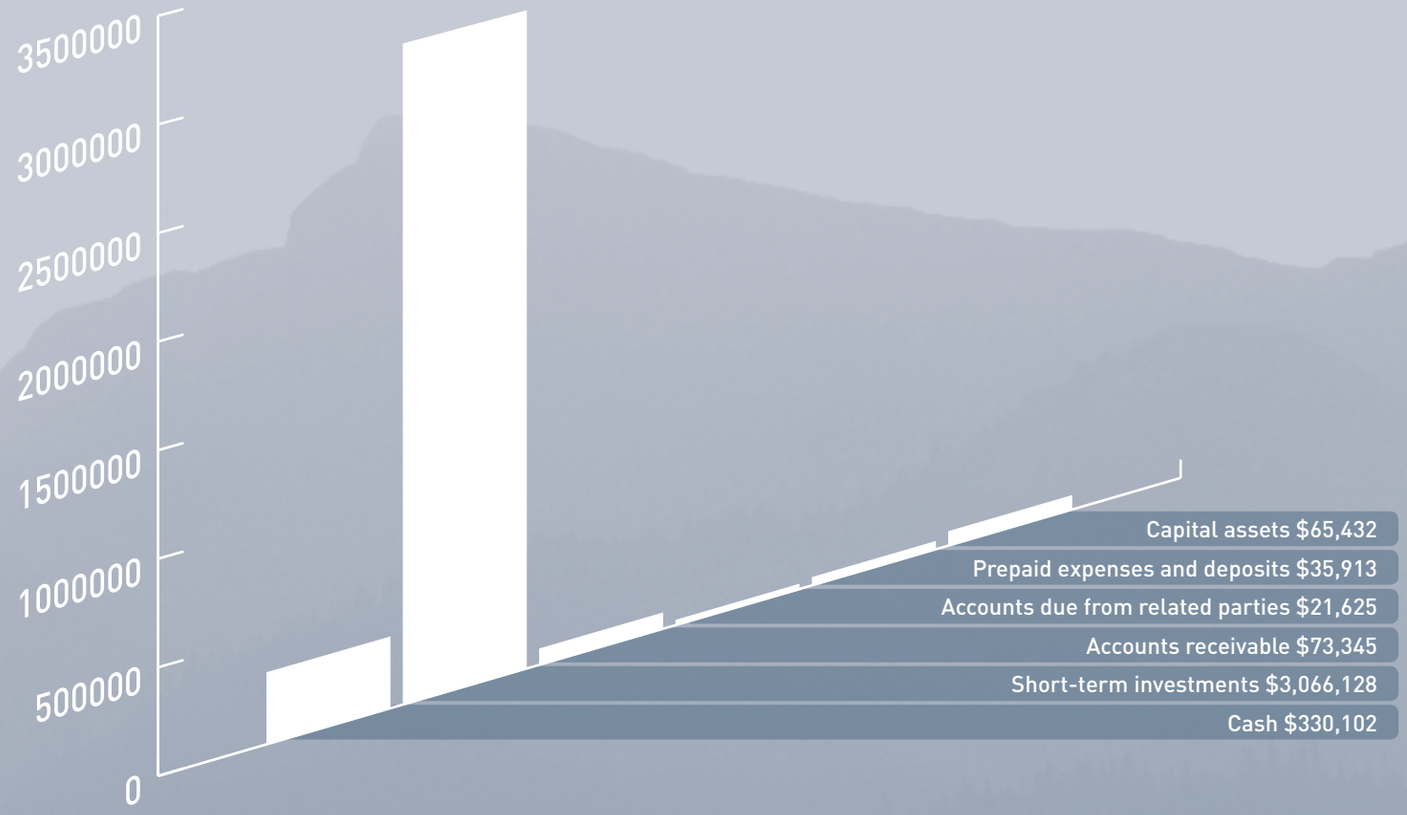
Contributions:

- Government agencies $1,586,883
- Corporate $1,697,561
- Non-profit entities $1,196,735
- Universities $207,222
- Interest income $25,228
- Other income $113,410

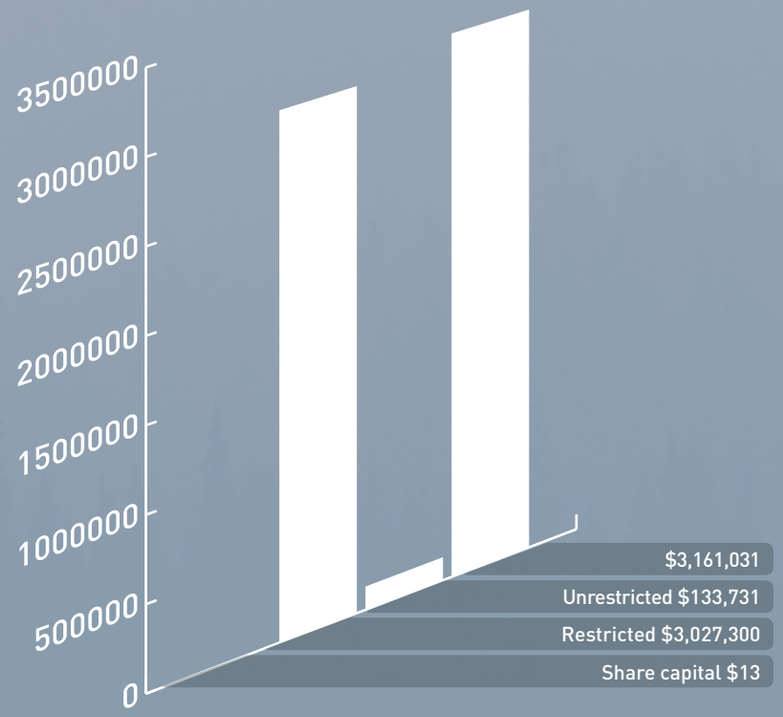
EXPENSES $5,445,214

- Amortization $18,469
- Bank charges and interest $3,235
- General operating expenses $954,784
- Wages/employee benefits $1,777,120
- Subcontracts $2,691,606

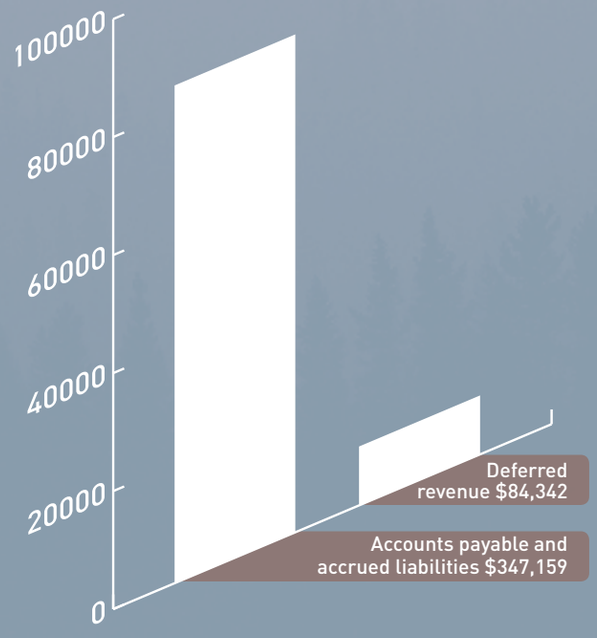
ASSETS $3,592,545



FUND BALANCE $3,161,044



LIABILITIES $431,501



fRI Research
Informing Land & Resource Management

Questions? Comments on this annual report?

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