Research Program Annual Report

FISCAL YEAR 2018–2019

BRITISH COLUMBIA

Ministry of
Forests, Lands, Natural
Resource Operations
and Rural Development

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The British Columbia Ministry of Forests, Lands, Natural Resource Operations and Rural Development is committed to a Research Program integrated across the province to provide timely, relevant, high-quality, and credible information to inform innovative solutions for British Columbia's complex natural resource sector challenges.

Executive Summary

The 2018–2019 fiscal year kicked off with the release of a three-year Research Program Strategic Plan (2018–2021) for the Ministry of Forests, Lands, Natural Resource Operations and Rural Development (FLNRORD) and the hiring of Francesco Cortini, PhD, RPF, as Research Management Lead to support the Research Program.

Internal projects 153

External projects 16

Collaborative projects 175

FLNRORD scientists led 153 projects funded through the Research Program, plus 16 externally funded projects, for a total of 169 projects. Research Program members actively collaborated with the federal government and several national and international universities on 175 projects.

In summer 2018, we conducted an internal user survey, which confirmed that the Research Program is a credible and reliable source of scientific information for decision makers and operational staff. A Mitacs fellow, Felicitas Egunyu, PhD, was hired to develop a framework for enhancing the integration of science into policy. And, in fall 2018, we held the first face-to-face meeting in five years, which allowed our research scientists to build stronger working relationships with colleagues who were internal and external to the provincial government (e.g., BC Ministry of Environment and Climate Change, BC Timber Sales, Natural Resources Canada, and academia).

To improve awareness of the Research Program, we launched a new intranet site with research information and a profile for each research scientist as well as an external-facing site with an up-to-date list of publications. We also started a Research Talks series of short and informative videos posted on the BC Public Service YouTube channel to highlight the work of our researchers. These videos and other research achievements are now broadly shared through targeted newsletters and magazines, including *The DIRT* and the Association of BC Forest Professionals publications.

The year was highly productive—the Research Program continues to provide innovative solutions to natural resource sector challenges in British Columbia through research, science, data, and extension, and is on track to achieve the objectives in the Strategic Plan.

Contents

Introduction

Working in partnership with provincial agencies within the natural resource sector, the Ministry of Forests, Lands, Natural Resource Operations and Rural Development (the Ministry; FLNRORD) plays a significant role in stewardship and authorizations of the Province's Crown land and natural and cultural resources. Overseeing a land base of 94.8 million hectares, the Ministry sustainably manages forest, range, mineral, and land-based resources.

In 2011, the Ministry committed to an integrated Research Program to provide timely, relevant, high-quality, credible information and to inform innovative solutions to British Columbia's complex natural resource sector challenges through research, science, data, and extension. The Office of the Chief Forester also manages additional operational research investments in forest carbon and forest genetics. Research scientists are integrated throughout Ministry operations at both provincial and regional levels to provide direct linkages between researchers and staff involved in decision-making, policy development, and resource management practices.

Establishing research priorities is complex, considering the scale of operations and the dynamic nature of the Ministry's mandate. Results and data from short- and longer-term research are essential to inform decision-making. Remeasurements and new studies using long-term research installations continue to support development and validation of modelling and decision tools for sustainable forest management. Annual research priorities are established by the Research Oversight Committee, composed of representatives from regional and provincial operations groups within the Ministry and chaired by the Deputy Chief Forester. In 2018, the Research Program released the Research Program Strategic Plan 2018–2021, which defines the Program's vision, values, governance, and strategic goals for the next three years.

Research Program Achievements in 2018–2019

GOAL ONE

Achieve Excellence in Applied Research

Actions taken to ensure that the Research Program is valued as a trusted provider of science information to support sustainable resource management decisions and policy development:

- Conducted the FLNRORD Research Program 2018 Survey on end-user awareness and satisfaction, the first of a planned tri-annual survey to evaluate user satisfaction, and confirmed that the Program is a credible, reliable source of science for decision makers and operational staff.
- Affirmed the alignment of roles and responsibilities of the Research Oversight Committee, Team Leads, management teams, and research scientists, through the planned annual governance review.
- Refined the research proposal process—planning, development, submission, and review—to ensure research alignment with Ministry needs and priorities.
- Recruited a Canadian Mitacs Science Policy Fellow, Felicitas Egunyu, PhD, who developed a science-policy strategy to enhance integration of research into policy advice and management decisions; a second Mitacs Fellow will support implementation during 2019–2020.

GOAL TWO

Maintain an Effective and Responsive Research Culture

Actions taken to ensure that the Research Program is delivered by well-educated, experienced, and respected research professionals:

- Released the Research Program Strategic Plan for 2018–2021.
- Hired Francesco Cortini, PhD, RPF, as the Research Management Lead to implement the Research Program Strategic Plan goals and activities.
- Held the Researchers' Meeting, in Richmond, BC, in November 2018; it gave research scientists, policy advisors, and decision makers the opportunity to discuss the Strategic Plan and strengthen working relationships with provincial government stakeholders and external collaborators.
- Initiated planning for a joint science policy forum in partnership with Natural Resources Canada, with forum delivery in November 2019 in Victoria, BC.
- Identified opportunities and partnerships with other agencies (e.g., universities, the Canadian Forest Service) to continue leveraging expertise and addressing issues of mutual interest and benefit.

GOAL THREE

Strengthen Research Knowledge Management and Extension Services

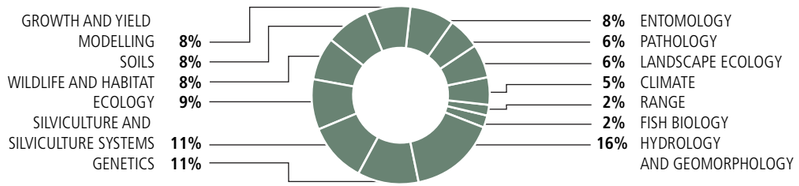
Actions taken to ensure that the Research Program has a strong presence both inside and outside the Ministry:

- Created a new intranet site for the Research Program to increase awareness of the Program; it includes a profile of each research scientist.
- Created and published a new, external-facing site with an up-to-date list of publications organized by author and expertise.
- Initiated new opportunities to share research science results:
  - Held the first Research Talks event in November 2018 at St. Ann's Academy in Victoria to highlight the work of five researchers.
  - Made the videos from the first event available on the BC government's official YouTube channel; in the three months since official release, they were viewed more than 2,500 times.
  - Held the second Research Talks event in May 2019.
- Targeted outreach and communication to increase awareness of the Research Program:
  - Shared Research Program accomplishments from 2018–2019 in the Association of BC Forest Professionals (ABCFP) e-newsletters and the inter-ministerial newsletter, *The Dirt*.
  - Established an agreement with ABCFP to publish research in every issue of their magazine.
  - Published an overview of the Program in the July/August 2019 issue.
  - Planned for research from each of the six research themes (Intended Outcomes) within the Program to be showcased in subsequent issues.
- Initiated work to update processes for establishing and protecting research trials.

Research Program Overview

Figure 1

FLNRORD research scientists by areas of expertise.

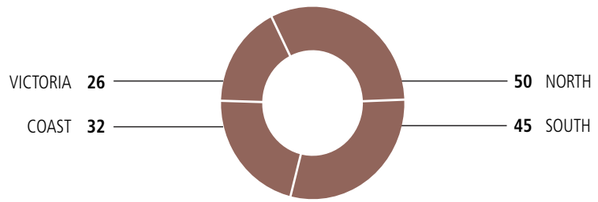


The Research Program includes more than 60 research scientists and dozens of technicians, co-op students, graduate students, and auxiliary personnel who plan and conduct research throughout BC.

During the 2018–2019 fiscal year, Ministry scientists delivered 153 projects funded through the Research Program, plus 16 projects funded outside the program for a total of 169 projects. Most of the Research Program projects span multiple forest districts and regions—the geographical location of the principal investigator is indicated in Figure 2. The 16 projects funded externally were mainly in the North area (10), and three each were in the South and Coast areas.

Figure 2

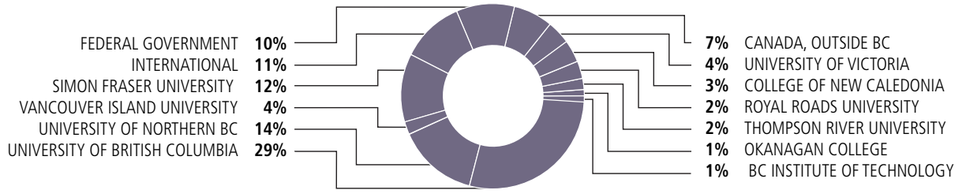
Number of projects by geographical location of the principal investigator for the fiscal year 2018–2019.



FLNRORD Research Program members actively collaborate with the federal government, provincial universities, and national and international research organizations (Figure 3). In 2018–2019, there were 175 collaborative projects with external research partners.

Figure 3

FLNRORD Research Program collaborations.



The Research Program is organized into six research portfolios or Intended Outcomes (IO): Ecosystem Stewardship, Ecosystem Health and Disturbance, Water, Species and Habitats, Timber Supply, and Bio-Economy. During 2018–2019, researchers from every IO conducted research projects (Figure 4); published research in peer-reviewed journals, field guides, or technical reports; gave presentations at workshops and conferences; and worked with graduate students.

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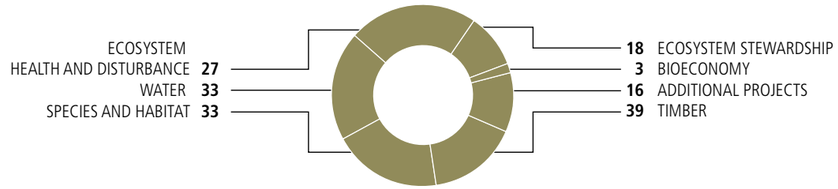
Figure 4

Number of research projects underway in fiscal year 2018–2019 by Intended Outcome.



Each IO is led by an interdisciplinary team that represents regional- and provincial-level research needs. Each IO has a three- to five-year strategic plan and prepares an annual summary of current and emerging research priorities, as well as an annual report of research achievements.

Ecosystem Stewardship

The intended outcome of this research is improved ecological knowledge for sustainable delivery of ecosystem services. This knowledge has strategic importance for supporting management decisions that maintain or enhance ecosystem resilience in the context of increasing uncertainty from social, economic, and environmental changes.

RESEARCH INITIATIVES

- Determine the vulnerability of ecosystems to resource development and climate change
- Foster ecosystem resilience and adaptive capacity through management
- Build adaptive capacity by providing flexible tools and comprehensive information to support management and decision-making

Climate Change Modelling and Monitoring

The ClimateBC, ClimateWNA (for western North America), and ClimateNA (for North America) programs use historical weather data, global circulation models, and regional predictions to project future seasonal and annual climate variables. ClimateBC is used extensively by researchers, resource managers, industry, consultants, and academia. It generates monthly climate data at the spatial scales necessary for resource management. It also powers multiple tools such as Climate-Based Seed Transfer (CBST), Climate Change Informed Species Selection, Drought Risk Assessment Tools, future projections for Biogeoclimatic Ecosystem Classification, and various regional water tools. Version 6.0 of the stand-alone software and web-based versions were released in 2018.

Climate change monitoring is important to help improve modelling. Research using weather stations and microclimate observations in lodgepole pine plantations provides better information for decision makers and natural resource managers to address climate change effects on natural resources in northern BC. Installations in ecosystems with little to no monitoring, such as alpine areas and areas of cold-air drainage, address data gaps for these northern areas that are not well represented in climate modelling tools.

Biogeoclimatic Ecosystem Classification (BEC)

The BEC system is an important resource for managing the complexity of BC's terrestrial ecology. It is the cornerstone of many stewardship and inventory decision-making processes, including tree species selection, stocking standards, and timber supply review. It supports habitat and forage mapping that are important to wildlife and range management, species distribution predictions, and high-resolution ecosystem map production. Ongoing updates are based on extensive field sampling for site-level classification and description and for landscape-level biogeoclimatic mapping.

Climate Change Informed Species Selection (CCISS)

Widespread changes in the suitability of commercial tree species for survival and productivity are expected due to climate change. Temperate tree species have increasing suitability, whereas boreal species have declining suitability. CCISS is a web-based decision aid for forestry professionals to incorporate projected climate changes into the selection of future climate-adapted tree species that are appropriate at a site-series level. Climate-related changes in suitability are expected for lodgepole pine, Douglas-fir, and western redcedar.

BC Soils

Digital soil mapping has revolutionized soil surveys globally. Ministry researchers and collaborators have a solid reputation in this field and in the production of high-quality spatial soil mapping products. Research includes database harmonization, digital terrain analysis, and machine learning for predictive mapping and product validation. This work has enabled a substantive contribution to the global soil organic carbon map and continues to support BC's online Soil Information Finder Tool.

Research on site productivity for Sitka spruce, western hemlock, Douglas-fir, and western redcedar in BC's temperate rainforests showed that soil nutrient constraints are well aligned with foliar nitrogen:phosphorus ratios. Thus this may be the most effective measure of site quality for operational use. This research supports better incorporation of site quality information into silviculture treatments, species nutrition and growth, climate change scenarios, carbon sequestration, and fertilization practices.

Ecosystem Health and Disturbance

The intended outcomes of this research are to identify and quantify risks and reduce effects on terrestrial ecosystem values from biotic and abiotic disturbances and management practices. The strategic importance involves understanding the effects of these disturbances on forest resource values, developing predictive tools for effects analysis and planning, and improving management practices. Land managers use these resources to enhance ecosystem resilience and respond to climate change and cumulative effects of resource development.

RESEARCH INITIATIVES

- Determine the factors and processes that cause natural and anthropogenic disturbances
- Determine the effects of disturbances on resource values
- Inform management practices to reduce the risk of significant predicted disturbances

Remote Image Analysis of Natural Resource Changes

Remote sensing is a cost-effective way to integrate applied research monitoring of environmental change with operational challenges over time and over large areas such as BC's 1 million square kilometres. Increasing our capacity to analyze large satellite-image data sets permits the quantification of natural, climate-induced, and human-caused changes to the environment. Many techniques—for example, using visible and infrared wavelengths—can reveal otherwise invisible phenomena. Algorithms from simple ratios and thresholds to complex machine learning and artificial intelligence are useful for understanding more complex phenomena over time.

Researchers in BC have developed a new method for automatically mapping fuels from satellite imagery using artificial intelligence. Fuels play a major role in fire behaviour—the rate of spread and fire intensity, which affect the difficulty of fire control. Timely updates of fuel inventories can improve fire behaviour simulation to assess threats across BC, and fuel hazard identification can mitigate wildfire risks to rural communities.

Long-term Soil Productivity Study

This study is part of an international network of permanent forest research installations that were established in the 1990s to gauge soil effects on forest productivity for undisturbed, disturbed, and rehabilitated soils. Results showed that typical harvesting operations in BC can allow establishment of healthy new forests except where there is severe soil compaction along with organic matter loss. New research is evaluating soil carbon high-resolution imagery and LIDAR data to provide more details at a finer scale.

Insect Damage in BC

Stress from a changing climate is exacerbating insect damage in BC forests. Understanding the effects of insect outbreaks at the stand and landscape level in high-elevation forests and how these host–pest interactions respond to erratic climate is critical for developing and implementing effective forest health management strategies. The research supported by this IO has documented that western balsam bark beetle alone or in combination with the balsam weevil is killing more mature subalpine fir annually than previously estimated. Both insect species respond to climate-stressed subalpine fir. More frequent drought and longer summers will contribute to an increase in the weevil's range and effects.

Options to maximize Douglas-fir beetle control with fibre recovery are needed for improved management and salvage operations after wildfire. Assessments of tree baiting, funnel trap clusters, and trap trees in containing and concentrating beetle populations indicated that attack centres can be successfully focussed using beetle attractants. Of the methods assessed in this study, trap trees and funnel trap clusters were the best methods to attract and concentrate beetles and should be applied in scorched, lightly burned, or green stands where beetle management is desired.

Water

The intended outcome of this research is improved hydrologic, geomorphic, and aquatic ecosystem knowledge for sustainable resource stewardship and informed public safety. Long-term projects increase scientific understanding of watersheds, surface water, groundwater, and geomorphic risks, as well as the effects of forest disturbance and regrowth and of climate change on water quality and quantity and public safety. This work is strategically important to support policy, decision makers, and practitioners.

RESEARCH INITIATIVES

- Develop predictive tools and guidance on changes to water quality, quantity, and timing caused by climate change, surface development, range use, and cumulative effects
- Develop, test, and improve predictive tools for instream flow requirements to maintain aquatic ecosystem health
- Develop tools for predicting landslides, floods, and sediment supply and determining the effects of wildfires on post-fire erosion and flooding

BC Water Tools Support Sustainable, Responsive Resource Management

BC Water Tools support better decision-making, water resource stewardship, water and watershed planning, and policy development. The web-based Tools are GIS-based, with watershed modelling incorporated into primary watershed units so users can identify a point anywhere on a river system and generate a report in seconds. Reports show mean monthly streamflow, reductions for environmental flows, current and potential water use allocations, water users, watershed details, and implications of climate change on precipitation and temperature. A user survey indicated that the Tools are relevant and broadly used.

Riparian Management in Small Streams

"The Importance of Small Streams in British Columbia" summarizes the condition of BC's small streams based on data collected from 2006 to 2015. A study of temperature, riparian function, and the supply of large wood in small streams is a new part of a larger project on the effects of variable retention policy. The study has assessed Bowron River watershed streams 25–30 years post-harvest and in response to mountain pine beetle and salvage harvesting. Understanding successful harvest strategies around small streams supports agreement on standards to protect these important resources, fosters industry collaborations, and informs climate change mitigation strategies to minimize effects on aquatic life.

Upper Penticton Creek Watershed – Streamflow Response to Logging

The Upper Penticton Creek Watershed Experiment, established in 1984, was designed to assess the effects of clearcut logging on water yield. It uses the classic paired approach to compare clearcut and unlogged watershed basins. The information it generates is valued for watershed assessment and operational practices for sustainable management in the Southern Interior. The 35-year hydroclimatic data set and the unlogged control basin make this long-term installation a rare "critical zone observatory" for understanding ecohydrologic processes and informing climate change modelling.

Creek Recovery after Wildfire

Monitoring the long-term recovery of the Fishtrap Creek channel and floodplain after wildfire increases knowledge of post-fire response and expected recovery rates. This research assesses the timing and magnitude of initial changes in creek channel morphology, peak flows, sediment supply, and sediment mobility after the 2003 McLure Fire, which killed most trees in the riparian area. The rate of channel change continues to accelerate over the life of the study.

Quantifying Climate Change Effects

Mean annual temperature in BC's northeast increased by approximately 2°C in the last 80 years. This has affected permafrost conditions and thaw potential. Water can reduce soil or rock stability, increase freeze–thaw conditions, and potentially increase landslide risk. Multiple weather stations and rock, soil, and snow-temperature monitoring installations provide data for integrating climate change into decision-making and risk identification. Analyses of climate and permafrost /slope stability provide information on permafrost state and climate change–associated risks.

Other research uses remote sensing technology for province-wide quantification of surface water, snow, and glacier ice over time to measure natural-use, climate-induced, and human-caused changes to water storage. Recent remote sensing analyses indicated that glacier retreat was three times faster in the past decade than in the previous two decades, and widespread industrial use of water is evident with more than 8,000 constructed water bodies identified in northeastern BC.

Species and Habitats

The intended outcome of this research is improved conservation and management of fish and wildlife populations and habitat, locally and provincially. Research focusses on the response of animal populations and their habitats to the cumulative effects of climate change and human uses of natural resources. This strategic knowledge supports guidance and tools to inform immediate decision-making and the development of scientific understanding so that policies can respond to emerging pressures on fish and wildlife populations and their habitats.

RESEARCH INITIATIVES

- Conduct research to inform management of harvested fish and wildlife populations and their habitats
- Understand the factors that cause the decline and limit the recovery of listed species in BC
- Understand the environmental and biophysical factors that promote biological diversity, including species, communities, and habitats on the landscape

Understanding Factors that Influence Terrestrial and Aquatic Wildlife

A wide range of species are studied, including managed species such as mule deer, moose, grizzly bear, and furbearers (Pacific and American martens and wolverine), and stocked fish species such as rainbow trout, steelhead, Kokanee, and sockeye salmon. Research on listed species included the barred owl, northern spotted owl, marbled murrelet, sooty grouse, coastal northern goshawk, white sturgeon, westslope cutthroat trout, western painted turtle, and western toad.

Mule deer These are a primary source of food security for interior Indigenous peoples and the most important game animal in BC in terms of licence sales and expenditures. A study of survival, mortality, and migration in southern BC was established by putting GPS collars on 19 fawns and 40 adults in five areas. Extensive research was initiated in southern BC to examine mule deer response to wildfire and habitat.

Moose A long-term study is underway to assess whether landscape changes from the mountain pine beetle outbreak and associated salvage logging are related to moose population declines. Results are generally inconsistent with this landscape-change hypothesis, which assumes that cow survival is the primary driver of population change. To date, observed survival rates are largely within the range of other stable populations. Understanding factors affecting population trends and habitat use informs land management and supports collaborative moose recovery efforts.

Grizzly bear Most grizzly bear populations are limited by human-caused mortality, but the effect of food quality and quantity is not clear. A study on Southern Interior grizzly bear demography found that hunted populations can increase by 7–8% per year when berry crops are abundant and bear population density is below the ecosystem carrying capacity. Mapping tools for huckleberry and buffaloberry occurrence, yield, and selection by grizzly bears are resources to improve habitat management.

Barred and northern spotted owls Recovery of northern spotted owls in southwestern BC relies on the 294,700-hectare Spotted Owl Management Plan, the Captive Breeding program, and removal and translocation of competing barred owls from spotted owl range. To analyze the efficacy of this removal, backpack satellite tags were placed on nine translocated barred owls, four barred owls resident in the translocation site, and four barred owls in control areas with no translocation.

Kokanee and sockeye salmon A collaborative, comprehensive evaluation of the ecology and habitats of deep spawning Kokanee and sockeye salmon was initiated to inform resource management decisions. Deep-spawning Kokanee stocks are rare and very little is known about their behaviour and habitats. Methods include short-set gillnetting for catch-and-release, collecting underwater remote-camera imagery, deploying sensor networks, mapping, and modelling.

Habitat and Resource Management Practices

Research on the effects of forest management practices on wildlife habitat values continues at long-term silviculture research installations.

Small headwater lakes A comprehensive study was initiated to assess linkages between forest harvest practices on headwater stream inflows and fish diet in lakes. Work will assess the linkages among organic matter drift, fish diet, lake biotic productivity, and forest harvesting.

Baseline index monitoring Other aquatic habitat research included baseline index monitoring of spawn activities to assess fisheries impacts on Fraser River sediment management and to assess impacts from fisheries and habitat alterations on juvenile sturgeon rearing in confirmed habitats.

Molecular Ecology Methods

Molecular ecology methods can assess species distribution change in response to factors such as human disturbance, invasive species, and hybridization. Studies of Pacific marten on the coast and American marten in the interior use snagged hair for genetic identification of individuals for modelling. An environmental DNA assay system for the listed western painted turtle and its common competitor, the red-eared slider, is being tested for its value in supporting western painted turtle recovery. Genetic diversity analyses, differentiation, and habitat connectivity are used to compare the adaptive capacity of declining populations of western toads on Haida Gwaii and Vancouver Island to the thriving populations on the western BC mainland. Sampling and genotyping of 110 populations of the listed westslope cutthroat trout determined that 94% are over 95% pure and thus are a high priority for conservation. Preliminary analyses of the genetic variation of the rainbow trout genome identified true wild stock populations for conservation.

Timber Supply

The intended outcome of this research is increased volume and value of timber and fibre. Establishing and stewarding forests and maintaining timber supply to support the economy and communities are more challenging with the more frequent and severe disturbances and climatic extremes associated with climate change, and with increased demands among competing values. This work has strategic importance for increasing the volume and value of the timber supply while fostering resilient forests that will support economic prosperity and environmental sustainability in the short, medium, and long-term.

RESEARCH INITIATIVES

- Develop and improve existing resource models to better estimate timber supply and range productivity and to support integrated decision-making
- Develop innovative and improved management practices that enhance timber supply and range productivity while managing for carbon sequestration, reducing environmental risks, and maintaining site productivity
- Enhance, maintain, and conserve forest genetic resources that maintain or enhance timber supply and site productivity

Alternative Silvicultural Systems to Support Multiple Resource Values

Research on silvicultural systems supports the evaluation of management options for multiple resource values such as wildlife habitat, biodiversity, and timber supply. Several studies that focus on how to manage habitat supply for mule deer and southern mountain caribou are underway. Research results to date indicate that clearcut harvesting in caribou habitat removes arboreal lichens (winter forage) for 100 years or more, while the group selection silvicultural system maintains this forage in the residual forest in time and space.

Shelterwood Silvicultural Systems – Dougas-Fir Regeneration

A long-term study was initiated in the Cariboo Region in 1990 to examine uniform shelterwood silvicultural systems as an alternative to the clearcut system in the Sub-Boreal Spruce Dry Warm forest. Frost damage on Douglas-fir regeneration in clearcut harvest blocks was unacceptably high. Trial sites were harvested three times to test regeneration success under various residual basal areas. Regeneration combinations of preparation and regeneration, or regeneration (30 m²/ha) and second regeneration (15 m²/ha), were all successful. There was also substantial growth on the residual overstorey trees, which resulted in an economically valuable final harvest.

Operational Brushing Effects on Douglas-Fir

Evaluation of different brushing treatments provides information for addressing operational stocking standards, stand-performance expectations, and treatment requirements in current free-growing obligations and forest stewardship plans. Long-term operational brushing trials were reassessed 10 years post-treatment for Douglas-fir survival and growth in the mixed broadleaf shrub complex of Southern Interior BC. Research results found that brushing to minimize broadleaf tree competition on young plantation Douglas-fir did not affect survival and significantly increased height and stem diameter.

Windthrow and Partial Cutting – Date Creek Silvicultural Systems

There is a widespread belief that trees retained in partial cut systems are at greater risk of windthrow and that the risk increases with harvest intensity. This perception has commonly been used as an argument against the use of retention systems; however, there are few long-term studies on how the overall level of partial harvest and time since harvest affect windthrow amount. Research results showed no evidence of increased wind damage to merchantable trees across partial cut systems with different levels of harvest in natural-origin mixed-forest sites.

Bio-Economy

The intended outcome of this research is enhanced knowledge of alternative forest resources and products, including carbon, in support of the emergent bio-economy and climate-focussed forest management initiatives. Government and industry need operational, technical, and resource management science and information to reduce investment uncertainty associated with new technology and developing markets. This strategic work is complemented by Ministry-funded research by FPInnovations.

RESEARCH INITIATIVES:

- Support development of the bio-economy: fibre access, product innovation and development, green economy information and marketing development, and supply-chain analysis
- Measure and manage our carbon footprint: carbon accounting analysis and system support, offset project opportunity development, economic cost/benefit analysis, and climate change risk assessment
- Determine non-timber values associated with product opportunities or climate change risks
- Address specific forest sector operational research requirements related to forest harvest operations, engineering, road development/maintenance, and to the concerns of Indigenous peoples

Resource Management Systems and Climate Change

Climate change effects are expected to be the most severe in Southern Interior BC based on climate envelope modelling. Some areas of BC, such as the Okanagan Valley, transition from desert to dry grassland to savanna to forest. Preliminary analysis of the hydrology and managed water systems of the Upper Penticton Creek watershed indicates that existing management

systems will be able to manage changes in flow rates. Further improvements to the hydrological model and sensitivity analysis to evaluate management assumptions for water flow are underway.

Wildlife and Biodiversity Thresholds and Benchmarks

Developing conservation guidance for sustainable biomass harvesting in BC requires a clear understanding of the biodiversity and wildlife dependent on fine and coarse downed woody material in forest ecosystems and the associated habitat thresholds to support retention targets. Experimental fieldwork was conducted to evaluate wildlife and biodiversity thresholds and benchmarks for coastal woody debris retention and recruitment under biomass harvesting. This research included an assessment of the interim coastal biomass harvest retention guidelines.

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The Ministry Research Program continues to support the development and proactive deployment of evidence-informed, operationally relevant solutions for adaptive natural resource management in British Columbia through research, science, collaboration, and knowledge transfer.

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