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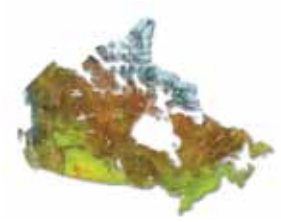

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One Hundred Years of BCFS–CFS Collaboration

Brian Peter and Henry Benskin

Canada

The Pacific Forestry Centre, Victoria, British Columbia

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Abstract

The British Columbia Forest Service (BCFS) and the Canadian Forest Service (CFS) have a long history of collaboration across a wide range of functions and topics. This includes research, technology transfer and extension, co-management and delivery of federal–provincial agreements, and partnering on national and international initiatives. As the BCFS approaches its centennial, it is interesting to examine the achievements that have come from this 100-year relationship. The nature of the various projects and initiatives undertaken over the years reflects the evolving nature of forest management, and the relative strengths of the CFS and BCFS have contributed to successful outcomes in many collaborative initiatives. Looking forward, we believe a continuation of CFS–BCFS partnering will benefit both institutions, and will help ensure management of BC's forests continues to balance the multiple needs of current and future generations.

Résumé

Le Service des forêts de la Colombie-Britannique et le Service canadien des forêts collaborent depuis très longtemps à une grande variété de tâches et de sujets, notamment la recherche, le transfert et la mise en commun de technologies, la cogestion et la mise en œuvre d'ententes fédérales-provinciales ainsi que le partenariat dans le cadre d'initiatives nationales et internationales. Alors que le Service des forêts de la Colombie-Britannique s'apprête à célébrer son centenaire, il est intéressant de souligner les réalisations issues de ce siècle de partenariat. La variété des initiatives et des projets entrepris au fil des ans reflète la nature changeante de la gestion forestière, ainsi que les forces des deux services des forêts ayant contribué au succès de nombreuses initiatives communes. Nous sommes certains que la poursuite de ce partenariat profitera aux deux organismes et aidera à ce que les forêts de la Colombie-Britannique continuent d'être gérées en tenant compte des multiples besoins des générations actuelles et futures.

1. Introduction

With the upcoming centennial of the British Columbia Forest Service (BCFS) and the recent marking of this same milestone by the Canadian Forest Service (CFS), it is interesting to examine the achievements that have come from the 100-year relationship between these two agencies. It is well recognized that BC's forests are vast, complex ecosystems that require careful management to balance multiple values. In this paper, we examine some of the ways in which provincial–federal collaboration has contributed to meeting this challenge over the past century. While BC's forests are largely the jurisdiction of the provincial government, the federal government has played an important role in forest management in BC throughout the past 100 years. Collaboration between the BCFS and the CFS (and its predecessors) has been the cornerstone of much of this contribution.

1.1 Origins of the BCFS and the CFS in BC

Federal involvement in forest management in BC can be traced back to the late 1800s when millions of hectares of land were granted to the federal government to establish a rail-link to the West Coast. Known as the "railway belt," these lands consisted of a 40-mile-wide strip surrounding the Canadian Pacific Railroad through BC, plus additional lands in northeast BC, known as the Peace River Block. Timber harvesting permits for these lands were issued by the Federal Department of the Interior's Timber, Mineral, and Grazing Lands Office. However, it was not until 1899, when Elihu Stewart was appointed Canada's first Chief Inspector of Timber and Forestry, that the federal government began to engage in a wider range of forest management activities and research. At that time, the birth of the organization now known as the Canadian Forest Service occurred when the Dominion Forestry Branch[1] (DFB) was established. In BC, the DFB designated forest reserves within the railway belt, established fire control programs, conducted surveys, and began studying thinning, taper, and yield in some BC tree species (Taylor 1999).

Forest Rangers' Camp, Harrogate Pass, Yoho Forest Reserve, August 18, 1917. (D.R. Cameron, Dept. of the Interior, Forestry Branch. Source: CFS)

In 1912, the BC Forest Service (then known as the BC Forest Branch) was created in response to recommendations in the 1910 Royal Commission of Inquiry on Timber and Forestry. Timber licenses, reforestation, revenue collection, fire protection, and trade in forest land and logs were the primary objectives of the new agency (Roach 1984). The first Chief Forester was Harvey R. MacMillan, a recent Canadian graduate of Yale University's forestry school who began his career working for the DFB. In 1912, BC's forests were already supporting a growing forest industry, though early reports of the BC Forest Branch (BCMF [various years]) note that the amount harvested was a fraction of what the land-base was capable of sustaining. The Forest Branch saw the encouragement of a larger forest sector as an important way to ensure better forest protection, and a way to develop a major source of revenue for the province.

2. One Hundred Years of Collaboration

2.1 Early Collaboration: 1912–1960

The first report of the BC Forest Branch (1912) documents some early instances of collaboration. Mention is made of testing BC timber species for strength in collaboration with the DFB and McGill University. Collecting and reporting statistics on forest product production was also planned with the DFB. Details of these early collaborations are scant; however, we do know that a federal forest products laboratory was established in Vancouver in 1918. This lab was initially focused on studying the suitability of western Canadian tree species for aircraft construction, which had become a major source of demand for Sitka spruce (*Picea sitchensis*) during

[1] In the past, what is now the CFS has gone by various names including the Dominion Forestry Branch, Dominion Forestry Service, Forestry Canada, Canadian Forestry Service, and Canadian Forest Service. In this report we to refer to the agency as the DFB up to the 1960s, and as the CFS from this time onwards.

the First World War. Following the establishment of the lab, research was conducted to provide more general support to a growing western Canadian forest sector (FP Innovations 2009), and frequent visits from BC Forest Service staff occurred (Johnstone 1991).

Federal involvement in pest research and management in BC also began in the early 20th century. At the start of the 1920s the Dominion Forest Laboratory was established[2] in Vernon to study forest insects. The department had also inspected forest pest conditions in BC in years prior to this (Van Sickle et al. 2001). One of the first priorities of the new lab was to collaborate with the provincial government to control bark beetle outbreaks in the Southern Interior. Between 1920 and 1928 these efforts involved conducting sanitation treatments in infested stands, directing timber harvesting to meet beetle control objectives, and ensuring slash in harvested areas was better disposed of (Rajala 2001). A sub-unit of this lab was opened at the University of British Columbia in Vancouver in 1925 (Van Sickle et al. 2001), and in 1936 the Forest Insect Survey was established. A separate disease survey was introduced in 1952, which was combined with the insect survey in 1962 to form the Forest Insect and Disease Survey (FIDS). This program systematically assessed forest pests and disease in BC, providing valuable information to forest managers for several decades.

Some other early instances of federal–provincial collaboration can be found in conferences that grappled with issues in forest management in Canada. In 1924, one of the first national forest conferences was held in Ottawa to discuss fire protection. In 1929, a second conference was held to discuss the need for a national forest inventory. It was decided that inventory data should be collected by provinces, but with nationally consistent standards and procedures and with the DFB acting as the lead agency in charge of compiling data into a national-level inventory. Federal–provincial co-operation in silviculture research was also proposed. A subsequent 1935 conference on forest research concluded that insect, disease, storm, and fire losses should be reported. Gillis and Roach (1986, p.212) conclude of these events, *"On the whole these were modest achievements, but, in an era when the concept of Dominion–provincial co-operation was only beginning to emerge, they were substantial enough . . . this was to be the last creative Dominion–provincial forestry initiative for over a decade as first the transfer of the natural resources to the western provinces rocked the Forestry Service to its foundations and then the depression of the 1930s sapped all levels of government of their ability to undertake any dynamic, co-operative activities."*

In the 1930s, the federal government ceded its ownership and control of the railway belt lands to the province. The DFB

Rangers with 1950 Mercury trucks, Forest Biology Station, Vernon, BC, 1953. (Source: CFS)

[2] Although this was established by the Department of Agriculture, it was integrated into the CFS in 1960 and is thus considered a predecessor of the CFS.

was reduced to some 30% of its previous size by 1932 (Gillis and Roach 1986). The establishment of a federal research forest in BC was discussed during the 1930s, and at one point negotiations were underway for the use of a 104-km^2 area on East Thurlow Island for this purpose. Disagreement over federal requests for the cancellation of existing timber sales on this site could not be resolved, and the idea was eventually abandoned. This event may, in fact, mark a low point in the collaborative relationship between the BCFS and the DFB. As Johnstone (1991, p.83) reports, *"Unfortunately, this disagreement developed into a serious personality clash between two strong-minded men, Finlayson and British Columbia's Chief Forester, Orchard. The feud was dormant during Cameron's relatively brief regime but surfaced again when D.A. Macdonald succeeded him. Thus, except for the forest products laboratory, the federal forestry service was denied an active research role in what had become Canada's most important forestry area because of personal animosity between these two individuals."*

In subsequent years some federal–provincial collaboration still occurred through various training and worker relief programs, some of which were sponsored by the federal government, including the Youth Forestry Training Plan (1937–1940) and the Alternative Service Workers Program (1942–1944). The latter allowed "conscientious objectors" during World War II to work in fire suppression and planting, and the BC Forest Branch Annual Report for 1942 reports that up to 740 people were involved in this program during May to December of that year.

P.J. Salisbury and W. Ziller working with *Pinus monticola,* DFB Nursery, Gordon Head. (Source: CFS)

These programs did not involve the DFB directly, though the Branch continued to conduct research in BC, including forest products research at its laboratory in Vancouver. D. Roy Cameron (1947) reported that, "*Its main function is to look after the special problems of the British Columbia timber industry. The present work of the Vancouver Laboratory includes research on the following: mechanical and physical properties of British Columbia woods and their application to the structural uses of timber; the use of British Columbia species for poles and piling; wood rotting organisms and their identification and control; air seasoning and kiln drying of British Columbia lumber and other wood products; logging and mill waste, its volume and utilization; and the effect of log size and grade on lumber manufacture in British Columbia.*"

In 1940, a new lab was opened in Victoria by the federal Department of Agriculture to take responsibility for forest pest management and surveys west of the Cascades, complementing the lab in Vernon, as its sub-lab at UBC was closed at this time (Rajala 2001). Research on Vancouver Island was also carried out at the BCFS's Cowichan Lake Research Station. Schmidt (1992, p.13) reports that, *"What is now the Canadian Forestry Service (CFS) made its first appearance at Cowichan Lake in 1941 when a lease was signed with the Forestry Branch for the use of two bunk houses for Dominion researchers for 25 years at no cost . . . This lease was renewed for an additional 21year period in 1962. During this second lease period, the CFS had a laboratory constructed . . . and when the lease expired this building was given to the Forest Service for one dollar. Today it serves as a conference centre."*

The passing of the *Canada Forestry Act* in 1949 allowed federal involvement in BC forest management to enter a period of substantial growth. The Act defined the role of the DFB, and included provisions for partnering with provinces to carry out forest management activities. In 1951 an agreement with the province of BC was made to conduct forest inventories and reforestation. This agreement came in the wake of BC's 1945 Sloan Commission, which helped introduce sustained yield management to BC's forests. Up-to-date inventories were needed to implement this approach, and federal assistance became key to obtaining this information.

Federal–provincial co-operation continued throughout the 1950s and 1960s, and grew to include road construction and fire protection. The 1962 Report of the BCFS states, *"The Federal–Provincial Forestry Agreement was renewed by*

John Chapman, Claire Farris, Jim Kinghorn, and George Metcalf at BCFS Cowichan Lake Research Station, ca. 1956. (Source: CFS)

memorandum of agreement dated May 11, 1962, under which Canada undertakes to pay the Province a sum of $1,804,461 in respect of expenditures made by the Province in each of the fiscal years 1962/63 and 1963/64. Forty percent of this amount must be in respect of expenditures on access projects, with the balance being distributed between forest fire protection, inventory, reforestation, and stand-improvement projects."

In 1960 the DFB and the Forest Biology Division of the federal Department of Agriculture were merged into a new Department of Forestry (Taylor 1999). The Pacific Forestry Research Centre was built on its current site in 1965, and soon became the headquarters for all federal forestry activities in BC. The Vernon lab was closed in 1970. The Forest Products Lab in Vancouver was run directly by the federal government until it was privatized in 1979 and renamed Forintek. This lab began operating under a similar arrangement to those at the Paprican (pulp and paper research) and Feric (forest engineering research) institutes, being funded jointly by government and industry members (see Section 2.4.6 for more recent organizational changes at these institutes).

2.2 Changes in the Collaborative Relationship: 1960–1980

Although federal involvement in BC forestry declined somewhat in the late 1960s and through the 1970s, this period did include a number of collaborative silvicultural projects, most notably the early development of the BC–CFS Styroblock (Reforestation) System. A CFS Liaison and Development Group developed the system of growing seedlings in expanded polystyrene moulds, and planting them as "plugs" (container free)—in contrast to earlier trials with seedling "bullets." Federal involvement with this project was subsequently reduced, and most of the CFS staff involved were transferred to the BCFS, which continued development to full operational status. In 1970, the first 100 000 "styro-plug" seedlings were planted in north–central BC; by 1980, container-grown tree seedlings represented 50% of all tree seedlings grown in BC, and today they represent almost 100% (Van Eerden 2002)—a remarkable achievement that reflects collaboration over the years by many individuals in the CFS, BCFS, universities, forest industry, and forest tree nurseries. BCFS operations developed in tandem with CFS research into forest tree seed testing (e.g., Edwards and Wang 1995), yet another example of a successful working relationship in advancing BC reforestation success. A recent report on the history of the BCFS Tree Seed Centre (BCMFR 2010) notes the close working relationship with the CFS, contributing to the development of many of the procedures at the Centre and facilitating extension efforts around the province. As interest increased in intensifying silvicultural practices on the BC Coast in the late 1960s and early 1970s, both BCFS

BCFS tour of the CFS Pacific Forestry Centre (date unknown). (Source: CFS)

and CFS researchers initiated new research activities. CFS established Levels of Growing Stock (LOGS) installations in the Sayward Forest (1969) and at Shawnigan Lake (1971) as part of a Pacific Northwest international co-operative (Arnott and Beddows 1981). From 1971 through 1975, the BCFS established extensive (empirical) studies of thinning and fertilization in Coastal Douglas-fir and western hemlock (e.g., Omule 1990; BCMF 1976). The CFS set up studies at Shawnigan Lake in 1971 to understand the biological basis for thinning and fertilization in Coastal Douglas-fir (Barclay et al. 1982). In addition to contributing information over the years to support operational treatments, many of these 1970s-era studies continue to be actively monitored. This provides valuable time-series data for growth and yield model calibration and validation, enabling foresters to use these predictive models for operational silviculture and timber supply analysis, as well as wood quality insights and information on ecosystem processes. The 1970s also saw the publication of a number of joint BCFS–CFS reports on silviculture and forest management, including guidelines on cone collection (Dobbs et al. 1976), results from studies of biological control of western spruce budworm (Hodgkinson et al. 1979), and a guide to pests and diseases in forest nurseries (Sutherland and Van Eerden 1980).

Over the years, CFS research strengths in understanding biological processes have complemented BCFS research and operational testing and development. Some of the many examples include assessing the fate of fertilizer on snow (Preston et al. 1990), and understanding belowground (soil) biodiversity (Marshall 1974) and mechanisms for tree resistance to insect and fungal attack (e.g., Kiss et al. 1994; Manville et al. 1994; Hunt et al. 1974; Shrimpton and Reid 1973).

2.3 Renewed Commitment to Collaboration: 1981–1995

In 1979, the Government of Canada struck a new co-operative agreement with the Province of BC to address concerns about looming timber supply shortages. This marked the beginning of an era of substantial federal–provincial cost sharing in forest management that continued for some 15 years. The first of these programs was the Canada–BC Subsidiary Agreement on Intensive Forest Management, which delivered $50 million in cost-shared reforestation, spacing, fertilization, and fire protection in treated stands (Rajala 2003). On its expiry in 1984, an $11-million, one-year extension to the program was put in place, which included provision for research. Furthermore, in 1982, while BC's forest industry was struggling through a recession, the $39.4-million Canada–BC Employment Bridging Assistance Program was initiated so displaced forest workers could work in various forest management activities including spacing, brushing, recreation site improvement, and rangeland fencing (BCMF 1983).

Forest Resource Development Agreement-funded research at BCFS Cowichan Lake Research Station. (Source: CFS)

The South Moresby Forest Replacement Account is another notable federal–provincial forestry initiative of this era. Begun in 1988 with a $24 million investment by the federal and British Columbia governments, the program was a response to forest sector impacts resulting from the creation of Gwaii Haanas National Park, and provided funding for various forest management activities on Haida Gwaii[3] such as silviculture, research, inventory, and community involvement in forest management planning (CFS 1999). In 2007, funds from the South Moresby Forest Replacement Account were transferred to the Gwaii Forest Charitable Trust, which continues to support similar programs on Haida Gwaii (Gwaii Forest Charitable Trust 2009).

What has probably been the most significant provincial–federal forest management program of the past 100 years began when the Canada–BC Forest Resource Development Agreement (FRDA) was signed on May 25, 1985. Concern was mounting over the growing backlog of not-satisfactorily-restocked (NSR) harvest areas and the consequent implications for future timber supply. A decline in wood supply was also expected as older, high-volume stands became scarcer, while managed "second growth" stands would not contain sufficient volumes to sustain the harvest. Furthermore, a downturn in the forest sector had increased unemployment among forest workers. The program committed the BC and federal governments to spend $300 million jointly over five years to address these issues through surveys, reforestation, and intensive forest management, improving the state of the

[3] Formerly called the Queen Charlotte Islands.

resource while providing employment in forest-dependent communities. At the same time, targeted research, extension, and demonstration projects were initiated to develop and transfer new knowledge about forest management. By 1990, the program had planted approximately 163 million seedlings on 138 400 ha, and the NSR backlog had been reduced by 35%. In 1991, a new 4-year, $200-million cost sharing agreement was struck between BC and the federal government, known as FRDA II. Under this agreement, the priority was to mitigate the anticipated timber supply shortfall by treating juvenile stands. The largest share of FRDA II funding went to spacing, pruning, and fertilization in provincial forests, and 107 500 hectares had been treated by the end of the program. Significant monies were also invested in small-scale forestry (on private, municipal, federal, and First Nations lands), as well as research and extension. Research topics included hardwood management, silvicultural systems, forest inventory, sustainable forest development, forest sector market opportunities, and socio-economic analysis. Several studies funded under FRDA II were a continuation of research initiated with FRDA I funding. The BC Ministry of Forests Annual Report for 1995–1996 said of FRDA research, *"Tremendous strides have been made in forest renewal, hardwood/mixed-wood silviculture, vegetation management options, growth and yield, biodiversity, old-growth management, and environmental impact assessment. This knowledge, in turn, helped bring about development of operational guidelines and more ecologically sensitive forest practices."* Joint administration of these agreements through a management committee and several technical working groups brought about closer interaction between the staff of both agencies.

CFS researchers taking soil samples at the Montane Alternative Silvicultural Systems site. (Source: CFS)

However, as FRDA II progressed, an era of government restraint was beginning to take hold, and by 1993 the FRDA II funding commitments had been scaled back by $19 million. The agreement was extended into a fifth year in 1995, and final expenditures amounted to $184 million. But as the FRDA II agreement expired, so did this era of provincial–federal partnering in direct forest management in BC. This also coincided with significant cutbacks at the CFS itself, including termination of the Forest Insect and Disease Survey program, which led to the BCFS initiating Forest Health Aerial Overview Surveys. At the same time, the province began funding intensive forest management and research through the Forest Renewal BC program (1994 to 2002) and, later, through the Forest Investment Account (2002 to present).

2.4 Recent Collaboration: 1996–Present

Despite the end of the FRDA agreements and downsizing at the CFS 15 years ago, collaboration between the CFS and the BCFS has continued in a number of important areas. For example, the Montane Alternative Silvicultural Systems (MASS) study was established on Vancouver Island in the early 1990s (with the help of FRDA funding) to investigate the long-term performance of innovative silvicultural systems in high-elevation coastal forests (Beese and Arnott 1999; Mitchell et al. 2004). The project involves collaboration between the CFS, FERIC, BCFS, universities, and local forest companies, and it has continued to be monitored and maintained since its establishment.

One of the main vehicles for federal–provincial collaboration on forest management is the Canadian Council of Forest Ministers (CCFM). Created in 1985, the council consists of 14 provincial, territorial, and federal ministers who are collectively responsible for the majority of public forest management in Canada. Each year a new member assumes the role of chair, and a secretariat is provided by Natural Resources Canada (the federal department in which the CFS resides) to support council initiatives. Several task teams and working groups within the CCFM help to formulate national positions, foster inter-jurisdictional co-operation and information exchange, and develop collaborative initiatives relating to critical issues such as climate change and wildfire.

As the CCFM became established, forest management around the world was going through a period of major change. Public concern was growing over a variety of environmental issues and the idea of "sustainable forest management" began to emerge. Building on the "sustained yield" approach to timber management, sustainable forest management draws on the broader concept of sustainable

Dr. René Alfaro (CFS) and Dr. John King (BCFS) explain results of a spruce weevil resistance research to local foresters, 1999. (Source: Lara van Akker, CFS)

development and strives to manage the full range of social, economic, and environmental forest values in a way that balances the needs of current and future generations (Wang 2004). Although this is more difficult in some locations, particularly where complex forest values and diverse stakeholders exist, the CFS and BCFS have embraced sustainable forest management, which is evident in many of the collaborative efforts that have occurred in more recent years, including those within the CCFM.

One of the longest-running initiatives of the CCFM has been the development of Canada's National Forest Strategy, which provides high-level direction for the management of Canada's forests and the development of Canada's forest sector. The latest strategy, *A Vision for Canada's Forests: 2008 and Beyond*, sets two main goals: 1) to ensure a prosperous and sustainable future for Canada's entire forest sector and 2) to become a world leader in innovative policies and actions to mitigate and adapt to the effects of climate change on our forests and forest communities. Several desired outcomes that fall under these goals are also detailed, such as forest sector transformation through environmentally responsible innovations, diversification, and greater Aboriginal participation. BCFS and CFS staff members have consistently played an active role in the development of all national forest strategies to date, as well as in reporting and review phases.

The CCFM co-ordinates the development and reporting of criteria and indicators of sustainable forest management in Canada, the reporting of which helps showcase Canada's forest practices within this internationally recognized framework. Six criteria represent the overall goals of sustainable forest management in Canada, while 46 indicators provide a means to measure progress towards these goals. The CCFM produced national status reports in 2000 and in 2005, and in 2004 and 2006 the BCFS adapted many of the indicators for use in its *State of British Columbia's Forests* reports.

The CCFM has also facilitated the development of Canada's National Forest Pest Strategy. The strategy itself was developed by a Steering Committee that included representatives from the CFS and the Canada Food Inspection Agency, as well as provincial employees from BC, Alberta, and Ontario. The National Forest Pest Strategy is expected to improve the protection of forests from forest pests in Canada by requiring timely, science-based risk analyses and by streamlining the flow of information and expertise to other jurisdictions through improved information management and national co-ordination (CFS 2008).

2.4.1 Forest Pest Management and Research

In addition to the CCFM, forest pest management and research remains a significant area of collaboration between the CFS and BCFS. The CFS has conducted numerous field studies over the years, and the BCFS often provides "in-kind" support from regional entomologists or other staff (L. Safranyk, CFS, pers. comm., 23 June 2010). In turn, the CFS regularly provides advice to the province on pest management in specific locations, particularly those affected by mountain pine beetle (*Dendroctonus ponderosae*). The overall strategies and tactics framework used to manage mountain pine beetle in BC was created through collaboration between the CFS and BCFS (Brooks and Maclauchlin 1994). In the area of forest disease, a 1983 Memorandum of Understanding between the CFS and BCFS enabled collaboration on developing western white pine (*Pinus monticola*) resistance to blister rust (*Cronartium ribicola*). Joint efforts to identify resistant trees throughout BC have been used to establish several seed orchards where further breeding and testing for rust resistance is conducted (Hunt 2004). Similar collaboration was undertaken for weevil-resistant Sitka spruce (King and Alfaro 2009). CFS forest health experts have also provided support to BCFS tree nurseries when various disease problems occur (M. Meagher, CFS, pers. comm., 4 July 2010).

The most recent epidemic of mountain pine beetle has been the major forest health priority for both agencies during the first decade of the 21st century. Although mountain pine beetle outbreaks have occurred at regular intervals in the past and have long been managed for in BC Interior forests, the current outbreak has been the most damaging and widespread infestation ever recorded. In response, the federal government launched the Mountain Pine Beetle Initiative in 2002, a 5-year, $26.7-million program that delivered timely, focused research to support management of the epidemic and prevention of future outbreaks. The program also managed the beetle directly on lands outside provincial jurisdiction

Representatives from the BC Forest Service (Penticton) and the Splatsin Indian Band during CFS-funded fuel management work on the Splatsin Reserve. (Source: Maureen Scott, CFS)

(e.g., First Nations Reserves, National Parks, military lands) and assisted with the costs of beetle management on private, non-industrial forestland. In 2005, the federal government also contributed $100 million to BC to assist with provincially delivered mountain pine beetle operational and research initiatives.

One important project that began under the Mountain Pine Beetle Initiative was the development of a province-wide mountain pine beetle spread model (Eng et al. 2005). This model was developed by CFS and BCFS personnel and consultants, and has been updated and refined on an annual basis since its first projections were published in 2004 (e.g., Walton 2010). The model has been the key decision-support tool that has allowed the impacts of the epidemic to be anticipated on a regional basis. The BCFS and CFS have collaborated to improve mountain pine beetle monitoring (e.g., Wulder et al. 2009), as well as develop new approaches to monitoring using satellite data (Wulder et al. 2006a; 2006b).

In 2007, as the federal Mountain Pine Beetle Initiative came to an end, the epidemic in BC was far from over. Furthermore, it was becoming apparent that the conditions that led to the outbreak extended well beyond the beetle's historical range. Mountain pine beetle populations began spreading into the Peace River region in northeast BC and into adjacent areas in Alberta. Apart from ongoing provincial and industry operational initiatives, the federal government responded by initiating the Federal Mountain Pine Beetle Program, which committed $200 million to reduce the consequences of the beetle infestation and slow its eastward spread. The CFS administered large components of this program, including the funding of beetle control efforts delivered by BC and Alberta. The CFS also delivered funding for planning and implementing fuel treatments in forests affected by mountain pine beetle that pose fire risks to communities, and for removing mountain pine beetle hazard trees in recreation areas and communities. A committee of mountain pine beetle experts, composed largely of employees from the BCFS, CFS, and province of Alberta, conducted a science-based risk assessment of the threat posed by mountain pine beetle to the boreal region. The CFS has conducted overwintering mortality surveys in northeast BC to assess the state of the epidemic in its expanded range and to support BCFS decision-making. Funding was also provided for research that was aligned with the information needs of stakeholders; research that was carried out by various universities, provincial agencies, federal agencies, and independent research organizations.

2.4.2 Fire Management

Fire management is another important area of collaboration. Since 1982, the Canadian Interagency Forest Fire Centre in Winnipeg, Manitoba, has facilitated the sharing of fire-fighting equipment and personnel within Canada when extreme fire events overwhelm the response capacity of individual provinces. Additionally, the Canadian Interagency Forest Fire Centre compiles statistics on fire management and works to improve fire management in Canada. The Canadian Interagency Forest Fire Centre receives one-third of its funding from the federal government, while the remaining two-thirds comes from the provinces, divided proportionately based on their area of inventoried productive forestland (CIFFC 2010). The Canadian Interagency Forest Fire Centre is managed by a Board of Corporate Trustees and a Board of Directors with representatives from agencies responsible for forest management from each of the provinces (including the BCFS), territories, and the federal government (CFS).

Collaboration between the BCFS and CFS on fire management predates the formation of Canadian Interagency Forest Fire Centre. Since the 1970s this has included development of the Prescribed Fire Predictor, fire weather indices, fire occurrence prediction models, smoke emissions and dispersion models, the Canadian Forest Fire Behaviour Prediction System, and the BC Natural Disturbance Database. Research has also been done on infrared imaging technologies, fire ecology, fire hazards from juvenile spacing, prescribed burning effects on future stand development, prescribed underburning, procedures to map fuel types using forest inventory data, fire in stands affected by mountain pine beetle, and techniques to model the potential growth of free-burning fires. In 2002, the CFS assisted the BCFS in developing a national fire danger rating system for Argentina. Currently the CFS is working with BC and other provincial/territorial agencies on the Canadian Resource Demand Model, which will project fire danger, fire occurrence, and resource needs over a 2-week planning period (S.Taylor, CFS, pers comm., 23 June 2010).

BCFS and CFS staff collaborate with colleagues in Argentina to establish a Fire Danger Rating System. (Source: BC MOFLNR)

In 2003, BC experienced an especially damaging fire season. In addition to record-breaking fire suppression costs (which have since been surpassed in 2009), the 2003 season included several fires that breached the "wildland–urban interface," destroying hundreds of homes and other community assets. One sawmill burned to the ground and was permanently closed as a result. These events triggered the development of the Canadian Wildland Fire Strategy, a collaborative effort to improve wildland fire management in Canada. The development of the strategy was led by a "task group" of CCFM assistant deputy ministers, which was co-chaired by a CFS and a BCFS representative. Much of the background research and analysis was conducted by a seven-person team that consisted of three CFS employees, two BCFS employees, one Alberta provincial employee, and one consultant (a former CFS employee). Numerous other BCFS and CFS employees also contributed to the development of the strategy, particularly through attendance at a two-day national workshop on fire management in Winnipeg. The outcome was a 2005 declaration signed by all CCFM members on the vision, principles, and goals for fire management in Canada. Proposals for various initiatives to improve fire management were also assembled.

2.4.3 First Nations Forestry

Although the CFS has often provided support to provincial initiatives that fall within the CFS mandate, the reverse has also been true, with the province providing support to the CFS. For example, BC provincial funds have been used to support the CFS First Nations Forestry Program. The First Nations Forestry Program helps Canada's aboriginal communities manage their forest resources and participate more widely in Canada's forest sector. In 2000, the Forest Renewal BC program invested over $90,000 in the First Nations Forestry Program, which helped various First Nations establish joint ventures, co-management agreements, and forest management plans (N. Cataldo, CFS, pers comm., 15 April 2010). From 2004 to 2009, CFS research projects were also awarded over $1.7 million in funding through the BC Forest Service's Forest Investment Account–Forest Science Program.

2.4.4 Forest Inventory

Forest inventory continues to be an area of strong collaboration between the CFS and BCFS. Although the BCFS takes responsibility for conducting forest management inventories on provincial industrial forestland (or delegates this responsibility to tenure holders), significant areas of the province fall outside these inventories, particularly in national and provincial parks, on private land, and on other federal lands such as military lands and First Nations Reserves. Many forest management issues are influenced by the role these areas

BCFS and CFS staff working in vegetation management field plots near Duncan, BC, 2006. (Source: Simon Shamoun, CFS)

play in the overall forest landscape. Furthermore, governments, industry, and other landowners require knowledge of the state of and trends in all forests managed for timber production and other uses, so they can complete large-scale reporting on forest management to fulfil obligations for criteria and indicators as well as forest carbon science.

To address this need the National Forest Inventory was developed, which established a permanent network of sample plots that cover Canada's entire forest estate, regardless of ownership or land use. The National Forest Inventory is a product of a successful collaboration of provincial and territorial jurisdictions and the federal government. The program is co-ordinated by the CFS, and the provincial and territorial collaborators collect and provide data using jointly developed standards and procedures. The CFS provides the infrastructure to manage the data, and leads in the analysis of data and reporting.

The BCFS was instrumental in the design and early development of the National Forest Inventory, sharing experiences gained through the development and implementation of the Provincial Vegetation Resources Inventory. The BCFS also played a leadership role in the National Forest Inventory since BC was the first province to complete the baseline inventory data collection and analysis. The BCFS makes use of the data for provincial-level analysis and reporting, and is considering the national framework as a basis for broad-scale forest monitoring. The BCFS also benefits from the collaboration by having input and access to the tools and applications developed for the National Forest Inventory (for example, biomass equations and models) and through participation in a forest inventory community of practice involving all provinces and territories. The National Forest Inventory plots are monitored on an ongoing basis to capture information on the extent and nature of changes to the resource over time. The BCFS and the CFS have renewed their commitment to work co-operatively on the maintenance of the National Forest Inventory over the next 5 years.

2.4.5 Climate Change and Forest Carbon Science

Climate change mitigation and forest carbon science are major research priorities for the CFS, and an area where important collaboration with the BCFS has occurred. One of the main contributions of the CFS towards addressing challenges facing the forest sector as a result of climate change has been the development of landscape-level carbon accounting models. These have been developed in close consultation with the BCFS since the 1980s, and are used to quantify and better understand the contribution of forests and forest management to climate change mitigation. The most recently developed model, known as CBM-CFS3 (Kurz et al. 2009), is the key analysis tool used by the CFS to estimate changes in forest carbon that must be reported under the United Nations Framework Convention on Climate Change (Environment Canada 2011; Stinson et al. 2011). Data for BC is provided by the BCFS, and the BCFS also uses this model to analyse provincial-level forest carbon changes. Furthermore, a national-level study (Kurz et al. 2008a) was done to determine

whether managed forests in Canada will likely act as a near-term carbon sink[4], and this involved collaboration with the BCFS and other provincial and territorial agencies through the National Forest Sinks Committee. In subsequent studies using the CBM-CFS3 model, CFS and BCFS employees collaborated to examine the impact of mountain pine beetle on BC's forest carbon stocks (Kurz et al. 2008b) and explore future impacts of climate change itself on BC's forests (Metsaranta et al. 2011). CFS researchers collaborated with the BCFS and other provincial and territorial agencies to produce a comprehensive report on the expected impacts of climate change on Canada's forests and some suggested adaptation strategies (Williamson et al. 2009). When BC developed its Net Zero Deforestation policy, this was done in close consultation with CFS deforestation monitoring and carbon accounting experts, and the implementation of the policy will make use of CFS deforestation and afforestation monitoring systems. Through the CCFM, BCFS staff members have also worked closely with other provinces as well as CFS staff members in responding to Canada's Council of the Federation requests for tree species vulnerability assessments in the face of climate change.

Development of the close collaborative relationship between the CFS and BCFS in the area of climate change science has been aided by actions at the highest levels within the BCFS. BC's Chief Forester created two key climate change positions within the BCFS. Initially, these staff worked directly with the CFS carbon accounting team for 2 years in a capacity-building phase before returning to BCFS offices, bringing with them newly acquired skills and a strong working relationship with CFS. Close collaboration and free exchange of ideas and information among forest carbon researchers working in BC, including those at BCFS headquarters and the CFS's Pacific Forestry Centre, has positioned BC as a leader in science-based forest carbon management.

2.4.6 Economic Research and Marketing

The CFS also conducts economic research to support the competitiveness of Canada's forest sector. Economists at the CFS maintain close links with colleagues at the BCFS, and they meet periodically to share research findings and to discuss current issues. CFS-led studies of particular interest to the BCFS include those on the Canada–US softwood lumber trade (Stennes and Wilson 2005), secondary forest product manufacturing in BC (Stennes and Wilson 2008), forest-based bioenergy production (Stennes and McBeath 2006), and impacts to communities from mountain pine beetle (Parkins and McKendrick 2007; Patriquin et al. 2007). Data sharing and collaboration on study design has occurred in many of these projects. In the area of marketing, the Canada Wood Export Program has partnered with BC's Forest Innovation Investment and major industry associations to promote Canada's wood products abroad and remove unnecessary trade barriers, such as those in local building codes. The CFS is also supporting technological advancements in BC's forest sector through the Pulp and Paper Green Transformation Program and the Investments in Forest Industry Transformation Program, which are helping the sector to diversify into innovative products and renewable energy, and are improving the sector's environmental performance.

The Forintek, Feric, and Paprican labs, while not formally part of the CFS, have continued to make strong contributions to forest products research in BC, and these labs receive significant support from both the federal and BC provincial governments. More recently, these labs have undergone a major restructuring by joining forces to form FPInnovations. Furthermore, the CFS has contributed additional staff and funding to a fourth division of this institute, strengthening its ties with the industry research labs. Named the Canadian Wood Fibre Centre, the division is staffed by CFS employees who focus on research that enhances the value of Canada's forest resources to the forest sector. This effectively broadens the scope of FPInnovations to encompass the entire forest products production chain. The FPInnovations Board of Directors and each of its four Divisional Steering Committees have members that are drawn from the CFS, BCFS, other provincial governments, and forest industry firms.

3. Discussion and Conclusion

Although we have found many examples of collaboration between the BCFS and the CFS, we acknowledge that some examples, especially more recent ones, feature more prominently due to the availability of information. Furthermore, there are almost certainly instances of collaboration that we have missed, under-emphasized, or for which we have only told part of the story. However, the above examples still illustrate the general pattern of collaboration and the ebb and flow of these

[4] Results demonstrated that Canada's managed forests would likely be a net source of carbon during the current reporting period (2008–2012) due to impacts from natural disturbance. Because of this, Canada elected not to include forest management in its accounting of Kyoto Protocol compliance, which is optional under the protocol.

activities over the past 100 years. Early collaboration was focused on fire management, pest management, and forest products research, which remain key areas of federal–provincial co-operation to this day. During periodic downturns in the forest sector, job creation through forest improvement projects has been emphasized. As BC advanced its sustained yield timber management, the federal government assisted the province by supporting timber inventories and reforestation. Once these activities had become well-established within the BCFS, collaboration shifted to other emerging priorities, such as intensive forest management.

More recent collaboration reflects the adoption of sustainable forest management principles at both the CFS and BCFS. Many collaborative initiatives, particularly those within the CCFM, flow directly from this approach, such as the National Forest Strategy and criteria and indicator reporting. Research conducted by CFS scientists reflects a broad range of values such as carbon storage, biodiversity, ecological resilience, and the ability of forests to sustain rural communities. BCFS researchers have focused on forest growth and yield, gene resources management, ecosystem classification and interpretation, watershed management, climate change, and other areas of operational and policy priority. Both the BCFS and CFS also play a direct role in promoting the competitiveness of Canada's forest sector through the CCFM, FPInnovations, and other initiatives. BCFS staff members have extensive experience overseeing the management and use of some of Canada's most important forest resources, and have shared this expertise in various forums to help Canada address national and international issues and responsibilities.

Although we focused on documenting collaborative projects, these form only part of the CFS–BCFS relationship. The BCFS and the overall forest sector have benefited from a wide range of CFS research over the years. Additionally, BCFS staff members have contributed to many national and international forest initiatives during that time.

Many of those interviewed for this report stressed the importance of the camaraderie that exists between staff members at the two agencies. As one interviewee stated, *"One thing I think should be emphasized is that successful collaborations are all about the people, and depend on personal relationships at the working level based on professional regard, mutual respect, trust, and a sense of common cause . . . ".* It is clearly the staff of the BCFS and CFS, at all levels, who must be credited for developing the spirit of co-operation that exists between the two agencies.

Field work at Darling Lake, 1945. (Source: CFS)

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