FOREST AND RURAL FIRE RESEARCH

# Fire Technology Transfer Note

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## Impressions of fire management, research and training in Canada

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### Introduction

I was recently fortunate enough to be able to visit Canada to undertake a three-week study tour, and to attend a week-long Advanced Wildland Fire Behaviour Course in Dorset, Ontario. The study tour component of my trip took me across the provinces of British Columbia, Alberta and Ontario. In each of these provinces I visited the provincial fire management agencies, as well as federal bodies and fire research organisations.

Being a relatively recent appointment to the Fire Research programme, with limited prior exposure to fire management, the aim of this trip was to provide me with a first-hand insight into fire management and research in Canada, and in particular to gain exposure to new developments and technologies. This study tour and the Advanced Wildland Fire Behaviour Course have significantly added to my knowledge and experience in these areas. This *Fire Technology Transfer Note* is a summary of my impressions of how fire management, research and training function in Canada, specifically related to the three provinces I visited.

Funding for this trip was provided for by the Forest and Rural Fire Association of New Zealand (FRFANZ), the Forest and Rural Fire Research programme's operational funds, and Forest Research's training budget. Without the external sponsorship from FRFANZ in particular, this trip would likely not have been possible, and so this support is greatly appreciated.

### Fire in Canada

The most striking feature of Canada in relation to New Zealand is its size: the total area is 927 million hectares. Forests (417.6 million hectares) cover approximately half of the landmass, and 57% of this area (234.5 million hectares) is considered to be "commercial" forest. Canada contains 10% of the world's temperate and boreal forest. Management of forests rests with the provinces, and they control 71% of the forest area. The federal government controls 23%, and the remainder (6%) falls under private landowners (CFS 2000). This is quite different to the forest ownership patterns in New Zealand, where commercial forests are largely privately owned.

Canada experiences an average of 9000 wildfires annually, which burn an area of 2.8 million hectares. Lightning is a significant cause of fire in Canada, with 35% of all fires being started by lightning. These fires account for 85% of the area burned. Only 3% of all fires grow to become larger than 3 hectares in size, but at the same time these fires account for 97% of the area burned nationally (Stocks 2000). The forest area burned annually in Canada equals the amount harvested annually (CFS 1998).

Responsibility for fire management lies with the provincial governments. Forest resources represent a considerable proportion of many of the provincial economies; e.g., in British Columbia, the forest industry produces $16 billion annually in forest products, and directly employs 80 000 people (BCFS undated).

It is therefore critical to protect as much of this resource as possible from damaging wildfires. Within the provinces, the provincial government is therefore responsible for fire management throughout the province's natural areas. Exceptions are national parks, which are managed by the federal agency, Parks Canada, which coordinates its own fire management policies. Significant areas of grasslands, such as the prairies, do also occur in Canada, but responsibility for fire suppression in these areas often lies with the municipal (or local) fire departments.

The provincial fire control agencies do in many cases have their own research capabilities, but on the national scale the federal government (through the Canadian Forest Service) largely carries out fire research. Cooperation and sharing of resources between agencies has been made possible through the Canadian Interagency Forest Fire Centre (CIFFC), and it was through this organisation that the large-scale deployment of approximately 900 Canadian fire personnel to the USA was coordinated this past fire season (2002).

### Fire management and control

As already mentioned, the responsibility for fire management and control principally lies with the individual provincial governments. The approach to fire management and control within the three provinces I visited (British Columbia, Alberta and Ontario) was very similar, with only slight differences in structure and function.

The over-riding goal of fire control in all three provinces is the same – to hit fires hard, and hit them fast. This is to reduce the area burned, and prevent relatively minor fires from becoming very large and costly ones. This philosophy is largely based on the value the forest resources represent to provincial economies. As a result of this, some of the provinces have a very high success rate with initial attack, such as British Columbia, where 92% of all fires are contained within 24 hours of discovery. Not all fires are attacked immediately, since it is not physically possible to do so. Priorities for attack are predetermined, and a good example of this is in Ontario, where the province has been divided into zones that are based on response action. Fires occurring in the remote and inaccessible northern regions of the province are largely left to burn unchecked, since there are no valuable timber resources and no populated areas in these regions. In contrast, in the areas where the timber resources are of high commercial value, the aim is to contain all fires to within 4 hectares.

The problem of development into Wildland-Urban Interface (WUI) areas, and the risk of devastating fires in these areas, is of major concern in all of these three provinces. Development into these WUI areas is proceeding at a rapid pace, and is often unchecked. The provincial governments are allocating large amounts of resources towards community protection and education, and this is especially evident in Alberta, where they have wholeheartedly adopted the "FireSmart" concept (Figure 1), as well as wildfire threat analysis processes (Partners in Protection 1999; Quintilio undated).

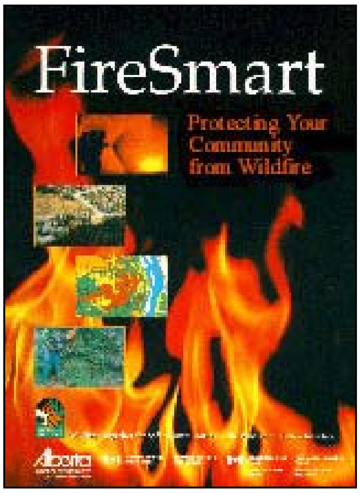


**Figure 1.** The "FireSmart" concept has been developed by Partners in Protection, a coalition representing a number of different agencies from across Canada. The concept has proven very popular, and has gained widespread support.

Fire detection methods do vary between provinces, with towers only being extensively used in Alberta. This is largely due to the flat terrain in Alberta, compared to the very mountainous terrain of British Columbia. Towers are very effective in detecting fires in Alberta, whereas in BC and Ontario members of the public are largely relied on to report fires. After severe lightning storms, especially dry lightning, patrols are often flown to detect fires in remote areas.

All three of the provinces operate through a very similar management structure. Fire control on the provincial level is coordinated through a provincial control centre. The province is then divided into a number of regions, and these regions each have their own fire centre. All fire control and suppression in the region is coordinated through this regional fire centre, and these regional centres in turn report to the provincial fire centre. The provincial fire centre coordinates activities on a provincial scale, and will handle requests for resources, and allocate these resources between regions as it sees fit. The provincial centre is therefore looking at fire management in the province from the "big picture" point of view, whereas the regional centres are responsible for their own regions. Regional centres will also have a number of subsidiary, or "zone" offices throughout the region, and these zone offices report directly to their regional centre. Once again, each province does do things a little differently, but this is the overarching practice in place in each of these provinces. The centralisation of resources between regions within a province has been most effective, and in all of the three provinces visited there was agreement that pooling of resources across the provinces was far more effective than each region retaining its own resources for the entire fire season. In this way, equipment, aircraft and crews can be moved from a region which is experiencing LOW fire danger to one that is experiencing EXTREME fire danger. The Incident Command System (ICS) has also been implemented across the provinces in Canada, and is very similar to the NZ Coordinated Incident Management System (CIMS).

The use of technology and dissemination of information throughout the provinces is most impressive. Integrated systems are used to monitor conditions, fire status and resource allocation across each province. Fire managers in the regional centres have the latest information at their fingertips, such as real-time lightning detection, weather forecasts, predicted fire behaviour across the region in the different fuel types, tracking of aircraft, resource allocation information, etc. Many of the provinces operate their own network of weather stations (in addition to the national network of stations operated by Environment Canada), and BC, Alberta and Ontario all have their own network of lightning detectors. Each provincial fire centre also has its own meteorology section, and the meteorologists are responsible for regularly updating fire weather forecasts, providing spot forecasts if required, and giving weather briefings throughout the day to personnel in fire centres across the province, if necessary.

Fire suppression methods do differ between provinces. Ontario handles fire suppression quite differently to Alberta and BC. In Ontario, because of the large volumes and areas of water available, extensive use is made of the CL-415 water bomber (Figure 2). These aircraft are capable of carrying over 6000 litres of water or foam, and can fill their tanks by scooping on a water source in 12 seconds (Bombardier Aerospace 2002). Ground firefighting is also different in Ontario, with a large number of fires being fought with portable pumps and hoses (similar to NZ). By contrast, in Alberta and BC, a large amount of


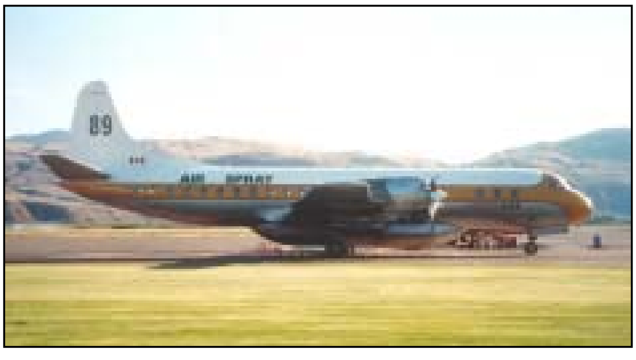

**Figure 2.** Bombardier CL-415 water bomber (left), owned and operated by Ontario Ministry of Natural Resources; Lockheed Electra L188 airtanker (right), contracted to BC Ministry of Forests.

hand-line is cut and burning-out is used to contain fires due to less available water. These provinces also do not generally use the scooping water bombers, but instead use more of the medium-sized air tankers, typically dropping retardant as opposed to foam or plain water (Figure 2).

One organisation that manages fire very differently to the provincial agencies, is Parks Canada, the federal agency responsible for all of the national parks throughout Canada. In national parks there is no commercial value placed on the timber. As in the USA, until fairly recently, fire was viewed as a destructive force in ecosystems and was excluded as much as possible. However, it is now recognised that fire has an important role to play in ecosystems, and Parks Canada is now trying to re-introduce fire to the landscape within its national park areas. Their policy is to largely let wildfires burn, except where lives or property are threatened. Extensive prescribed burning programmes have also been introduced in these parks. A good example is in Banff National Park, in the Canadian Rockies on the BC/Alberta border, where the aim is to burn 1400 hectares every year through prescribed burning. However, this is still only approximately 20% of the area that would have historically burned through wildfires. Reintroducing fire through prescribed burning has been no easy task, and a great deal of time and effort has had to be put into public education. Difficulties also arise with the provincial governments who are responsible for forest areas on the boundaries of national parks, for if a wildfire (or prescribed burn) burns from a national park into the provincial forests, considerable losses of merchantable timber could occur.

Wildland-Urban Interface (WUI) issues are also of major concern in many of the popular tourist areas in these national parks, such as the Banff and Jasper townsites in the Banff and Jasper National Parks. Extensive thinning operations are being conducted around these areas to reduce the fuel loads and, it is thought, crown fire potential (Figures 3 and 4).

**Figure 3.** Example of thinning operations carried out as part of a community protection exercise at Lake Edith, near Jasper town in Jasper National Park. A settlement of cottages surrounds the lake, and extensive thinning has been carried out around the settlement to reduce the fire hazard and afford some protection to properties in the event of wildfire. The photographs illustrate how dense the unthinned areas are (left), and the result after thinning (right). It is thought that the thinned areas will reduce the risk of high intensity crown fires, which are difficult to control.

**Figure 4.** Part of Jasper townsite in the Jasper National Park, surrounded by forest.

A key to the success of these projects has been the involvement and participation of the local communities. Parks Canada staff have worked very closely with communities in these areas, and in many instances, such as the Lake Edith project (refer to Figure 3), the community has largely taken ownership of the project, wholeheartedly supporting the efforts of Parks Canada staff.

I also managed to visit Elk Island National Park, near Edmonton, Alberta. Here fire is also used extensively, primarily to maintain wildlife habitat. This park has an important role in maintaining populations of elk and bison, and stocks many other wilderness areas throughout North America. Again, maintaining an active prescribed burning programme has been difficult here, largely due to the park's proximity to a large urban area (Edmonton), and its relatively small size (approximately 20000 hectares) with farmland surrounding it.

## Fire research

As already mentioned, fire research is largely carried out at a federal level through the Canadian Forest Service (CFS); however, individual provincial agencies also have a research capability within their organisations. This function lies with the science and technology divisions, and personnel in these sections are responsible for research, development of systems, fire technology transfer, etc. They often work together with researchers from other organisations, such as the CFS. Universities also have active research programmes in fire-related topics.

### *Canadian Forest Service*

I visited three of the CFS Research Centres: the Pacific Forestry Centre (Victoria, BC); the Northern Forestry Centre (Edmonton, Alberta) - this is the main fire research centre; and the Great Lakes Forestry Centre (Sault Ste Marie, Ontario). The CFS maintains an extensive fire research capability throughout a number of its research centres. Research activities are coordinated through the Fire Research Network (FRN), which facilitates extensive collaboration on a number of research projects.

Climate change is becoming an increasingly important area of research within the CFS, and the focus of fire research programmes in recent years has been increasingly aimed at studies on the implications of climate change on fire and fire management in Canada. The general long-term prediction for Canada, using a number of global climate change models, is for a drier and warmer climate. This will obviously have a significant impact on the number and size of forest fires in Canada in the future. Researchers are also involved in studies aimed at quantifying annual carbon emissions from forest fires. Researchers have been producing models to simulate future scenarios, and are also investigating ways in which these risks can be mitigated, such as through planting of less flammable species (e.g., aspen), and thinning and other activities to break up areas of continuous and highly flammable fuels. The impact of climate change on vegetation fires perhaps also deserves closer attention in NZ?

A range of other research projects are still being undertaken, with many exciting developments taking place. The CFS has had significant involvement in developing a fire danger rating system for Southeast Asia (Figure 5). This is particularly aimed at reducing smoke emissions in these countries from slash and burn agricultural practices. By relating FWI fuel moisture codes such as the Duff Moisture Code (DMC) and Drought Code (DC) to fuel types in these

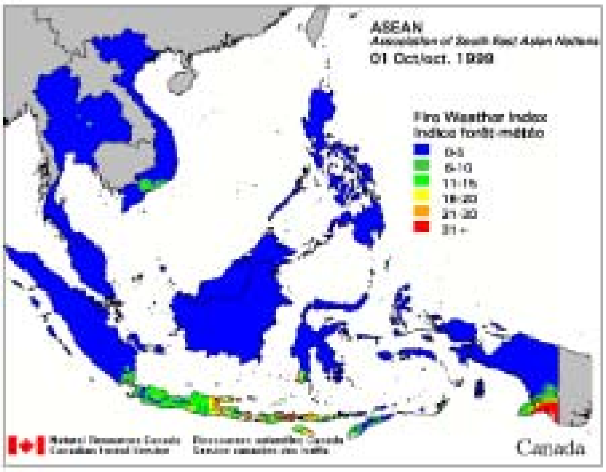


**Figure 5.** Example of mapping of the FWI values for the Southeast Asia region, part of the project being undertaken by the CFS.

countries, it is hoped to implement guidelines for burning (based on the FWI values) to reduce the smoke emissions at certain times of the year. Smoke is a major issue in these countries due to agricultural burning, and has significant health implications. A number of training programmes and technology transfer activities have been undertaken by the CFS in these countries in recent years, and other Asian countries, such as Vietnam, are now expressing an interest in this work. Interestingly, the adaptation of the Canadian Forest Fire Danger Rating System in NZ is often referred to by the CFS as a good example of what can be achieved through successful adaptation of the system outside of Canada.

CFS researchers are still involved with fire behaviour modelling in the Canadian fuel types, and are constantly looking for ways to improve existing models and systems in place. In Ontario, at the CFS Great Lakes Forestry Centre in Sault Ste Marie, recent efforts have been aimed at improving the fire behaviour models currently in use for the mixedwood fuel types (these fuel types are characterised by varying proportions of conifer and deciduous species). Another good example of the work undertaken in improving fire behaviour models is the International Crown Fire Modelling Experiment in the Northwest Territories.

A number of exciting developments are taking place with development of fire growth models and other systems. The CFS, together with a number of other organisations, has been involved with the development of Prometheus, an integrated fire growth prediction system, which will have the potential to predict not only rates of spread and fire shape and size, but also other factors such as spotting and firebreak breaching potential, crown fire potential, fireline construction rates, etc. A number of other fire growth models are also under development. The development of fire occurrence prediction models has also been underway, with an interesting model being developed predicting the occurrence of person-caused fires. The development of this model, however, emphasises the need for accurate and consistent record keeping, an area that needs improvement in NZ! Models have also been developed to predict the probability of ignitions from lightning strikes. Researchers are increasingly making use of satellite imagery and remote sensing to develop tools for fire weather modelling, large fire detection and mapping, vegetation condition analysis, smoke dispersal patterns, etc. In recent years there have been improvements in the technology available, and it is perhaps timely for NZ to take a closer look at the use of remote sensing (as previously investigated for the grassland curing project). The CFS has also developed the Spatial Fire Management System (sFMS), which was recently implemented in NZ by the NRFA. This is a very powerful and useful tool (Figure 6), and has the potential to include fire occurrence prediction, optimal resource allocation, and smoke dispersion patterns.

CFS researchers are also involved in a number of other research areas, including fire ecology, fire history mapping, WUI and community protection projects (such as "FireSmart" and wildfire threat analysis), prescribed burning and the use of fire to prevent encroachment of woody species.

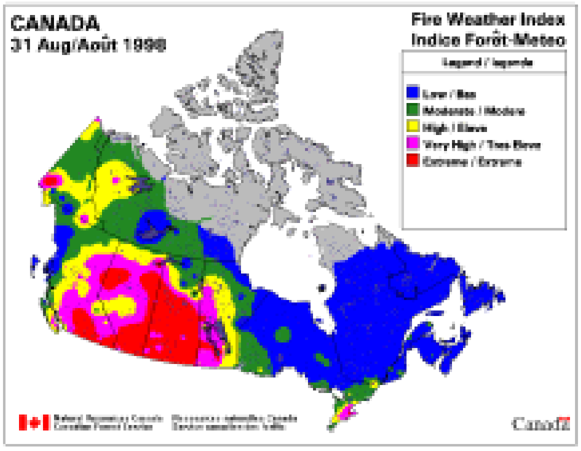


**Figure 6.** Example of daily fire weather mapping across Canada, undertaken by the CFS using sFMS. Mapping of all the components of the FWI System is carried out daily, as well as other indicators such as head fire intensity.

*FERIC Wildland Fire Operations Research Group*

The Wildland Fire Operations Research Group (WFORG) is a part of the Fire Engineering Research Institute of Canada (FERIC), and is based at the Environmental Training Centre (ETC) in Hinton, Alberta. The WFORG undertakes operational fire research and technology development, and was established in 2001 to meet the need for operational fire research in Canada following the closure of the Wildland Fire Operations Research Centre in Petawawa, Ontario, in 1995. The research focus is on wildfire operations (fire suppression and management), forest management (related to wildfires), and evaluation and development of equipment and systems. The existing team of four researchers, including Greg Baxter (who worked for the Fire Research programme in NZ for 2½ years), is looking at expanding their numbers and increasing their funding base.

The WFORG undertakes research into a range of interesting and diverse projects. Some of these projects that have (and still are) being undertaken include:

- A study of ground travel rates by firefighters through vegetation in emergency escape situations;
- The effective use of helicopters for extended attack fires;
- An evaluation of the effectiveness of presuppression preparedness systems;
- Methods to improve the detection of wildfires in Alberta;
- Fire implications of selective harvest practices;
- Appropriate footwear for firefighters;
- The use of sprinkler systems in structure protection;
- An investigation into fire starts due to All-Terrain Vehicles (ATVs);
- The use of airborne infrared remote sensing systems in wildfire management.

Details of these, and other projects, can be viewed on the WFORG website (refer to the "Useful websites" section at the end of this paper).

*Fire Management Systems Laboratory, Faculty of Forestry, University of Toronto*

The main focus of the research being carried out at the Fire Management Systems Laboratory at the University of Toronto is aimed at developing decision support systems for fire managers, using operational research methods and information technology. These models and decision support systems focus on "real problems", and are aimed at assisting in fire management and suppression. The research team here consists of a number of post-graduate students under the leadership of Dr David Martell.

The focus of research here has broadened slightly in recent years. Current students are undertaking research into a diverse range of areas, such as an investigation into the effects of fuel treatments on wildlife; community protection in interface areas through various fuel treatments; and development of decision support systems for prescribed burning. For further details, visit the website listed at the end of this paper in the "Useful websites" section.

## Fire training

In addition to attending the Advanced Wildland Fire Behaviour Course, I also visited the Alberta government's Environmental Training Centre (ETC) situated in Hinton. The ETC offers a range of forestry and environmental training courses, and an extensive range of fire-related training. A large amount of this fire training is aimed at the provincial (i.e., Alberta) level, but the ETC also runs a number of national courses, such as the Advanced Wildland Fire Behaviour and Wildland Fire Behaviour Specialist courses. They have also developed a number of interactive training systems, such as the fire simulator and CD-ROM training packages, which are proving very popular. A number of curricula for courses are developed here, and then passed on to regions for delivery at the regional level. Similarly, a number of "train the trainer" courses are run from here. There is also a move in Canada towards national standards in training, and the ETC has played a key role on this National Training Working Group.

### *Advanced Wildland Fire Behaviour Course*

I completed my trip by attending the Advanced Wildland Fire Behaviour (AWFB) Course in Dorset, Ontario. This is a national course, and is regarded as a prerequisite for the Wildland Fire Behaviour Specialist Course. The AWFB is a seven day course, consisting of six days of lectures, with a theoretical and practical examination on the final day.

There were a total of 52 students attending the course, and the group was made up of personnel with a number of years of experience in fire control, such as: fire centre duty officers; Fire Management Technicians; Air Attack Supervisors; and experienced crew leaders. The course content is aimed at a level higher than the existing NZ Intermediate Fire Behaviour (IFB) course. Emphasis is placed on how all the factors of the fire environment (fuels, weather, topography) interact and determine fire behaviour. The course strongly emphasises how these factors interact, and serves to consolidate one's understanding of fire behaviour. The theory sessions include an in-depth background to the development of the Canadian Forest Fire Danger Rating System, upon which the NZ Fire Danger Rating System is based. A large part of the course, including most of the last 3 days, was based on exercises and case studies of actual fires. These practical sessions were an excellent opportunity to apply the knowledge gained to "real-life" situations, and to compare predicted fire behaviour against what actually happened. Emphasis was laid on the "art", as well as the science, of fire behaviour prediction.

Throughout the course, a strong emphasis was placed on safety, and fire behaviour discussions were always related to the effect of predicted fire behaviour on safety. Both the first and last sessions of the course covered safety issues related to fire behaviour. All in all, I found it to be an excellent course, and it definitely enhanced and cemented my knowledge and understanding of the fire environment.

## Discussion and conclusions

The aim of the study tour component of the trip was to gain an understanding of fire management and research in Canada, and in particular to take note of new initiatives in fire research and the development and use of new technologies.

I was most impressed by the use of new technologies in fire management and operations across the three provinces I visited, and at how the outcomes from research are integrated into fire management. Fire managers have the latest technology at their fingertips, backed up by quality research and very effective technology transfer programmes. This ensures that the daily decision-making undertaken by fire managers is done so using up-to-date technology and reliable scientific models and systems.

It is easy to say that Canada is different to NZ, that the fire problem is much larger there than it is here, and that Canada has many more resources available for fire management and research. This may be true, but regardless of these differences, I found that many of the issues facing fire management and research in Canada are very similar to those being faced in NZ. Agencies across Canada, both in fire research and management, are facing reductions in funding and pressure to reduce spending. As a result of this and other factors, there is an increasing loss of experienced personnel from fire management. Wildland-Urban Interface (WUI) issues are becoming a serious problem in Canada, with more and more unchecked development taking place in these areas. Although fire is a part of ecosystems in Canada, the attempted use of fire as a management tool still faces opposition from many sectors. A good example is the case of Parks Canada, who have had to invest considerable resources into public education in order to undertake prescribed burning and thinning operations in national parks. Climate change is also another major issue across Canada, and fire research organisations, particularly the CFS, are focussing on the future impacts of climate change on fire in Canada. Perhaps this is something we should be investigating in New Zealand?

With a number of people from NZ having now undertaken fire behaviour training in Canada, such as the Advanced Wildland Fire Behaviour and Wildland Fire Behaviour Specialist courses, the question arises as to what are the needs for an advanced level of fire behaviour training in NZ (beyond the current Intermediate Fire Behaviour course)? It is my impression that there is a need for an advanced level of fire behaviour training in NZ, and such a course could be developed for delivery in NZ. There was certainly no shortage of offers from the Canadian instructors to come over here and assist!

With the continuing development of the NZ Fire Danger Rating System, and its basis the Canadian Forest Fire Danger Rating System, there is certainly a great deal that can be learned from Canada in terms of both fire research and management. However, there is now also a significant amount of interest being shown by the Canadians in what we do here in NZ. This was particularly apparent to me with respect to fire research. The Forest and Rural Fire Research programme has obviously gained a great deal from Canadian fire research organisations over the years, but significant interest is now being shown in fire research developments here in NZ. The scrub fire modelling work is a good example of this. Scrub-type fuels are found throughout various parts of Canada, and very little research has been carried out into fires in these fuel types. There is now an interest in understanding fire behaviour in these fuels, and Canadian researchers are very interested in the work that has been done here in NZ. Another good example is the grassland curing project. Canada does have vast areas of grasslands, and fires in these areas can be significant. Again, very little research on estimating the degree of curing has been carried out in Canada, and there is a lot of interest in the work that we are doing, specifically in investigating the relationships between soil moisture and/or Drought Code and degree of curing. This is most encouraging, in that the flow of information between the two countries can become a two-way flow, and not just NZ gaining from Canada. This also reflects the high regard the NZ Forest and Rural Fire Research programme now has internationally.

**Acknowledgements**

In addition to the financial support already mentioned, the trip would not have been a success were it not for the assistance and support I received from all the organisations I visited. The time taken from busy schedules to host me is much appreciated. In particular, I would like to thank Dr Marty Alexander of the Canadian Forest Service, who assisted with arranging my activities and itinerary for the trip; the Ontario Ministry of Natural Resources, who arranged my attendance at the AWFB course and waived my accommodation fees; Shawn Bethel of the BC Ministry of Forests; and the Environmental Training Centre and FERIC WFORG at Hinton, Alberta, for hosting me during my visit there.

## References

BCFS. No date. British Columbia Forest Protection program profile. British Columbia Ministry of Forests.

Bombardier Aerospace. 2002. Amphibious aircraft: Bombardier 415. http://www.bombardier.com/

CFS. 1998. Canadian Forest Service Fire Research Network. Natural Resources Canada, Canadian Forest Service.

CFS. 2000. The state of Canada's Forests 1999-2000. Forests in the new millennium. Natural Resources Canada, Canadian Forest Service. http://www.nrcan-rncan.gc.ca/cfs-scf/national/what-quoi/sof/

Partners in Protection. 1999. FireSmart: protecting your community from wildfire. Partners in Protection, Edmonton, Alberta, Canada.

Quintilio, S. No date. Integrating fire and sustainable forest management - FireSmart landscapes. A discussion paper. Draft report. Alberta Sustainable Resource Development.

Stocks, B.J. 2000. Climate change: implications for forest fire management in Canada. Natural Resources Canada, Canadian Forest Service. 4 p.

## Useful websites

Canadian Forest Service Fire Research
- www.nrcan-rncan.gc.ca/cfs-scf/science/resrch/forestfire_e.html

British Columbia Ministry of Forests, Protection Branch
- www.for.gov.bc.ca/protect/

Alberta Sustainable Resource Development, Forest Protection
- http://envweb.env.gov.ab.ca/env/forests/fpd/flash.html

Ontario Ministry of Natural Resources, Aviation and Forest Fire Management Branch
- http://affm.mnr.gov.on.ca/

Environmental Training Centre, Hinton, Alberta
- www3.gov.ab.ca/srd/forests/resedu/etc/

Parks Canada
- www.parkscanada.gc.ca

FERIC Wildland Fire Operations Research Group
- http://fire.feric.ca/

Fire Management Systems Laboratory, University of Toronto
- www.firelab.utoronto.ca/

Canadian Interagency Forest Fire Centre (CIFFC)
- www.ciffc.ca

Partners in Protection
- http://www.partnersinprotection.ab.ca/