Forest Fires and Sustainable Forest Management in Canada

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During the summer of 2003, Canadians were captivated by vivid images and stories about forest fires, especially those in British Columbia and Alberta. Portrayed as an unmanageable menace that only produces loss and suffering, fire is, in fact, essential to maintaining the health, structure, and diversity of most of Canada's forest ecosystems. Given the dichotomous nature of these two realities, policymakers as well as land and resource managers face a daunting challenge as they seek to find ways to balance effectively the potential benefits and detriments of fire in an attempt to ensure the ecological, economic, and social sustainability of our forests, the forest industry, and forest-based communities.

Canada's Forests

Canada has 418 million hectares of forest, which constitutes 10 percent of the total forested area in the world. These forests are vital to the cultural, social, and economic well-being of Canadians. For example, exports of forest products are the single largest contributor to Canada's balance of trade ($32.6 billion per year); the employment of 361,000 Canadians is directly tied to the forest sector; and there are over 300 forest-dependent communities in all regions of the country. Millions of Canadians also use forests for recreational activities, such as hiking, bird watching, canoeing, fishing, and hunting, spending over $11 billion annually on trip-oriented, nature-based activities. From an international perspective, we have been entrusted with a vast resource whose stewardship is critical to achieving global sustainability. Canadian forests not only contain thousands of different plant, animal, and insect species, but they also store a sizeable portion of the world's terrestrial carbon.

Forest Fires in Canada

Most of the forests in Canada have evolved harmoniously with fire since vegetation began colonizing land after the glacial retreat at the end of the last ice age, some 10,000 to 15,000 years ago. Many species are adapted to or dependent on fire, which serves numerous functions in forest ecosystems including influencing species composition and age structure, regulating forest insects and diseases, affecting nutrient cycling and energy fluxes, and maintaining the productivity, diversity, and stability of different habitats. Currently, there are about 8,500 forest fires reported each year in Canada (Figure 1). About 60 percent are caused by humans, but in some regions the number of lightning fires greatly exceeds those caused by people. The mean annual area burned is 2.5 million hectares, but this varies significantly from year to year (e.g., 0.3 million hectares in 1978 to 7.5 million hectares in 1989) and spatially across the country (Figure 2). Under a changing climate, forest fire activity is also expected to increase in many parts of Canada, especially the continentalInterior, due to longer fire seasons, increased ignitions, and more severe fire danger conditions resulting primarily from an increase in the frequency and severity of drought.

Operational forest fire management activities, such as fire suppression, prevention, and prescribed burning, are the responsibility of provincial and territorial governments, and Parks Canada. Collectively, these agencies expend between $400 million and $800 million annually, making fire

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management one of the most expensive aspects of forest management in Canada. The federal government plays an important role in fire management, in that it has maintained an internationally recognized research program in this area since the mid-1920s. The results of this research, in combination with the efforts of a formal federal and provincial/territorial forest fire committee created in 1947, have assisted Canada in becoming a world leader in forest fire management.

Fire Management in the Sustained Yield Era

Forest fire management is defined as the activities concerned with the protection of people, property, and forest areas from wildfire, and the use of prescribed burning for the attainment of forest management and other land-use objectives, all conducted in a manner that considers environmental, social, and economic criteria. It is, therefore, not an end in itself but, instead, provides mechanisms by which desired resource management goals can be achieved.

In the late 19th and early 20th centuries, the focus of Canadian forest policy and practices on resource extraction, combined with European-based perceptions of fire, resulted in forest fires being seen as "the enemy." Fire was considered a major threat to public safety having destroyed numerous communities across Canada (e.g., Miramichi, NB in 1825; Lac St. Jean, QC in 1870; Vancouver, BC in 1886; Fernie, BC in 1908; Matheson, ON in 1926; Haileybury, ON in 1922). It was also seen as wastefully consuming readily accessible timber. Consequently, early foresters and the general public sought the total elimination of fire.

FIGURE 1

Number of Fires and Areas Burned in Canada 1959-2002
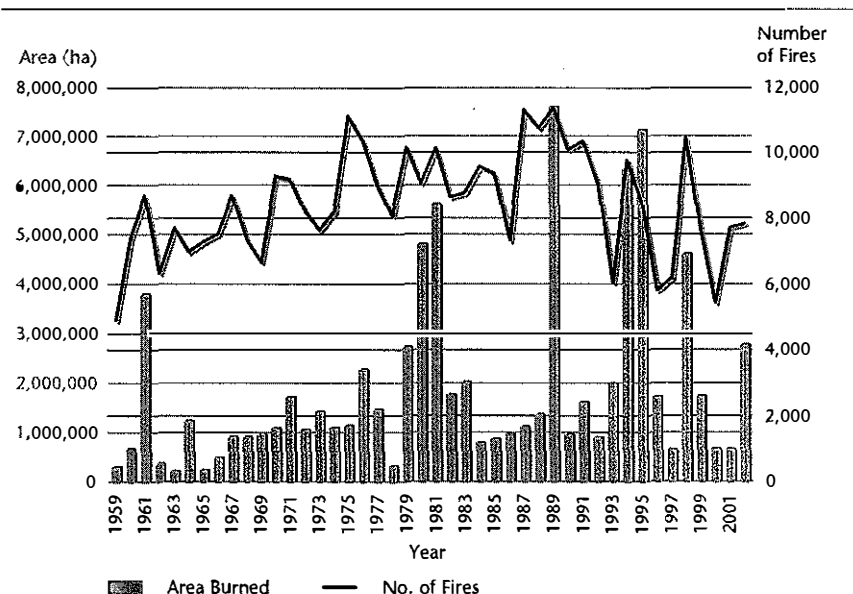
Source: Stocks et al. (2003).

FIGURE 2

Map of the Large Forest Fires in Canada (>200 ha) 1980-1994
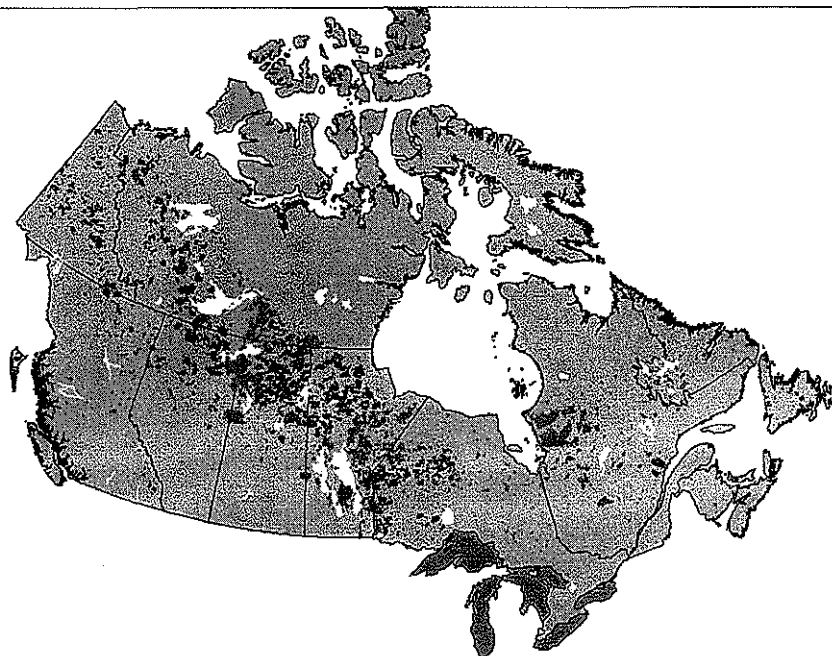
Source: Amiro et al. (2001).

In the mid-20th century, under a philosophy of sustained yield, forest management practices in Canada concentrated primarily on efficiently maximizing fibre production at the stand level (i.e., on a small area usually less than a few hundred hectares). This goal, along with the lingering fear of fire, caused fire management to remain focused almost exclusively on wildfire prevention and suppression to minimize the area burned and, ultimately, the loss of life, property, and natural resources. To this day, large, uncontrolled, unplanned wildfire is considered undesirable from various Canadian viewpoints. Within both the forest industry and forest-dependent communities, the extensive allocation of available timber resources has heightened concerns about the economic and social impact of wildfire. Increasing threats to urban development in or near flammable forest areas, the potential impact of smoke on public health and the economy, and the effect of wildfire emissions on the global carbon cycle are all cited as reasons to minimize the number and size of wildfires.

The desire to control wildfire and the belief that this is possible is founded primarily in an attitude of human mastery of nature. It has also been fuelled by unprecedented technological developments in transportation (e.g., airplanes and helicopters), equipment (e.g., gasoline-powered pumps and aerial helitorches), communications, and now satellite and computer technology, all of which contribute to faster and stronger initial attacks and sustained forest fire suppression activities. In fact, in the last few decades the effectiveness of fire suppression programs has risen to the point where

97 percent of all fires in Canada are contained at a very small size (less than 200 hectares). However, a small percentage continue to escape initial attack, and these fires, which are extremely difficult to control, account for almost all the area burned and a majority of the fire management expenditures in Canada. Further, fire suppression is subject to the law of diminishing marginal returns. According to the literature, and based on recent experiences with large fires in Canada and other developed nations, suppression appears to be reaching its limit of economic and physical effectiveness. Those who work closely with fire now realize it is neither economically possible nor ecologically desirable to eliminate fire from our forest ecosystems.

Embarking on a New Era for Forest Fire Management

Over the last 10 to 20 years, there has been a growing recognition of the need for an integrated, systems-based approach to forest management at the stand and landscape levels. This recognition has been a catalyst for a philosophical shift from single or multiple resource sustained-yield management toward a more holistic, ecosystem-based approach. In Canada, this is referred to as sustainable forest management, which has been formally defined as management to maintain and enhance the long-term health of forest ecosystems, while providing ecological, economic, social, and cultural opportunities for the benefit of present and future generations.

In forests where fire has historically played a significant role, the transition toward sustainable forest management has tremendously increased the com-

plexity of forest fire management. It is no longer acceptable for policies and practices to focus on the exclusion of fire. As such, greater consideration is being given to the short- and long-term socio-economic and environmental risks associated with both the presence and absence of fire. The rate of advancement toward this new paradigm is, however, hampered by past perceptions and attitudes toward fire, as well as by individual and institutional inertia associated with the status quo. Many steps need to be taken by both the private and public sectors to overcome these challenges, but three steps appear essential.

First, resource management professionals and the public, especially those who live and work in or near forested areas, must acknowledge and respect the inherent flammability of forests, and the vital role of fire in the long-term sustainability of these ecosystems, and the products and services they provide. Recognition must also be given to the fact that because suppression has its limits, the challenges posed by wildfire cannot be overcome by an increase in firefighting capacity or funding. Although it is certainly important to be able to react appropriately in emergency situations, proactive measures are needed to alleviate the root causes of such problems before they occur. For example, cross-training of structural and wildland firefighters will improve their ability to respond to wildland–urban interface fire incidents, such as those that occurred in Kelowna, BC, but it would be even more preferable if the frequency and severity of such incidents could be minimized through proper implementation of FireSmart guidelines (see the accompanying

sidebar for details) for land-use planning, home construction, and area maintenance.

Second, the spatial and temporal uncertainty associated with forest fires and other natural disturbances needs to be incorporated into strategic and operational forest and fire management planning. Planning in the forest sector, which has historically been based on deterministic models, will now need to consider the stochastic nature of fire. This can be readily accomplished by adopting a risk management approach to sustainable forest management. In dealing with fire, such a process would include attaining a comprehensive understanding of the historic fire regime(s) of a management area, a quantitative assessment of the current and projected fire environment (i.e., fire behaviour potential, ignition potential, suppression capability, and values-at-risk), and an evaluation of short- and long-term strategies to minimize vulnerability and risk to achieve desired management objectives. Numerous techniques and discipline-specific models are available to assist analysts and decision-makers. However, further interdisciplinary research and modelling, as well as an effective knowledge exchange are required to make significant advances.

Third, policies governing resource management must be revised to foster the development and application of innovative, results-based forest management practices founded on the best available science and traditional knowledge. Policy-makers will have to give resource managers the mandate and support to take reasonable risks in the present to minimize other risks in the future. This could include

FireSmart: Protecting Your Community from Wildfire

FireSmart is both a concept and a product. Initially, a FireSmart manual was developed to encourage community-based initiatives to reduce the risk from wildfire in the wildland-urban interface. Produced by Partners in Protection (an association of federal, provincial, and municipal government agencies and non-government organizations), it provides knowledge, tools, and examples of how to increase public safety, decrease the potential for structure loss, and reduce public and private expenditures for evacuations and fire suppression. Through a Web site <www.partnersinprotection.ab.ca> and the distribution of over 10,000 copies of the manual, many individuals and communities across Canada and internationally have undertaken FireSmart activities.

FireSmart thinking is now expanding to include forest landscapes. Research and operational trials are underway to identify how forest management practices (e.g., harvest scheduling, cutting and road designs, regeneration, and stand tending) can be used in a proactive and planned manner to reduce the area burned by unwanted wildfires and also the risk associated with the use of prescribed fire. The eventual goal is to have FireSmart homes, within FireSmart communities, within FireSmart landscapes to help people and fire-dominated ecosystems harmoniously co-exist.

increased use of prescribed fire to enhance ecological integrity and manage forest fuels as is occurring in our national parks, or converting highly flammable coniferous forests to less flammable deciduous species at strategically located areas on the landscape. Coincident with greater freedom and flexibility, land managers must also assume more responsibility for ensuring public deliberations and support for their activities, increase monitoring of possible impacts of their actions, and ultimately be accountable for the eventual outcomes of their practices.

Moving Forward

Fire has been and is likely to become an even more significant disturbance in Canada's forest ecosystems. This means the sustainable management of these forests will depend on the ability

to balance the social, economic, and ecological impacts of fire. Although philosophically attractive and desirable, this goal may not be pragmatically attainable due to the difficulty of reconciling all the trade-offs associated with the positive and negative aspects of fire. Nevertheless, it is a worthy objective and, therefore, the responsibility of government, industry, nongovernmental organizations, and the public to encourage and foster the open and informed evaluation and debate of the future directions of forest fire management policies and practices in Canada.

Further suggested readings related to this article can be found in the version that is posted on the PRI website at <www.policyresearch.gc.ca>.

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Sustainable Development
Where Next?

While the term sustainable development was not defined until more than a century later, recognition of the concept by the Government of Canada dates to Confederation. In 1871, Prime Minister Sir J.A. Macdonald remarked that

> [t]he sight of immense masses of timber passing my windows every morning constantly suggests to my mind the absolute necessity there is for looking into the future of this great trade. We are recklessly destroying the timber of Canada, and there is scarcely a possibility of replacing it.

Recent major milestones in Canada's sustainable development (SD) journey include the 1987 Montréal Protocol on ozone-damaging chemicals, the 1992 Earth Summit, and Canada's 2002 ratification of the Kyoto Protocol on climate change. These developments reflect increasing attention being paid to SD issues, and increased recognition of the interactions between the environment, the economy, and social development. The February 2, 2004 Speech from the Throne included a lengthy section on SD – a clear demonstration that sustainability is of central importance to the Government of Canada.

The Policy Research Initiative's Sustainable Development project was launched in 2001, focusing on corporate social responsibility, environment and trade, and governance. This issue of *Horizons* marks a major turning point in the PRI's SD

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Canada

project, with the first wave of activities coming to an end, and a new phase begin-
ning. The first feature article, by project lead Ian Campbell, signals that the PRI's
own SD journey will take the path of studying socio-economic and governance
aspects of freshwater management.

A summary of the findings of the report, *Advancing Sustainable Development in
Canada,* recently published by the PRI, sets the stage for the remainder of the
issue. In this report, the International Institute for Sustainable Development
identifies seven priority areas for SD policy research. A variety of articles, briefs
and reports follow, introducing selected aspects of these and other SD issues.
The topics covered here are far from comprehensive, and some major themes
are not included. Some of these other themes have been covered in previous
issues of *Horizons* and the fall 2002 issue of *Isuma.* These include corporate
social responsibility, international engagement, health and development,
ocean resources, and climate change.

An eco-region or landscape approach is critical to many aspects of SD, and is
one of the seven priority areas identified in *Advancing Sustainable Development.*
Kelvin Hirsch (Natural Resources Canada), Ruth Waldick (Environment Canada),
and Ken Farr (Natural Resources Canada) contribute on different aspects of
landscape sustainability. Examining optimal policy mixes for managing water
demand will be a key focus of the PRI work on freshwater management.
Fatma Maged (Environment Canada) discusses voluntary measures for
environmental protection.

Lest it be thought that SD in Canada is only about the environment, several
articles deal with social aspects of SD. Urban transportation consultant Richard
Zavergiu shares some thought-provoking observations on how environmental
sustainability can help Canadian cities compete with their American counter-
parts. Pearl Eliadis (PRI) and Donald Lemaire (Justice Canada) discuss nonnative
approaches to policy, in particular as they apply to the field of social policy.

As regards data development in the area of SD, David McGuinty (National Round
Table on the Environment and the Economy) presents the NRTEE's new integra-
tive indicators, and Robert Smith (Statistics Canada) highlights data gaps related
to water management in Canada.

Research briefs, book reviews, and conference reports related to social capital, early
child development, and evidence-based policy in education round out the issue.
The next issue of *Horizons,* due out in the spring, will be primarily dedicated to
the North American Linkages project.

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