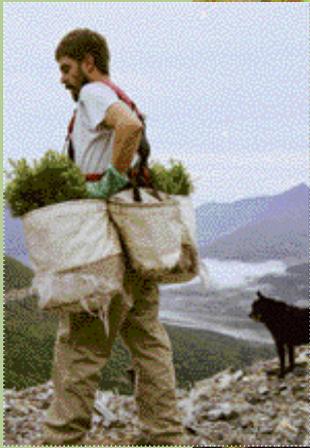
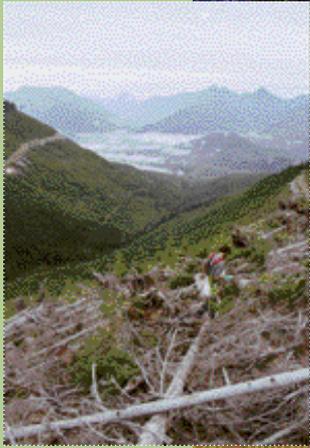




CANADIAN

# SILVICULTURE

WINTER 2004



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 NEW BRUNSWICK

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Canadian Silviculture is published four times a year by EMC Executive Marketing Consultants Inc., 6058 187A Street, Surrey, BC V3S 7R6.  
Phone 604-574-4577 Fax 604-574-2196  
Email [silviculture@emcmarketing.com](mailto:silviculture@emcmarketing.com)  
Copyright Canadian Silviculture Association  
Subscription rates: 4 issues per year - \$30.00 & GST  
PUBLICATIONS MAIL AGREEMENT NO. 40026059  
RETURN UNDELIVERABLE CANADIAN ADDRESSES TO  
CIRCULATION DEPT EMC PUBLICATIONS  
6058 187A ST  
SURREY BC V3S 7R6  
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### FEATURES

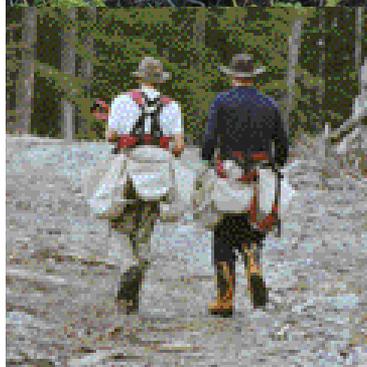
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Biomass can be both a source of hydrogen atoms as well as a source of the energy that will fuel hydrogen cells.



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New Brunswick is at a significant crossroads and clearly the invitation for renovation dialogue has been accepted by a broad constituency.



## Ken Drushka: forest trails

In October 2003, a slim book was published, *Canada's Forests, a history*, by Ken Drushka. In less than a hundred pages, Drushka deftly sketches the emergence of Canada's forests regions after glaciation, the period of fire that dominated Aboriginal forest modification, the rise of industrialization and the conservation movement, between which arose today's challenge of sustainable forest management.

For anyone working in the woods and wondering how we got here, in order to better understand where we are, Drushka's history accurately positions today's great challenge - sustainable forest management.

Those of us struggling to clarify the next steps will miss Drushka's unique skill at making complex subjects simple without sacrificing accuracy. Ken's cancer will soon end the lifetime of unique learning and skill necessary to create such an elegant summary of Canada's forest history.

We step into and play out each of our sagas in the dynamics of our era. People like Ken Drushka share some of their lessons and their growth becomes everyone's learning.

At age 22, Drushka's inherited skill for word-smithing a steady, reading edge was honed as the Globe and Mail education reporter. He moved to seek refuge from Toronto's urban lifestyle and sought adventure out west. Buying horses, tack and gear from a friend in Alberta, he rode through the high Rockies from Canmore to Golden, eventually finding a new life making a living from the adventures of logging and silviculture contracting in BC's remote forest. After a decade and a half, Drushka's skill at research and

writing lead to forest history projects for the Campbell River Forest Museum and Expo '86.

His subsequent histories "*Against wind and weather*" of coastal tugboating, "*Tie hackers to Timber Harvesters*", "*Working in the woods*" and "*Tracks in the forest*" captured the innovative scope of BC's forest harvesting. His biography of HR Macmillan, BC's first Chief Forester and autobiography with Ian Mahood in "*Three men and a forester*" captured the gripping vitality of two lives whose struggles defined the challenges of balancing industrial growth and forest conservation. "*Ligmun, a history*" captures the intergenerational phases of the family owned businesses that dominate forest industry development. His 1986 and 1999 books "*Stumped: The Forest Industry in Transition*" and "*In the Bight: the BC Forest Industry today*" along with hundreds of articles and columns detailed the dynamics and complexity of the uniquely Canadian version of sustainable forest management that emerged in BC and across Canada. For his research, he traveled to compare practices and document the work of forest innovators in other parts of the world.

Drushka's combination of experience, analytic research, body of writing work and word skill make *Canada's Forests: a history* uniquely alive and available for any reader.

Select quotes from the conclusion set this era's stage:

"The idea of sustainable forest management is not new. Half a century ago Aldo Leopold proposed essentially the same concept. It lay more or less dormant until about twenty years ago. Now it has become part of mainstream

thought, and throughout the country thousands of people are attempting to put it into practice."

"This is not an easy task. It is difficult enough for people to change the way they think about the work they do. It is also difficult to reform the forest economy without inflicting hardship on individuals and communities. It is even harder to revise laws, regulations, practices, industrial structures and social conventions that will need changing before sustainable forest management begins to achieve the goal set out for it in the Canada Forest Accord."

"In choosing to manage their forests in the manner outlined in this strategy, Canadians have set themselves an immense challenge. Because the revenues required to fund it must be earned in a global marketplace that includes producers who are not similarly constrained."

"They will be the first to learn the strengths of the concept of sustainable forest management, and the first to see its weaknesses."

"Today, after centuries of forest use, Canadians have accepted their role as stewards of the forests that define this country. They have committed themselves to sustaining them, enhancing them, and passing them on to succeeding generations."

Ken Drushka wrote with the informed, independent clarity he admired in the pioneers of Canada's forest history. His legacy is a record of our past achievements and failures. This record makes it easier for successive generations to take up the changing challenges of their times.

Thanks Ken.



# Fuel For Thought Bioenergy

by Luc C. Duchesne and Suzanne Wetzel

Harry Kelly stared across the table in the smoky Greenstone restaurant. He pulled on his grey goatee and shook his head. He said, “We’re trying to get big industries to set up shop in Greenstone but our biggest problem is that we can’t support them with sufficient power and cost-effective energy sources.” Mr. Kelly is as outspoken as you would want a director of economic development to be. An industrial engineer by trade, he has been Greenstone’s director of economic development for 15 years and he has vowed to break through Greenstone’s economic development barrier. “It’s paradoxical that the future of the community depends on the rising cost of energy while we are sitting on a treasure trove of biomass either from the wastes of the forest industry or from the huge amount of peat reserves.”

At the Pikangikum First Nation’s Whitefeather Forest Initiative research office in Northwestern Ontario, adviser Andrew Chapeskie, President of Whitefeather Forest Management Corporation Alex Peters, and Chief Paddy Peters lean over a map of the Whitefeather Forest Planning Area – the area within which the First Nation intends to develop protected areas and community-led forestry partnerships. When the initiative is realized, Whitefeather Forest Management Corporation will assume commercial forest management and local stewardship responsibilities for over 1.3 M ha of boreal forest in northwestern Ontario. Chapeskie points out, “One of the biggest concerns of this community of 2,200 people is to create value-added forestry opportunities locally while

maintaining forest cover and biodiversity on the land. They want to do this guided by their aboriginal environmental values and knowledge tradition partnered with western science.” Alex Peters states what this will mean in practice: “When the Elders say that they want nothing to be wasted in a new use, such as forestry, on our ancestral lands, they want to be leaders in showing how this can be done. Critical to how we will do it is to secure new green energy sources.”

In Newfoundland, district manager Brian Stuckless looks at a mound of waste bark and sawdust with growing concern. He would like to see the fire hazard removed but he is reluctant to force a struggling sawmill owner into bankruptcy.

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alliance to develop gasoline-based fuel cell cars. In June 2001, Nissan and Renault announced they would make gasoline-based fuel cell cars their priority and initiated a five-year joint R&D program supported by nearly a \$900 million investment. In January 2003, they announced plans to begin limited marketing of fuel cell vehicles in Japan, two years ahead of their previously announced schedule. Road tests are currently underway in Japan. Canada's Ballard Power Systems of Burnaby BC is one of the world's leaders in this field. Hydrogen is especially attractive as it can be generated from any existing fuel source. Today, roughly half the hydrogen currently produced for industrial purpose is generated from natural gas, whereas coal accounts for a fifth of the hydrogen production. Most observers expect natural gas to continue to be the feedstock of choice for hydrogen producers for the next 10-20 years. Biomass is expected to play an increasingly important role in the hydrogen economy. It is important to understand that hydrogen cells are not sources of energy: they are storage mechanisms. Enter biomass, which can be both a source of hydrogen atoms (biomass contains roughly 6% hydrogen) as well as a source of the energy that will fuel the hydrogen cells.

### What are Canada's sources of forest biomass?

Fossil fuels are biomass transformed over geological eons and trapped in particular geological conditions. In the

**Table 1.**  
**Sources of forest biomass for biofuels for Canada**

<b>Unharvested portion of the annual allowable cut</b>
<i>81,500,000 M Tonnes of dry biomass</i>
<b>Logging Residues from current forest operations</b>
<i>75,300,000 M Tonnes of dry biomass, assuming a ratio of 1/0.85 between merchantable to waste biomass.</i>
<b>Peat Moss</b>
<i>50,000,000 M Tonnes as the annual allowable harvest of peat from over 111 M ha of peat lands</i>
<b>Energy plantations from fast growing species</b>
<i>46,500,000 M Tonnes of dry biomass per year from 15,500,000 ha of fallow land planted with fast growing species accumulating at 3 tonnes/ha/year</i>
<b>Sawmill Residues from current operations</b>
<i>20,000,000 M T</i>
<b>Municipal Waste wood</b>
<i>8,100,000 M Tonnes per year</i>
<b>Paper mill Sludge</b>
<i>1,540,000 M Tonnes per year</i>




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fall 2003 issue of Canadian Silviculture, we emphasized that a biofuel needs to meet three basic requirements: 1) it should be storable—which is why electricity or steam can be problematic as they cannot be stored, 2) it needs to have sufficient energy density to be moved cheaply, and 3) it needs to be cost-competitive with fossil fuels.

The reason why crude oil is such a valuable source of energy is that it is cheap, it can be stored effectively and it can be shipped cheaply. In contrast, forest biomass is at the other end of the spectrum: it is expensive to extract, it cannot be stored well for long periods and is very costly to move around over long distances. Thus, the creation of forest biofuels requires a great deal of careful planning.

Canada is both an importer and an exporter of energy, so the country's energy budget requires the accounting of imports and exports into a common unit, the Gigajoule. Canada's net energy use, after we have transformed electricity, natural gas, coal and crude oil into Gigajoule units, is roughly 7,400,000,000 Gigajoules. As a leading industrialized country our energy budget is huge. To put it in context, given that a gas-guzzling car - let's say your average SUV - burns up to 30 Gigajoule per year, then the country's energy budget is enough to run 247 billion SUV's in one year. That's a lot of mileage but note that 60% of Canada's energy budget is taken up by the industrial and transportation sectors together.

In theory, there are 283 million tons of forest biomass available annually for conversion to bioenergy (Table 1). We can convert each tonne of dry biomass into 2 barrels of oil equivalent or 12 Gigajoule of BioOil and 2.4 Gigajoule of char using Fast Pyrolysis, a patented process owned by DynaMotive Energy Systems Corporation. Therefore, there should be 3,400,000,000 Gigajoule of BioOil and 680,000,000 Gigajoules of char available from forest biomass. By and large, forest biomass can theoretically contribute

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are needed at several levels

one half of the country's energy budget. In practice, it will require a great deal of planning to reach this level.

The low-hanging fruits in the world of feedstocks for biofuels are those that come free or with a negative economic value (material that costs money to land fill): municipal waste wood, mill residues such as bark, sawdust, planer shavings, end cuts, paper sludge or slabs that are waste streams from the transformation industry. In the past, we used to dispose of this material in beehive burners, most of which have been faded out from the country because of their impact on air quality. Now there are a number of disposal methods for this material: secondary industrial applications such as particleboards, in-house energy use, offsite co-generation strategies or, at the bottom of the list, land filling. By and large, and despite the resurgence of secondary biomass use, there is still sufficient biomass available to meet 11% of Canada's biofuel demand and, given the right set of economic circumstances, generate fuels that are cost-competitive to fossil fuels. Biofuel from wastes are more cost-effective in that they are also carbon creditable under Kyoto, as they can be used as replacements for fossil fuels.

The other feedstocks, including logging residues, post-disturbance salvage operations, fuel control harvests, unallocated biomass and energy plantations all require varying amount of cash outlays to manage, grow, harvest, process and transport to transformation sites, and therefore require complex economic evaluations. In the harsh world of economics, there are situations when the energy cost of



acquiring, transforming and transporting bioenergy to markets will be greater than the proceeds from energy sales. In a purely free market economy a significant proportion of this biomass will be below economic thresholds. But the bigger picture shows biofuels as having tremendous societal benefits that far exceed plain sensitivity analyses.

Canada's forestry sector has much to learn from Brazil's sugar industry. Brazil's experience in the development of green fuels (Proalcool program initiated in the 1970's) puts it in a unique perspective. It was through this program that the country established ethanol as a mobile fuel effectively displacing an excess of

70 billion USD in fossil fuel imports. There were two main economic spin-offs to the fuel generation program. On the one hand, it created local jobs involved from the transformation of sugarcane residues into ethanol—these jobs were a net gain in employment as they were created in lieu of buying foreign fuels. On the other hand, it made the Brazilian sugarcane industry the most competitive sugar industry in the world and insured its sustainability.

In Canada, biofuels from forests can also be used to offset fossil fuel imports. Even with a negative balance sheet, they create domestic employment and generate fiduciary revenues that should



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offset the values of subsidies that may be required to jumpstart this industry. Indeed, the purchase of fuel from a foreign source is a net export of jobs and funds, whereas Canada would gain a great deal by replacing fossil fuel imports with domestic biofuels that will support rural, First Nation economies and make the forest industry more competitive.

### The future of biofuels

The mainstreaming of biofuels from forest biomass rests on four pillars: technology, economics, ecology and policies.

Now Canada has access to technology that is second to none. For one thing, R&D support has been instrumental in pushing technological development a

long way. However, the private sector is poised to take the leading technologies to market in demonstration plants. We should expect the next couple years as crucial for market development.

The economics of biofuels will continue to influence the mainstreaming of biofuels. Indeed, market forces will select those technologies that are price competitive with fossil fuels. Without a clear economic advantage, we cannot see how biofuels will acquire market share.

Ecological precepts will be critical to ensure ecological sustainability as well as biodiversity conservation. Using waste streams from current milling operations will have a positive environmental impact as far as the

reduction of materials to landfills is concerned together with the reduction in green house gas emissions. But what of energy plantations and peat land exploitation? These issues need to be addressed through hypothesis testing and experimentation to assess the potential drawbacks associated with the intensive management of forest ecosystems that are poorly understood for the most part. Thus with proper planning, we will be able to offset the potential negative impact of these technologies.

Policies will play a critical enabling role in the establishment of biofuels in Canada. New enabling policies, including tax incentives, are needed to support the emergence of this industry. Tax incentives are needed at several levels, here are a few examples: woodlot owners need to see property taxes reduced or eliminated; the transport of biomass and biofuels should be tax-exempt; property taxes and corporate taxes for companies conducting the transformation of biomass to biofuels should be drastically reduced to favour this market.

In the long run, biofuels will not replace fossil fuels, which will continue to be a major contributor to Canada's economic growth. However, we should envision biofuels taking an increasingly bigger market share in the future.

Luc C. Duchesne is Chief Forester of DynaMotive Energy Systems Corp. in Vancouver, BC. He can be reached at [لودuches@NRCan.gc.ca](mailto:لودuches@NRCan.gc.ca). Suzanne Wetzel is a Research Scientist with Natural Resources Canada, Canadian Forestry Service, in Sault Ste. Marie, ON. She can be reached at [swetzel@NRCan.gc.ca](mailto:swetzel@NRCan.gc.ca)

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# Silviculture Contracting Within SFM

By Sen Wang\*, Bill Wilson, and Brad Stennes



## Introduction

In the last decades, the notion of sustainable forest management (SFM) has emerged in response to a global movement concerned with forest management practices.

It is now widely accepted that natural resource and ecological sustainability, economic vitality, community stability, and industrial competitiveness constitute the most important dimensions of sustainable forest management. SFM comprises management regimes to maintain and enhance the long-term health and integrity of forest ecosystems and forest-dependent communities, while providing ecological, economic, social, and cultural opportunities for the benefit of present and future generations. Essentially, the argument put forward by Dawkins (1972) has prevailed; that is, forests ought to be viewed as "... highly valued life support systems, rather than as specialized suppliers of any one type of product or benefit."

In the same time, silviculture research has advanced on multiple fronts. These research findings suggest silviculture has an important role in attaining the principal objectives of SFM.

## Contribution of Silviculture to Sustainable Forest Management

Broadly defined to entail the entire cycle of cutting, regeneration, and tending of forests, contemporary silvicultural systems have evolved over two hundred years of practice.

The traditional role of silviculture was threefold: (i) enhancing forestland productivity and timber production, (ii) maintaining financial profitability of forest products industries, and (iii) promoting social well-being via employment opportunities. Silviculture has gone beyond these original objectives to embrace the full spectrum of controlling forest establishment, composition, structure, and growth for a wider range of goals. Lacaze (2000) notes that the recent contextual changes of SFM call for silviculture practices that prioritize conservation and recreation over timber production, hence, giving rise to an expanded role for silviculture, i.e., to protect ecosystems, preserve biodiversity and manage their role as carbon sources and sinks. One important trend is that timber harvesting is seen as an activity secondary to the protection of other multiple-use values. Lands harvested under President George

W. Bush's American "Healthy Forests" initiative emphasizes thinning for wildfire management on federal forestlands near communities. This is in the wake of one of the worst summer wildfire seasons in American history, during which some 2.5 million hectares of forests burned. <http://www.whitehouse.gov/infocus/healthyforests/>

## Economic Considerations

Despite its fundamentally biological nature, silviculture is, by and large, an economic activity. By treating silvicultural planning and program delivery as a business undertaking, forest managers must confront the question: Is it financially justifiable to undertake a given silvicultural activity? Conventionally, the principal criterion for identifying and selecting silvicultural investment options is to choose from those projects that are capable of yielding positive net present values. The net present values are calculated using the standard discounting technique for comparing alternative scenarios of silviculture regimes that promise positive net present values. This capital budgeting approach is based on the principle of maximizing economic efficiency by comparing the opportunity costs of investment options.

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However, the economics of silviculture is by no means an exercise of merely reducing complex investment problems to a simple capital budgeting exercise. The multitude of silvicultural activities involves risk and uncertainty because of the difficulties associated with pre-determining end products and with scheduling specific activities in an intertemporal and spatial framework. Silvicultural planning also takes place at the forest level as well as the stand level, with different implications for each level. In the new silvicultural regimes emerging within SFM—i.e., those that aim for both ecological and economic sustainability—rotation age and retention level of live trees in harvesting units are considered important stand-level components.

Clearcuts are among the most disputed of silvicultural treatments. The move toward smaller openings has been driven by environmental concerns and changing societal values. However, in the transition to smaller clear cuts, new environmental and social problems—such as short-term timber supply, access management, and forest fragmentation—have emerged. While large openings in forest stands may impact biodiversity and aesthetic values, smaller openings generally result in greater fragmentation of forest habitat and have financial implications regarding timber-harvest volume and economic returns.

SFM leads to intensive forest management because multiple-objective harvesting (i.e., a reduced ecological footprint) and creation of additional parks and protected areas will reduce access to timber. Intensive forest-management practices that can off-set the harvest loss effect include using stock types produced from improved seed; matching species and stock type to soil/site condition; varying initial plantation spacing to maximize the use of available growing space; and undertaking vegetation management, pre-commercial and commercial thinning, stand-improvement cuts, fertilizing, pruning, prescribed burning, and multi-cropping.

Despite the demonstrated high yield, the risks and costs of growing short-rotation forest plantations for biomass production outweigh the biomass value in many areas of the world. As illustrated in Figure 1, profitability of intensive forest management for biomass alone may be obtained in Chile and New Zealand, but not in North America.

For fibre volume goals, genetic improvement and late-rotation fertilizing activities stand a good chance of being economically justifiable. For instance, tree genetics work is confirmed to be capable of yielding a 10–15% gain over unimproved seedlings, and new seed orchards promise to double those gains. Wood science and technological advances create new uses and values for low-value trees. In recent years, the use of poplar for oriented strand board and pulp has increased utilization of this former “weed” species. Fast-growing eucalyptus fibre is emerging as a financially attractive plantation investment in large part due to innovative processing technologies. The short rotations also reduce the risk of catastrophic loss due to fire or pest events.

### New Challenges in Silvicultural Operations

Silviculture is an important component of BC's forestry sector due to the relative size of the harvest, higher potential growth rates and stand values. Prompt reforestation of harvested sites

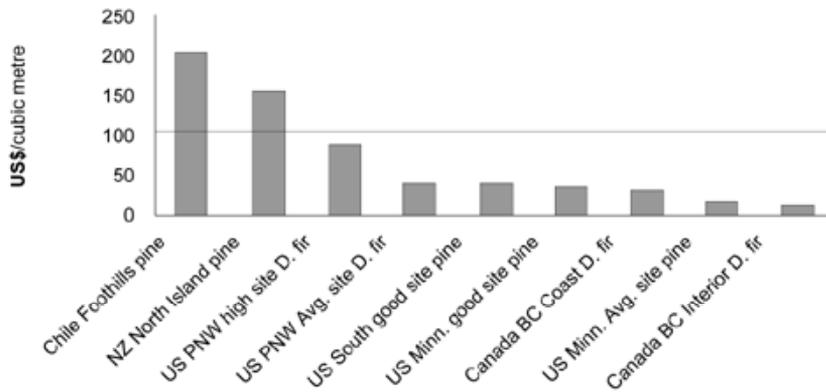


Figure 1. Profitability of intensive forest management calculated for fibre volume: net present value of US\$100 invested at 8% real interest rate. Based on various studies compiled by CIBC Wood Gundy.

to free-growing status is compulsory on BC's public forestland. Given the commitment to SFM, is it necessary to expand investment beyond the stage of basic silviculture to include incremental silviculture? In the Canadian context, basic silviculture is defined to include all the silvicultural practices required to achieve a free-growing regeneration of desired species at specified densities and stocking. Incremental silviculture has traditionally referred to the silvicultural prescriptions and practices in stands that are past free-growing conditions for the purposes of enhancing stand value and yield.

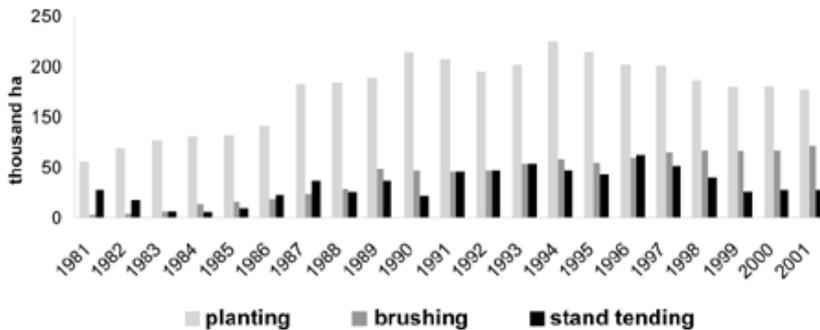


Figure 2. Silvicultural activities on BC's public forestland. Based on various editions of BC Ministry of Forests annual reports.

The past two decades have witnessed an expansion in both scope and scale of silvicultural operations in BC (Figure 2). However, results of empirical research on the timber value profitability of incremental silviculture projects in BC are not robust. Forest tenure also plays a role, in that silvicultural expenditures tend to be higher on forestlands in private ownership, or on those that are under relatively secure tenure arrangements. Binkley (1997) urges BC to adopt forestland zonation, arguing that such an approach will yield several public benefits: (a) maintaining a non-declining level of timber supply, (b) satisfying environmentalist demands for parks and protected areas, and (c) helping sustain employment levels in forest-dependent communities.

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The essential premise of Binkley's argument is that investors should focus their investment on sites that are above average in biological productivity. This approach involves higher costs, but increased growth rates and eventual dividend prospects are expected to offset the higher costs. In addition, incremental silviculture is more likely to be viable from a financial perspective on smaller, more concentrated sites, especially when financial returns are considered together with socio-political motivations.

The use of herbicides and the impact of silvicultural activities on wildlife and biodiversity has resulted in a trend towards the adoption of environmentally friendly approaches like site preparation and brushing. Table 1 shows the decline in the use of chemicals and the rise in the use of new treatment approaches such as sheep

**Table 1. Selected silvicultural activities on British Columbia's public forestland \***

Fiscal year**	Site preparation (ha), by method				Brushing (ha), by method	
	Burning	Mechanical	Chemical	Other	Manual	Chemical
1988/89	74 515	49 659	7 188	6 556	13 273	22 237
1989/90	60 108	77 021	6 200	4 564	22 135	37 887
1990/91	37 772	72 815	3 182	3 922	23 390	34 270
1991/92	41 636	99 878	5 080	6 805	29 320	26 759
1992/93	23 699	97 739	6 492	10 508	29 544	27 949
1993/94	41 294	97 762	6 211	21 140	27 075	26 452
1994/95	28 338	84 546	1 677	23 037	35 681	24 972
1995/96	25 758	72 259	1 127	13 077	45 447	19 355
1996/97	19 669	66 293	616	8 941	42 852	28 554
1997/98	15 590	68 807	240	8 279	51 066	26 587

\* Source: British Columbia Ministry of Forests (2000).

\*\* British Columbia's fiscal year begins April 1 and ends March 31 of the following year.

grazing. Quantifying these environmental benefits and including them in a cost benefit analysis is complex, and tools for this are only recently emerging.

Policy issues, planning issues, and knowledge gaps, are some of the major hurdles involved in silvicultural planning and program delivery. Obviously, further inquiry will lead to a call for changes in government policy regarding institutional framework and policy instruments.

## Conclusion

Due to a growing public acceptance of SFM and the widening participation of an increasing number of stakeholders in forest management, silvicultural practices will continue moving toward multiple-use resource management, and ecosystem or landscape management. The global demand for forest products (both consumptive and non-consumptive) will continue to grow as incomes and populations increase. SFM and silviculture investment are key elements to meet this increased demand. British Columbia's experience is of wider interest to a number of temperate developed countries, because of the common challenge of practicing forestry within the dictates of "triple bottom-line". More empirical research is needed to examine prevailing issues, including that of forest land zonation. The findings will help arrive at a cost-effective silvicultural investment strategy, taking into account the impact of silvicultural activities on wildlife and biological diversity. After all, silviculture investment is a central ingredient to sustainable development, in terms of ecological, social, and economic dimensions.

Sen Wang, Bill Wilson, and Brad Stennes, are with Natural Resources Canada, Canadian Forest Service, Pacific Forestry Centre, 506 West Burnside Road, Victoria, BC, V8Z 1M5 phone: 250-3630726; email: senwang@pfc.cfs.nrcan.gc.ca. Thanks to Rod Maides and Roger Whitehead for providing the photos for the cover and the article.

# FOREST HEALTH

## Impacts of Climate Change on Forestry

A general trend towards warmer conditions combined with increasing levels of carbon dioxide could increase forest distribution and growth in Canada. It could take decades, or even centuries, however, before forests adjust to new climatic conditions. During this period of adjustment, the boreal forest in particular could be more vulnerable to insects and diseases, forest fires, and competition from unwanted species, and the forestry industry will have to adapt to new climatic conditions. The rate of change, as well as the number and severity of extreme events, will dramatically affect the magnitude of impacts and our ability to cope with them.

## Potential Key Effects

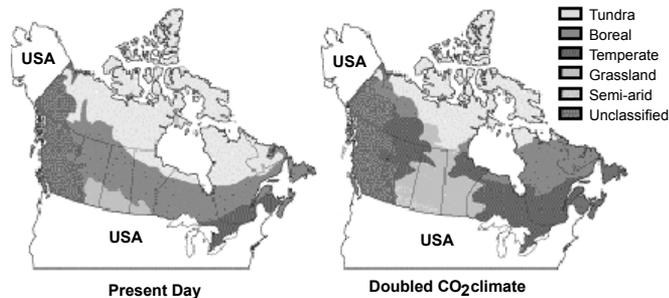
If carbon dioxide levels were to double, the Taiga and Boreal forest belts could shift northward by about 500 km. However, it would not be the Taiga or Boreal forest as we know it that would move northward, but rather the more fast-moving flexible

species such as those with wider seed dispersal, faster growth, and early maturation.

The boreal forest itself is expected to undergo an extensive reduction in size, as grasslands and temperate deciduous species may invade from the south, and northern expansion is limited by poor soils and insufficient sunshine amounts. Forest fires and pest infestations are expected to increase in frequency, area, and intensity due to warmer and drier conditions. Increased fire incidence will lead to loss of habitat for species that inhabit mature forests. This may be eased by changes in fire management policy in order to facilitate species migration and forest adaptation, but this would require significant investment. In 1994, Canada lost four million hectares of forest to fires. Since 1980, Canada has lost an average of 2.4 million hectares of forest to fires each year, a 140 per cent increase over the previous 30 years.

Within the Temperate Conifer zone of British Columbia, forests could shift upward in elevation and, under the worst scenario, disappear entirely from some zones due to a lack of winter cooling for forest regeneration, drought, stress, and increased sensitivity to spring frosts.

## Changes in Forest and Grasslands Boundaries



SOURCE: Rizzo 1990

Source: Environment Canada

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## SILVICULTURAL CONTRACTORS' ASSOCIATION

The year 2003 produced an exceptional wildfire season throughout much of Western Canada. In many cases, catastrophic fires extended across the forest landscape into the urban interface. Thousands of residents were evacuated and hundreds of homes lost. This apparent assault on the security of rural and suburban life left communities stunned and emergency response agencies often stretched beyond their capacities. In some cases they were overwhelmed.

However, for many of those familiar with the accumulating wildfire threat in our forests, the remarkable thing about the 2003 wildfire season was that it hadn't happened sooner and more often. For

years, the confluence of forest fuel build-up, weather, and residential in-growth into forestlands has been creating a disastrous mix. Other jurisdictions in the U.S. and Australia have received their indoctrination into this new order of things, over the past decade with repeating years of catastrophic wildfires. With 2003, Western Canada's immunity to these events appears to have expired. Many believe we have entered a disconcerting new era of wildfire behaviour (a condition we can expect to stay with us for some time).

The WSCA has organized a major wildfire urban interface conference, in Whistler, in May 2004, to address how the industry can deal with these issues.

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# LUSTR FOREST RENEWAL CO-OPERATIVE

by William F. Murphy, R.P.F., General Manager

What has happened to the Containerized Tree Seedling Industry since the last great minds met in Toronto, in 1981 at the Canadian Containerized Tree Seedling Symposium? Many changes have occurred to the types of containers in which seedlings are grown, quality and sizes of seedlings, the way they are extracted, over wintered, cold stored and shipped. There are also the different types and styles of containers in which the seedlings are shipped, how they are stored in the field, and methods of protection on and off site. How are we to summarize all this data on one page? It cannot be done. LUSTR Forest Renewal Co-operative is therefore planning to host a World Containerized Seedling Conference in Thunder Bay, in the summer/fall of 2005. The conference will bring together leaders in container

seedling production and reforestation to present the state of the art in these fields. The meeting is being organized by our Co-op and by our member in the Ontario Forest Research Institute of the Ministry of Natural Resources.

We were invited to the Alberta Forest Nursery Module 12, held in December in Edmonton. A lot of information was given out. Dave Trotter, of the Extension Services Tree Improvement Branch of the BC Forest Service, presented one module which really caught our attention - Homeland Security. What does this mean for anyone in the Agricultural Business who ships seedlings or any other live product south across the border? At the present time, you require only 24 hours notice of shipment to enable your product to be sent without hesitation to your buyer in the States.

However, this is only as good as the person in charge at the border. In one year, this will change and we had better be prepared for it. The Federal Government is not coming forth with a lot of information on what the U.S. is going to require. Just to summarize what Mr. Trotter has indicated, a security program on theft prevention, shipping and receiving controls and an information process for your security and reporting process may be required for your facilities.

LUSTR Co-operative Inc is planning to hold a workshop in early spring on this subject for the seedling industry in Ontario.

Look for us on our new website [www.lustr.ca](http://www.lustr.ca) for upcoming events, useful articles and our newsletter.

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# ASSOCIATION DES ENTREPRENEURS DE TRAVAUX SYLVICOLES DU QUÉBEC

QUEL EST L'AVENIR DE L'ÉCLAIRCIE PRÉCOMMERCIALE AU QUÉBEC ?

par Fabien Simard, ing. f., Directeur général

L'été dernier le comité du manuel d'aménagement a jonglé avec l'éventualité de retirer le traitement d'éclaircie précommerciale dans le tremble et peuplement mixte à dominance de tremble dans son manuel d'aménagement. Effectivement, devant l'apparition du chancre hypoxylonien dans certains peuplements ayant subi une éclaircie précommerciale, le comité a eu raison de se préoccuper de l'effet sur le rendement forestier de ce traitement. Les membres du comité ont choisi de maintenir l'epc dans le tremble pour la prochaine génération dans les plans généraux d'aménagement forestier, surtout dû au manque d'information et de documentation démontrant avec certitude les causes. Beaucoup d'études et de travaux de recherche ont été publiés sur ce chancre sans pour autant en tirer une généralité. En effet, plusieurs études se contredisent. Par exemple, certaines signalent une présence beaucoup moindre dans les peuplements purs alors que d'autres démontrent le contraire. Les membres de l'AETSQ ont donné raison au comité de ne pas prendre une position définitive étant donné que plusieurs questions demeurent sans réponse telles que :

Est-ce que le chancre a été observé sur quelques sites seulement ou sur plusieurs ?

Est-ce que le chancre était présent avant l'éclaircie ?

Est que le chancre est plus présent dans les parties traitées ou les parties témoins ?

Le chancre se développe-t-il sur toutes les qualités de sites ?

Est-ce que le chancre a été observé sur tous les types d'origine de peuplement (pionnière, transition ou climax) ?

Quel est l'impact du chancre sur la strate, si la présence du chancre est de 2, 4 ou 6 % ?

Est-ce que le chancre se développe essentiellement sur des anciennes friches ?

Les membres de l'AETSQ effectuant de l'epc dans les peuplements de tremble sont persuadés du rendement positif du traitement tel que le démontre les deux photos ci-dessous. Par contre, les entreprises effectuant de l'epc dans le tremble s'entendent pour

dire que nous devrions nous doter d'un guide (ex : par un projet de recherche bien ciblé) pour permettre à l'ingénieur forestier de mieux cibler les strates qui ne sont pas vulnérables au chancre afin de mieux planifier et prioriser les meilleurs peuplements dans leur prescription.

(Voici un peuplement de 8 ans. Sur la photo 1 il y a eu un traitement d'epc réalisé il y a 5 ans. Alors que sur la photo 2 aucun traitement n'a été réalisé. Nous portons à votre attention qu'il s'agit bien du même peuplement sur les deux illustrations.)

1.



2.



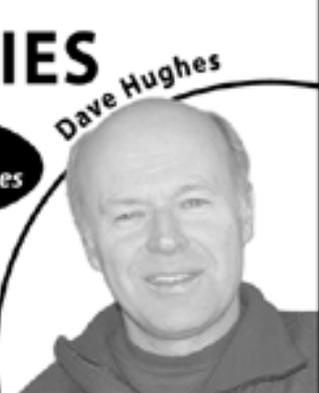


Don Vigue

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### WHAT IS THE FUTURE FOR PRE-COMMERCIAL THINNING IN QUEBEC?

by Fabien Simard, RPF, Executive Director



For some time scientific studies have been questioning the hypotheses on which pre-commercial thinning activities in Quebec have been based. In fact, the scientific advisory committee of the Manual of Forestry Management, after analyzing various scientific studies, has proposed the hypothesis that, in a mature stand that has undergone pre-commercial thinning, the marketable volume might not be any greater than that of a stand that has not been thinned. This conclusion therefore questions the usefulness of carrying out these activities if the primary aim (a substantial increase in the total volume at maturity) does not seem to be achieved.

In the light of this possibility, the AETSQ has undertaken to bring together certain specialists to work

jointly on research projects in order to validate the findings of the Manuel committee. This multidisciplinary team will include the silviculture researcher Mr René Doucet, RPF and Ph.D; an economist, Mr Marc-André Lapointe, Ph.D; a researcher in vegetal biology, Mr Réjean Gagnon, Ph.D; and a further researcher, Mr Sylvain Parent, Ph.D.

Starting from the premise that PCT might not increase the marketable volume of the stand, the team is attempting to show that other possible gains should be considered. Moreover, most industrialized countries and even the other Canadian provinces are agreed that it is nevertheless advantageous from the point of view of the forest and of the economy to practise pre-commercial thinning. It is profitable for the forest because it permits an increase in bole diameter and thus of average trunk volume of the stand at maturity. This feature, in the forestry setting, reduces the number of windfalls, allows the recomposition of stands, and may limit its vulnerability to insects and disease. Furthermore, on the economic level, increasing the diameter of trees can lead to a reduction in the cost of harvesting (cutting, loading, lopping)

and processing, as well as increasing the value of the timber. Finally, several experienced foresters have noted, without being able to quantify the phenomenon exactly, that the proportion of marketable volume actually recovered in harvesting operations is less in the case of small-diameter trees. We believe that several of these considerations taken together might amply justify pre-commercial thinning. We note, however, that until the present these various items have received only limited attention, and usually only in isolated contexts. They should now be examined simultaneously if we are to establish the value of pre-commercial thinning.

Thus many questions remain unanswered. This year the AETSQ will concern itself with three research projects that will, we hope, furnish sufficient information for us to see our way clearly. These projects are: The Impact of Diameter on Increased Growth, The Hardwood Invasion of the Boreal Forest, i.e., the pressure of deciduous trees on softwood stands, and The Socio-Economic Impact of Forestry Activities in Resource Regions.

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# PRINCE EDWARD ISLAND

## FOREST IMPROVEMENT ASSOCIATION

*by Wanson Hemphill, Manager*

Another new year with its share of ups and downs. Maritime lumber producers would support a negotiated deal if Atlantic Canada's duty-free share would be capped at the historic levels of 2 billion fbm as well as a return of the \$110 million already paid in anti-dumping duties. Canada's large lumber producers seem evenly split on whether to accept or reject the latest offer from the US which means Canada's Trade Minister will stay the present course of appeals until a deal is reached (if ever) which satisfies most of the large Canadian mills.

PEI FIA's busy workplan this year includes providing lots of information and maintaining a website at [www.forestimprovement.ca](http://www.forestimprovement.ca). FIA will provide support for member groups, coordinate two workshops and field trips and a Sustainable Management Practices manual for Island forest contractors. We will also promote safety and training,

complete a forest industry directory and participate in the PEI Model Forest project. At the annual Association of Woodlands Trainers (AWT) in Fredericton, Paul Cyr of Maine presented an excellent presentation on the need to present safety training "at the stump" to those actually doing the work while making it interesting, brief, credible and consistent. Safety compliance action plans must be developed with goals, focus and expectations, and with follow-up on results, claim costs and evaluation.

A recent non-timber forest products workshop had Marla Emery of the US Forest Service describe the planning and requirements for a small forest products business. Businesses must have a reliable, high quality sustainable supply and harvest, provide resource information and develop strong customer relationships.

Several PEI forest owners visited

Jim Dretcher at Windhorse Farm, near Bridgewater, Nova Scotia, ([www.windhorsefarm.ca](http://www.windhorsefarm.ca)) this past fall. These owners experienced firsthand the ecological working forest management, harvesting and processing of large slow-growing trees that provide the knot-free wood for the many high-valued forest products that Windhorse sells to generate an income for 7 families. Evidence of the forest spiritual connection at Windhorse was demonstrated by Jim's philosophy as well as the meditation house and the kami shrine under the large hemlocks by the brook.

FIA is hopeful of the establishment of Sector Councils on PEI to allow industries to plan their own human resource development. Discussions with HRDC and the Province have been encouraging with a recent visit by 7 Nova Scotia Sector Councils.

Best wishes for a safe and healthy 2004.

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# NOVA SCOTIA

## SILVICULTURE CONTRACTORS ASSOCIATION

by Allen O'Brien, President



As the year winds down, the silviculture profession in Nova Scotia looks less enticing by the day. It is less possible to hire qualified people who deserve a reasonable wage. We (contractors) are creating the GIS files for the province for no monetary reward. We run the forest extension program with private woodlot owners for no monetary

reward. We wait for months to be paid for completed treatments. Our costs continue to rise, A recent Supreme Court ruling could add another 1.8% to our workers' compensation rate. This is to compensate employees for long-term and chronic injuries. Also chronic is the Nova Scotia silviculture contractors' plight in the forestry marketplace. We have been considered expendable, industry's attitude is if one cashes in another can be found to replace the departing contractor. The former consensus among industry experts in NS is if you cannot do anything else (profession) you can become a silviculture worker/contractor. A little RESPECT would be nice, but more money would be better. The NSSCA is committed to changing this situation.

My comments for the year to fellow contractors would be to stop completing work that is averse to profit making. If you are breaking even or losing on most treatments completed, it is time to switch occupations.

The web site will be up and running in the new year providing a list of reputable contractors to private woodlot owners, both at home and abroad.

The site will list services provided by members of the association to potential clients. It will hopefully provide information to all members. (A list of different rates paid by the mills on a province-wide basis.)

The cleanup of woodlots affected by hurricane Juan continues in central NS. The roadside price for logging products has been good and snow has been minimal to date.

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# New Silviculture in New Brunswick



Over the last year, I have provided brief updates on the Jaakko Pöyry (JPMC) report: New Brunswick Crown Forests: Assessment of Stewardship and Management. The Select Committee of the Legislative Assembly of New Brunswick scheduled 11 public hearings and added two more to finally end on December 22. More than 288 groups and individuals interested in the future of New Brunswick forests made presentations or submitted written briefs to the Committee.

Various interests pointed out important elements found in the JPMC report and important elements not found in the report. The Committee has a challenging

task to sort out what it heard.

Here is an overview of the context of the JPMC report and a review of four presentations made to the Committee, each with its own perspective.

## Overview

1982 marked the inauguration of the current Crown Lands and Forest Act which flowed from the Tweeddale report (1974) and the Bathurst Pilot Project (a five-year pilot project which tested the current Crown license and fibre-allocation system). Forest land (all tenures) in New Brunswick is 6.1 million hectares stretching from Québec to the

North, Maine to the West and Nova Scotia and saltwater for the rest.

Before 1982, New Brunswick had both small and large Crown timber licenses, or limits, many of which were not linked to a processing facility. In 1982, eight licensees managed ten 25-year Crown timber licenses and 140 sub-licenses had five-year volume allocations based on the Crown timber licenses' AACs. Crown Licenses accounted for 50 per cent of the province's wood supply.

Since then, investments in increased processing capacity, supported by the "security" of supply from Crown land, require more wood. More wood secured through production rationalization: the

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# the report suggests increasing silviculture expenditures to \$50million

purchase of existing mills and Crown allocation and concentrating operations into fewer, larger mills. Mill closures were driven, in part, by business attrition and in part by business acquisition and rationalization. The bottom line is that there are now six licensees and 70 sub-licenses: fewer, larger production units needing more wood in fewer communities.

Similar developments in neighbouring jurisdictions have created stiff competition for purchased wood from New Brunswick's private woodlots, especially in the neighbouring state of Maine. The result? Demand exceeds supply and New Brunswick mills must import wood from less secure sources in other jurisdictions.

At the same time, New Brunswick's forest sector pioneered world class, integrated resource-management planning systems, developed in response to a forecast shortfall in wood supply. According to the Maclean's 1991 Fate of the Earth issue "only... New Brunswick... has a system capable of giving planners accurate and detailed information about their forest inventory." The article goes on to say that New Brunswick is "the only province to have the ability to improve the methods of prediction by continuously comparing results to forecasts." Clearly, these were uncharted industrial-scale resource management waters.

As management capability improved, the Crown's integrated resource-management objectives evolved with each five-year Crown forest

management plan. With integrated resource management came increased acknowledgement of environmental and ecological values and issues.

The management and protection of these resource components required more land to be set aside, from less than 10 per cent in 1987 to 32 per cent in 2002.

The bottom line was less available productive forest land, progressively lower AACs and less wood from a Crown timber license system with leading-edge resource management capability. Wood supply took a back seat to other non-timber values.

The JPMC report was released in December 2002. That just happens to be the twenty-year renovation rendezvous for kitchens, bathrooms and Crown wood supply systems. The report was launched with as much fanfare as industry could muster and has been taken as industry's "renovation" proposal, an open invitation to rethink and remodel the Crown allocation system, kitchen sink included. Over the past twenty years, some things have worked well, others have not and there are some clear abuses. All of these are now being brought to the (kitchen) table as though we were re-negotiating the terms of our marriage with industry.

The foundation of the JPMC report is selective benchmarking and analysis focused on Crown land fibre production. It is described as a discussion paper by some and as industry's proposal for improved commitment from the Crown. The report's recommendations (found

on Page 8 of the JPMC report) are:

- A timber supply objective should be set for each license area that would be binding on the Government and on the licensee.
- The industry and DNRE [now DNR – Department of Natural Resources] should jointly fund and support research and development of science-based forest management practices applicable in New Brunswick.
- The public should participate in reviewing the objectives of management for New Brunswick's Crown lands to provide a mandate for the direction and magnitude of change in forest management.
- The DNRE should reduce overlap in management and oversight of Crown lands.
- Special management zones should be critically reviewed and where possible, additional harvesting permitted.
- Conservation values of private lands should be taken into account when evaluating the need for set-asides and special management on public lands. These are inoffensive general statements. The report goes beyond these six recommendations - even to great lengths - to present a doubling of the Crown wood supply scenario from 3.5 million m3 to 7 million m3 by 2032.



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The report suggests increasing silviculture expenditures for a few years to \$50 million from the \$23 million spent in 2001 and then tapering the silviculture budget to \$34 million a year. This would be a major annual expenditure for a province that spends 33 per cent of its entire budget on health care. In the absence of government funding, industry would fund the enhanced program in return for guaranteed access to Crown fibre. Industry's presentations from the outset came across as a do-or-die situation; however, the current \$23-million-a-year silviculture program would increase Crown wood supply to 5 million m3 in about the same period.

## Perspectives

The call to discuss the future of New Brunswick forests was well-answered : over 280 briefs were presented or submitted to the Committee and are part of the public record.

The following perspectives are taken from forestry presenters:

In contrast to the JPMC report, the New Brunswick Forest Products Association's (NBFPA) brief aims to clear misconceptions, distortions and misinformation heard by the Committee – and the public - over the course of the hearings. Presented by Yvon Poitras, the brief refers to invitations to specific

disgruntled or misinformed presenters to visit forestry operations – as yet, unanswered. It discusses plantations and reforestation and tree farms and monoculture, clear-cutting and community forests. This gives you a sense of what the Committee has heard from presenters from different interest groups.

The association presents private woodlots as a key wood-supply partner and says, "for the first time in history, the Directors of both the New Brunswick Forest Products Association and the New Brunswick Federation of Woodlot owners will be meeting to start discussing the path forward with respect to working on a solution to their concerns."

Clearly, there is movement to rebuild and forge new relationships.

The association reviews the industry (JPMC) strategy of doubling the Crown wood supply by referencing and agreeing with other presenters' opinions and recommendations and inviting cooperation.

There is a sense of industry being caught in an overwhelming situation, which was not part of the original game plan. It is unfortunate, because much of what is proposed in the JPMC report reflects reality and needed to be brought to the forefront.

Dave MacLean, Dean of the Faculty of Forestry and Environmental Management at the University of New Brunswick, presented a brief which clearly states the basics he and his colleagues support:

- there are opportunities to increase timber supply ... while maintaining desired non-timber, habitat, water and other values;
- having planted stands make up a portion of the forest landscape has several benefits;
- a timber supply objective should be set for each Crown license in New Brunswick;
- industry and DNRE should jointly fund and support research and development of science-based forest management practices;
- the public should participate in reviewing management objectives for Crown land.



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They disagree with “doubling the wood supply” as the “best objective for NB Crown land” and say that the JPMC report does not provide sufficient quantitative analysis and recommend further analysis, including:

- amount and role of planted stands;
- potential of ‘zoning’ of the forest to define maximum permissible amounts of intensively managed, extensive, and protected forest areas on a given license;
- the role and requirements for special management zones;
- comprehensive evaluation of trade-offs;

- explicit goals of minimum areas to be maintained of all natural forest types (species groups, age classes and stand sizes) by ecological district and license.

The brief goes on to review earlier commitments to research: “Twenty years ago, New Brunswick became a world leader in forest management with the Crown Lands and Forests Act, an effective Forest Research Advisory Committee structure, and active applied research.”...“Now is the time to move to become a forest management leader for the 21st century.”

Dave Palmer, RPF, manager of the York-Sunbury-Charlotte Forest Products Marketing Board, raises the business case realities surrounding the proposed increase in silviculture budget. He favours a “faster growth rate and a quicker return for wood lot owners – it only makes good business sense,” he says. He is not opposed to so-called tree farms and he is not opposed to spending more public money to increase our wood supply in 50 years provided that “there is a clear and well laid-out business case to do so.”

Palmer says there is a catch:

- the province has no money to spare;
- if private companies invest in the public forest, timber guarantees would be required; and
- it is not clear how the investment and associated benefits would play out over time or if all of the forest industry players have the means to enter into such a rich scheme.

Roughly, the scheme could initially cost an extra \$5 per m3 (at the \$50-million level) and

an extra \$3 per m3 a year after that (not indexed) with an expected increase in volume in 30 years [the JPMC report suggests 30 years], which Palmer refers to as Timber Equity Credits. The total investment at a modest interest rate of 5 per cent would be \$2 billion in simple math. He then turns the investment into a Crown liability, let’s call it a Crown Timber Liability. The concept of a guarantee and associated liability is a source of discomfort that has come up in several briefs. Simon Mitchell, RPF, of the Woodlot Stewardship Cooperative (Forest Stewardship Council) which certifies woodlots, says it is clear that the JPMC report has brought us to a crossroads. He questions the current system’s (Crown licenses and fibre allocation) economic and social benefits and suggests a balanced approach is needed.

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The distribution of Crown wood is akin to distributing wealth and benefits, the cooperative says. Mitchell stresses the role of government, which is mandated by the voters. The responsibility of the Minister of Natural Resources is the “development, utilization, protection and integrated management of the resources of Crown Lands...” Mitchell writes, “If this recommendation is implemented, the citizens of New Brunswick would see further control of Crown lands ceded to the St. Anne Nackawics, UPM-Kymennes and Nexfor Frasers of this province.”

He then presents the merits of FSC certification over other systems. “These industry-based certification schemes evaluate and monitor the forest industry,” at which point the brief advances the merits of FSC.

Finally, Mitchell reviews the different concepts of community forestry tenures such as aboriginal or municipal, referring to the Revelstoke Community Forest Corporation’s 500,000-hectare Crown land tract.

From the presentations heard by this Committee, there is an appetite for this type of tenure in New Brunswick.



## Conclusion

As Simon Mitchell said, “New Brunswick is at a significant crossroads and clearly the invitation for renovation dialogue has been accepted by a broad constituency.” There are some key points:

1. **The Crown has made commitments**, however flexible, to provide wood from Crown land through the Crown Lands and Forests Act.

2. Security of supply is, universally, an important component of supporting investment. It is particularly important for new developments.

3. The forest sector, which has implemented integrated resource management in its planning process, also provides and maintains important infrastructure that the public uses. As a participant in one of the province’s Registered Professional Foresters’ workshops on this topic said, “Let’s not forget why we started to manage the forest in the first place.”

The time for renovation has come and we need to carefully review our needs

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and our commitments to the industry, which already funds resource management on Crown lands, to the communities who live by the resource, from loggers to outfitters to adventure tourism operators. In reviewing our needs we should examine, without pointing fingers, the principles used as the foundation of the current system; some are intact, some are no longer effective. There is currently no additional Crown wood available to stimulate further new development of a vibrant forest sector or to revive forest based economic activity in communities that no longer have an allocation of Crown wood!

This is not the end. We are in the reaction phase and current dialogue is based on well and long-established positions. The next phase is that of reflection and there is a growing sense of urgency among professionals that we need to bring public consultation to a new level of informed participation. These hearings were just the first steps.

Gaston Damecour is a Registered Professional Forester in New Brunswick and Nova Scotia. He is a senior consultant and principal of AGFOR Inc., a New Brunswick-based forest and management consulting firm. Damecour has been instrumental in bringing about significant changes in the forest sector by representing both governments and industries on such issues as health and safety, forestry equipment standards, industrial relations, wood allocations and forest management policy. He has worked with communities and businesses and various interest groups to initiate change.

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John Levesque, Staff Writer, Ontario Forestry Safe Workplace Association

## Winter Hazards: The cold, hard facts

A prominent phrase in the vocabulary of every Canadian in the dead of winter is “wind chill”. We consider ourselves experts on coping with winter conditions, but how much do we really know about cold weather hazards, hypothermia and frostbite for those who work in Canada’s forests in winter?

### Consider these two facts:

- Bitter cold and winter storms cause the deaths of more than 100 Canadians every year—a higher death toll than from tornadoes, thunderstorms, floods, hurricanes and heat waves combined.
- Most cases of fatal hypothermia have occurred when the air temperature was at or above the freezing point, between 0 and 10 degrees Celsius.

Hypothermia occurs when the body’s temperature drops and internal processes slow to the point that the body is unable to generate as much heat as it’s losing. Symptoms include shivering, confusion, stiff muscles and pale, bluish lips. When hypothermia reaches the life-threatening stage, shivering stops and the victim lapses into unconsciousness.

Frostbite is the freezing of a part of the body, usually extremities such as the ears, nose, fingers and toes. The milder version of frostbite results in freezing of the skin only, which turns yellowish or white and burns or tingles painfully. Severe frostbite occurs when both the skin and underlying fat, muscle and bone are frozen. The skin appears white and waxy and the affected area is numb.

Cold temperatures and wind chill are the two clear causes of frostbite. Hypothermia can result from a combination of additional factors such as immersion in cold water, wet clothing and even fatigue. For example, a person who is wearing wet clothing in a cold wind can suffer hypothermia even if the temperature is well above freezing.

In winter, strong winds can make all the difference between a pleasant day and a dangerously cold one. Wind increases the loss of body heat by sweeping it away. On many winter days, the wind-chill index is a more accurate—and important—measurement than air temperature.

Ontario Forestry Consultant Trainer Mario Vottero is based in Hearst Ontario and works with forestry firms in one of the coldest regions of the province. “The people here know from experience what to expect in the

winter, so they’re generally well-prepared,” he says. Many of the firms in his district use the work/warm-up schedule published by the American Conference of Governmental Industrial Hygienists (ACGIH) as their guideline for responding to cold-weather hazards. (See chart below)

“People here know the importance of emergency kits in winter—flares, a blanket or sleeping bag, extra clothing, first-aid supplies, a cell phone or some other form of communication,” Vottero says. “It’s a fact of life when you live in this part of the world.”

The hazards of working in extreme cold increase significantly when someone is working alone. Vottero remembers an incident in which a supervisor was out alone on a cold day to survey a cut site and locked his keys inside the truck. He had to break the window of the truck to get back in.

“Workers using mobile machines and vehicles can fall and injure themselves outside of their vehicle, and because the cab of their machine is heated, they might not be properly clothed for the weather,” Vottero says. “The buddy system is important in those situations. For example, the person in the vehicle will communicate with another operator by radio to let him know that he has to step out of his machine

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for a few minutes. It's also important that the supervisor stays in regular contact with the people in the bush, and machine operators should always have appropriate winter clothing with them."

Clothing is the primary line of defence against frostbite and hypothermia for forestry workers. The first considerations should be the head and extremities. As much as half of the body's heat is lost through the head, and extremities such as the hands, feet and ears are the most vulnerable to frostbite.

"Contact with metal can be dangerous in extreme cold," Vottero says. "People have to be careful about touching metal with their bare hands. I know of a worker who got frostbite in the knees from kneeling on metal in the cold."

To prevent hypothermia, keeping dry is as important as staying warm. Clothing that is wet from rain on the outside or from sweat on the inside speeds up heat loss from the body. For that reason, layering is important in cold-weather wear. Thin layers of loose-

fitting clothing keep warm air trapped close to the body but don't trap sweat near the skin. Layers also enable workers to adjust the amount of clothing they wear to the type of physical work they're doing, since the body produces different amounts of heat depending on how energy is being exerted. "Nobody goes into the bush with a jean jacket if it's -30 degrees. It's all about being prepared," Vottero says.

## Work/Warm-Up Schedule for Outside Workers

The American Conference of Governmental Industrial Hygienists (ACGIH) has adopted the guidelines developed by the Saskatchewan Ministry of Labour for working outdoors in cold weather. The recommended exposure times are based on a combination of air temperature and wind speed. The work-break schedule applies to any four-hour period with moderate or heavy activity. The "normal breaks" are 10 minutes in a warm location. The schedule assumes that breaks are taken once every two hours. At the end of a four-hour period, an extended break (lunch, for example) in a warm location is recommended.

Air Temperature -Sunny Sky	No noticeable wind		8 km/h wind		16 km/h wind		24 km/h wind		32 km/h wind	
°C (approx)	Max. work period	# of breaks								
-26° to -28°	Normal breaks (1)		Normal breaks (1)		75 min.	2	55 min.	3	40 min.	4
-29° to -31°	Normal breaks (1)		75 min.	2	55 min.	3	40 min.	4	30 min.	5
-32° to -34°	75 min.	2	55 min.	3	40 min.	4	30 min.	5	non-emergency work should cease	
-35° to -37°	55 min.	3	40 min.	4	30 min.	5	non-emergency work should cease			
-38° to -39°	40 min.	4	30 min.	5	non-emergency work should cease					
-40° to -42°	30 min.	5	non-emergency work should cease							
-23° and below	non-emergency work should cease									

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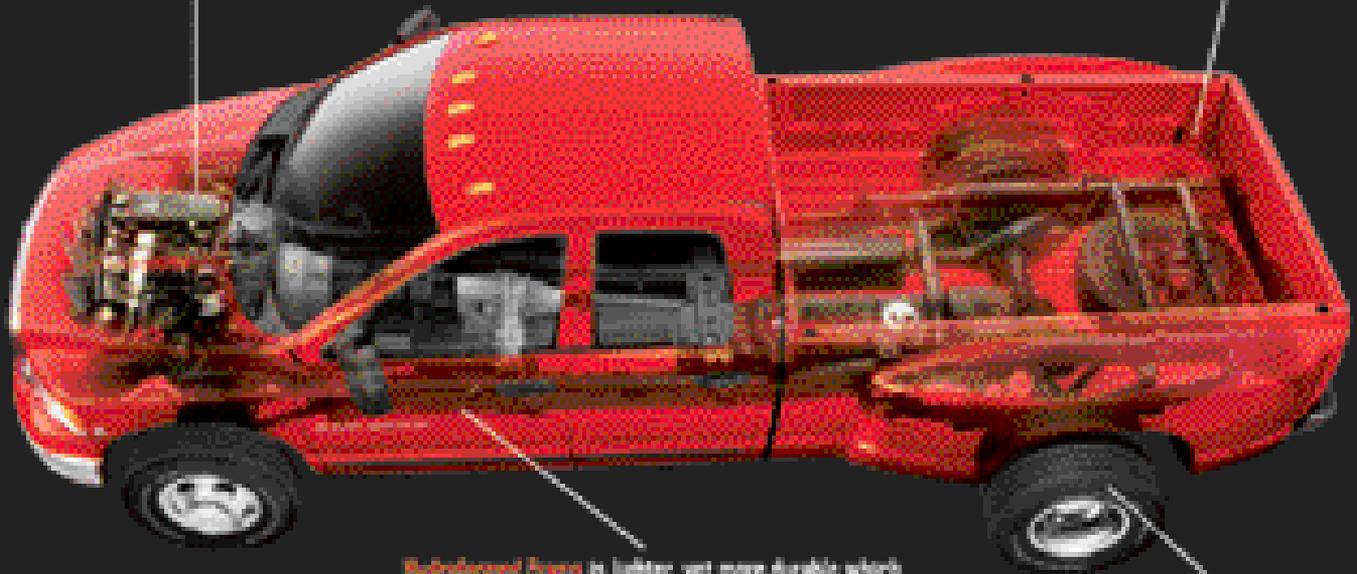
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