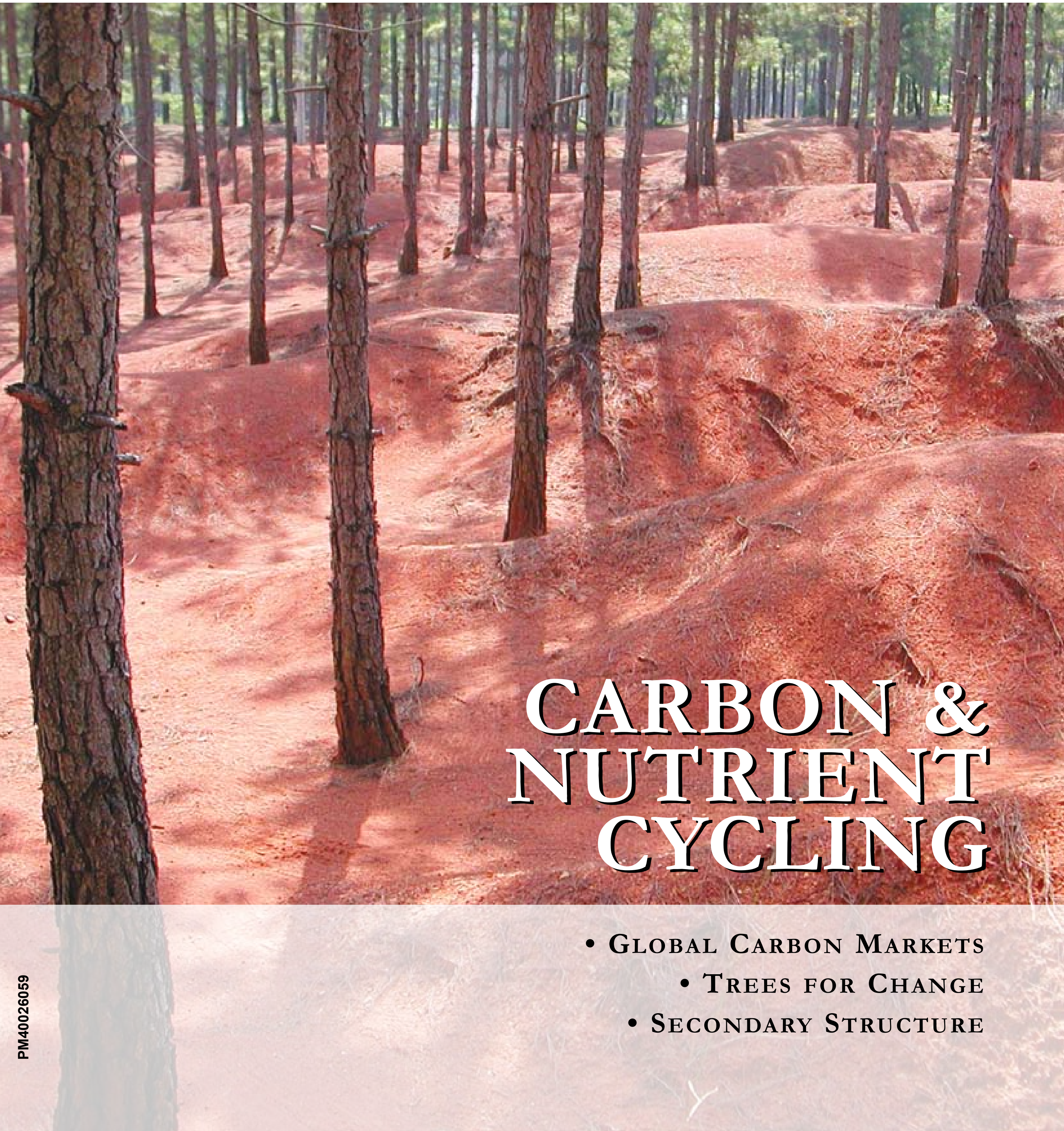
CANADIAN

# SILVICULTURE

MAY 2008



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## Columns

# Editorial

by Dirk Brinkman

## Mobilizing Canada

The Canadian Institute of Forestry's (CIF) 100th anniversary edition of the *Forestry Chronicle* inserted an irresponsible promotion of Fred Singer's book disputing human causes of climate change and solutions to it. Fred Singer, formerly employed by the tobacco industry to deny the connection between smoking and cancer, was recently engaged by the oil and gas industry to use similar pseudoscience to seed doubt about global warming by denying it is unusual, denying that fossil fuels and deforestation have caused climate change, or denying that anything we can do will prevent climate change.

The largest global community of the best natural resource scientists ever brought together on a single project has confirmed that climate warming is caused by the emissions-intensive way of life of the wealthiest people on the planet, which, of course, includes all Canadians. To promote this book seems to fly in the face of the *Forestry Chronicle's* tradition of peer-reviewed science, though perhaps not its tradition of stimulating debate.

In the economic boom before the Great War, naturalists and conservationists recognized the threat of North America's addiction to consuming its abundant forests. In 1906, in response to the conservation movement, Prime Minister Sir Wilfred Laurier chaired the first Canadian Forestry Congress. One outcome of the congress was the formation of the CIF in 1908. The organization was introduced to both certify professional foresters and create a forum for the debate that would lead to more responsible harvest decisions, including reforesting the more valuable species, which were disappearing. The conservation movement's leading thinkers, like Henry Thoreau, articulated the emerging public conservation ethic, while political leaders like Laurier and pioneer foresters created huge national parks and crafted the debates that started the CIF.

One hundred years later, global warming has been identified as the greatest threat ever faced by Canada's forests. Climate change projections predict current forest stands and their progeny will be exterminated from most ecosystems within their current rotation. As a first management response to this emerging catastrophe, BC began a debate on the best replacement stands with its Future Ecosystem Initiative. Because the future climates will not be those in which trees growing today once thrived, BC has also begun to experiment with adaptive Climate Seed Transfer guidelines to better anticipate the kinds of geo-climatic zones in which new trees will find themselves. This small beginning suggests the direction required in a national forest response.

The global warming threat today resembles the threat of industrial forestry 100 years ago, as once again, "We have seen the enemy and he is us." But the formation of a professional institution like a future climate ministry to oversee a rational solution is inadequate to match the scope, scale, and pervasive challenge of climate change. That is because, unfortunately, the consequences of climate change are far more severe than the destruction of Canada's forests. Those who will suffer the most are the poorest people, populations that live in subsistence with marginal lifestyles. The consequences of warming are so severe that some US congressional members have suggested that climate deniers like Fred Singer and those who finance them should be investigated and charged with the harm they may cause by postponing action to prevent climate change. Anyone who has read the Pentagon's briefing note on the "global geopolitical chaos" that will follow from climate tipping, or has read *With Speed and Violence* by Fred Pearce, will share this sense of moral responsibility.

Climate deniers like Fred Singer are not Lord Haw Haw, the last person in the UK to be shot for treason. Lord Haw Haw's daily radio broadcasts from Germany alternatively cajoled and consoled his (the British) people throughout the war to prepare them for the unstoppable Nazi domination. The world has not yet declared war on climate change. The other difference is the pure evil of Hitler's deliberate industrial genocide. Most climate change activists are not suggesting that today's energy addiction is more than a curable pathology of an immature civilization. But there is one important thing that is the same: the scope, scale, and intensity of the response to climate change will have to match how Canadian society responded to the Second World War to have any hope of success.

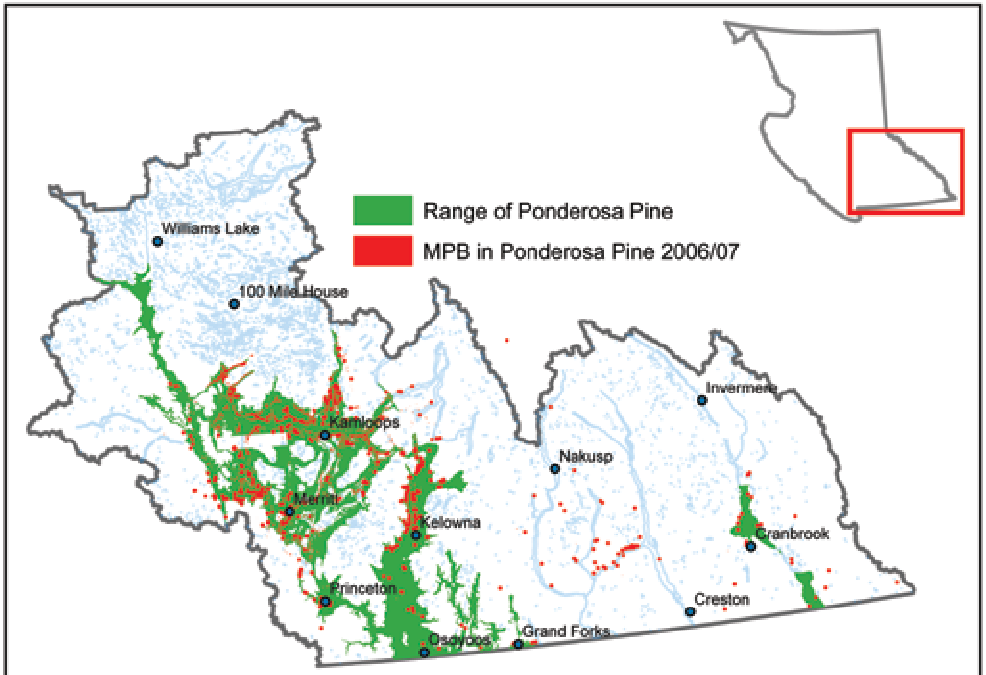
Canada's Juno Beach memorial opens with a quote by Prime Minister Mackenzie King musing on the employment benefits of Nazism. A year and a half from the moment Canada decided to act, the Armed forces grew from a few thousand to one and half million strong, and all Canadian society and industry, including the forest sector, was mobilized to support them. The response to the challenge of climate change will have to be far more powerful than the vision embodied in the CIF 100 years ago, since climate change is a challenge that permeates every aspect of our way of life.

Canada's historical leadership qualities must once again be mobilized, but this time to converge within all of the interlocking challenges to exorcise the devil from the details of climate solutions, and again rise to become a new exemplar mobilized society for the world.

# Forest Health

by Janice Hodge, RPBio and Mike Fenger, RPF

## Bark Beetles Add More Stress to BC's Ponderosa Pine Ecosystems



Source: B.C. Ministry of Forests and Range Aerial Overview Surveys

Forest insects, diseases, and wildfires are natural disturbance agents that cycle and shape forest stand structure and composition. Their role has remained unchanged, however, the frequency, duration, and intensity of some of these disturbances has been modified due to a number of factors, one of which is climate change. In BC climate change is undoubtedly partially responsible for the unprecedented mountain pine beetle (MPB) outbreak. While much of the focus of this outbreak is on the lodgepole pine ecosystem and forestry dependent communities in the core of the outbreak, there are other issues or concerns that receive less attention. One such concern is the effect of this MPB outbreak on the ponderosa pine ecosystem.

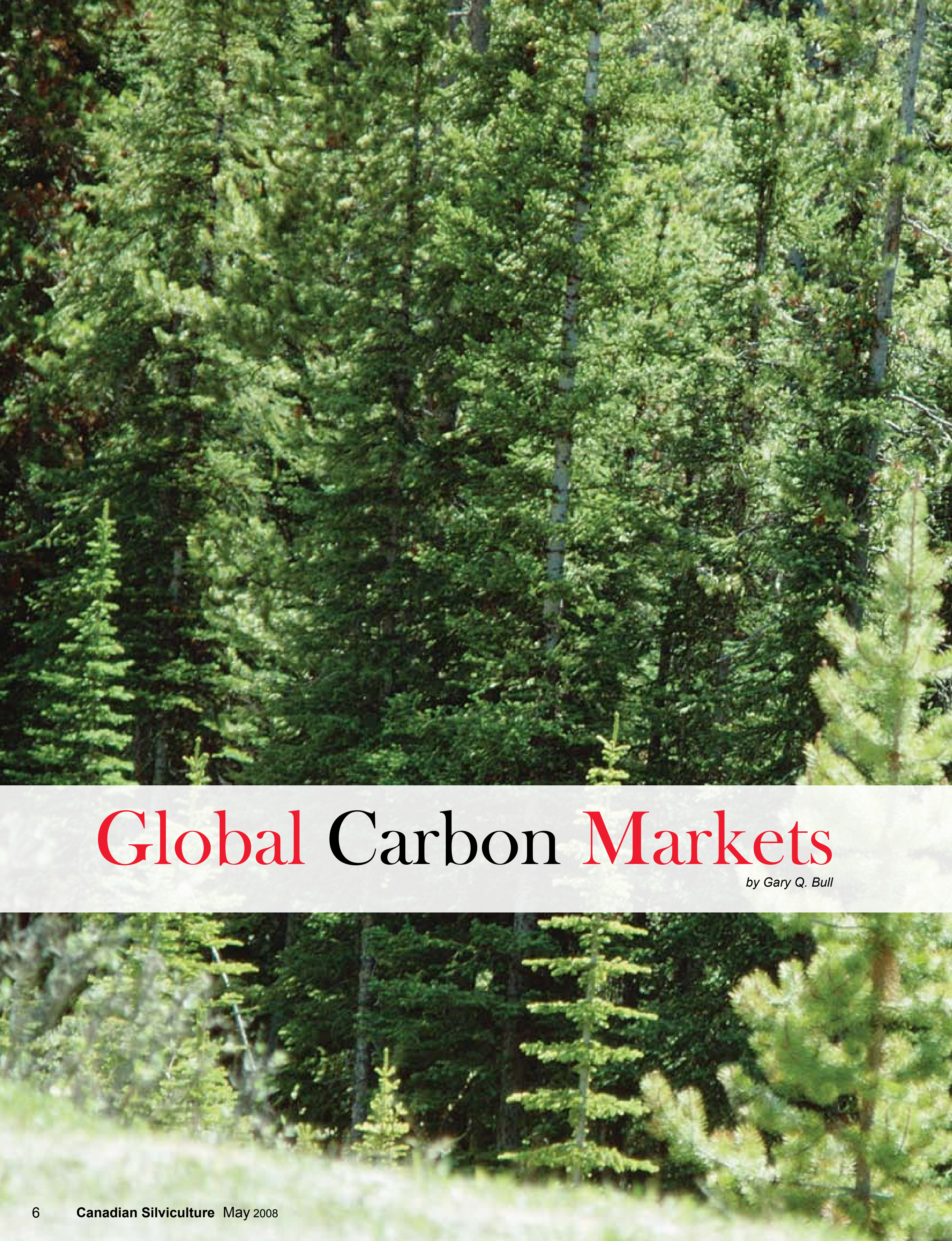
A little known or perhaps overlooked fact is that MPB successfully attacks other pines, including ponderosa pine. This type of pine grows along the dry valley bottoms and slopes of the southern interior forests of BC (see distribution map). Historically, these low density park-like forests experienced frequent stand-maintaining fires, approximately every 15-25 years. Fire was the main disturbance agent with occasional localized mortality of stressed trees caused by either western pine beetle (WPB), and/or MPB, and/or red turpentine beetle. Ponderosa pine is the most drought-resistant and fire-adapted conifer, which requires open conditions for seedling establishment. The heavy seeds from the large cones do not disperse far from the seed tree. Good cone crops come every 4 -5 years and seedlings need open conditions. Once established, ponderosa pine provides structure which is extremely valued by many species.

In 2005, the provincial peak (red attack) year of the MPB outbreak, pockets of MPB-killed ponderosa pine were recorded in portions of the southern interior. By 2006 approximately 45,000 ha of MPB-killed ponderosa pine were recorded on the leading edge of the outbreak, and in 2007 the area infested almost doubled to 83,000 hectares. Modeling projections indicate peak MPB years of 2007 onwards for BC's southern interior. As the MPB continues to spread southward from central BC, the likelihood of more ponderosa pine mortality over the next few years is high. In addition to the loss of habitat due to MPB, urban expansion, conversion of ponderosa pine forests to vineyards, and a shift from open grown ponderosa pine to higher density shade tolerant species such as Douglas-fir (due to fire exclusion) have placed forest-dependent wildlife at risk.

Ponderosa pines live 300-400 years and begin to develop excellent critical habitat features at about 100 years of age. Physical attributes of both mature and old or dead ponderosa pine trees (wildlife trees) provide nesting, roosting, and feeding for 52 species that depend on them for part of their life cycle requirements. There are 13 species of birds of prey (owls and hawks), 10 species of woodpeckers, 8 species of bats, 11 other bird species, and 5 mammal species in the ponderosa pine zone that use ponderosa pine as well as Douglas-fir and riparian black cottonwood. There are several forest-dependent species at risk with the white-headed woodpecker most strongly restricted to mature and old growth ponderosa pine for nesting and a source of seeds. Though more elastic in tree selection, Lewis's woodpecker, Flammulated owl, Western Screech Owl, and Williamson's sapsucker are other listed species that use ponderosa pine as habitat.

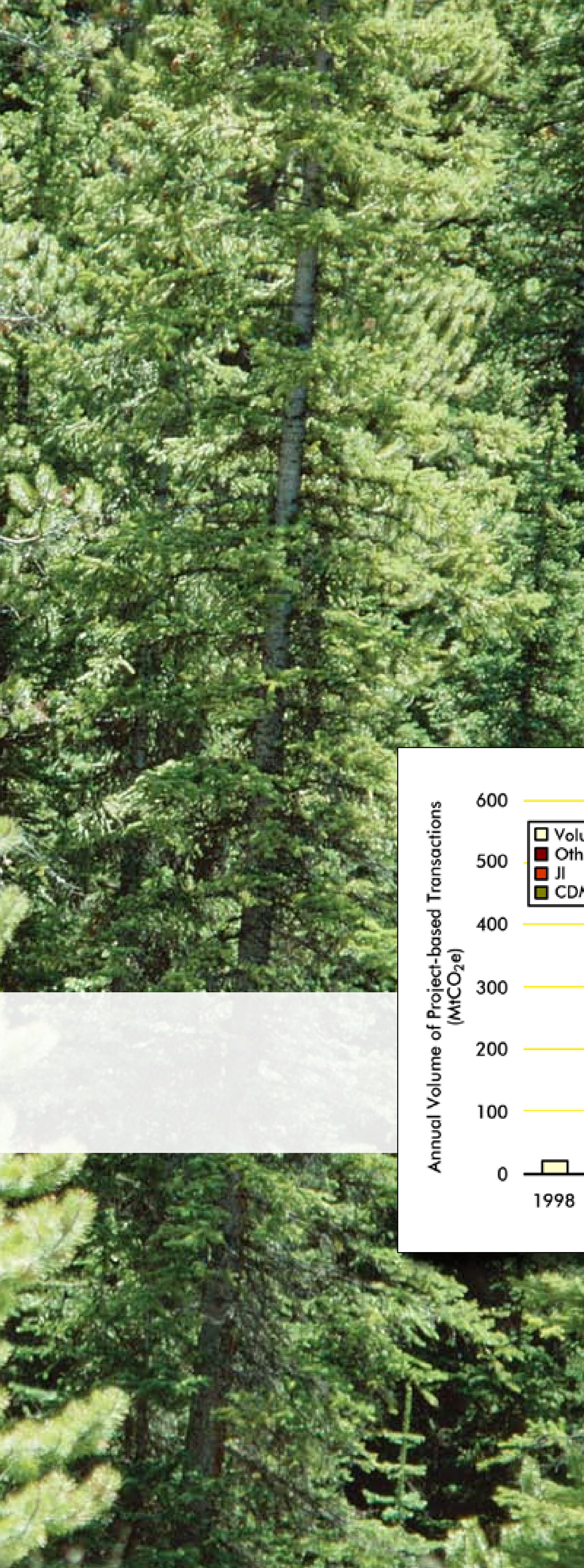
In the short term, leaving as many dead trees standing where safe to do so will mitigate the impacts for some wildlife species. There is no way, however, to create a supply of mature ponderosa pine in the mid- term to replace stands that will be lost because there are too few mid-seral pine stands.

The longer view indicates there may be significant opportunity for improvement to BC's ponderosa pine forest ecosystem. Climate change will create warmer, drier conditions to which ponderosa pine is well adapted. Climate envelope forecasts indicate that suitable conditions for ponderosa pine will be present in northern BC - Prince George and Fort St. John - 60 years hence. Given its resistance to drought, there is an opportunity for silviculturalists to expand the range of ponderosa pine by prescribing it to sites for which it is suitable. This may be a prudent strategy, which must take into consideration potential changes in the range and behaviour of biotic and abiotic agents resulting from climate change. Even though ponderosa pine is not valued as an economic species, it may well be the tree of choice to hedge for an uncertain future.



# Global Carbon Markets

*by Gary Q. Bull*



The global carbon market is growing at an exponential rate (Figure 1) and some investment banks and reinsurance companies predict that carbon will be the single largest commodity in the global commodity market. Estimates are that it will grow from over a $60 billion industry in 2008 to a $1 trillion dollar industry by the year 2020.

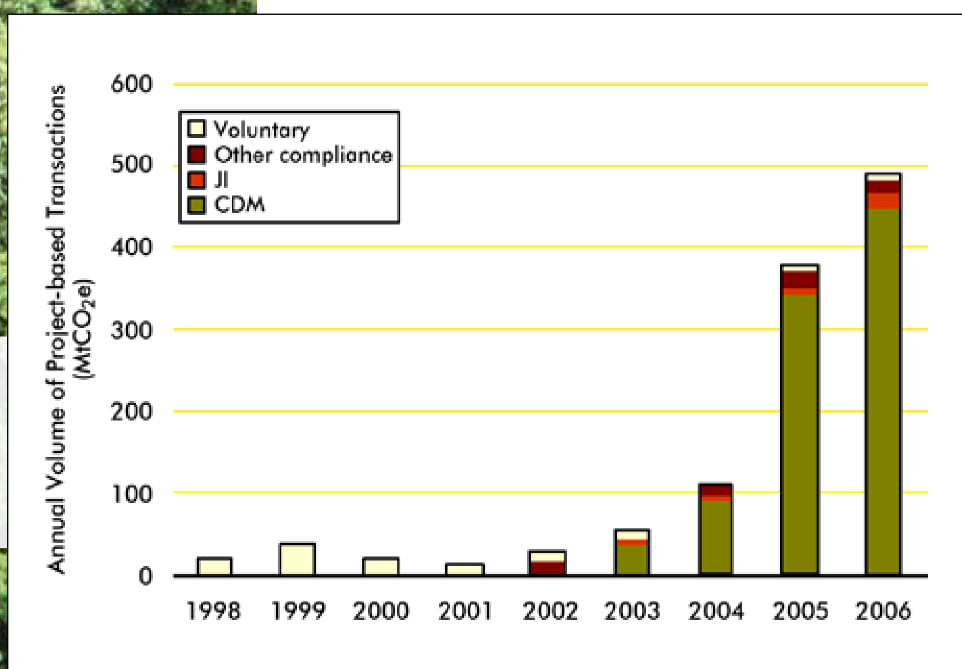



*Figure 1: Annual volumes ($MtCO_2e$) of project-based emission reductions transactions (vintages up to 2012). Source:* State of Carbon Report 2007

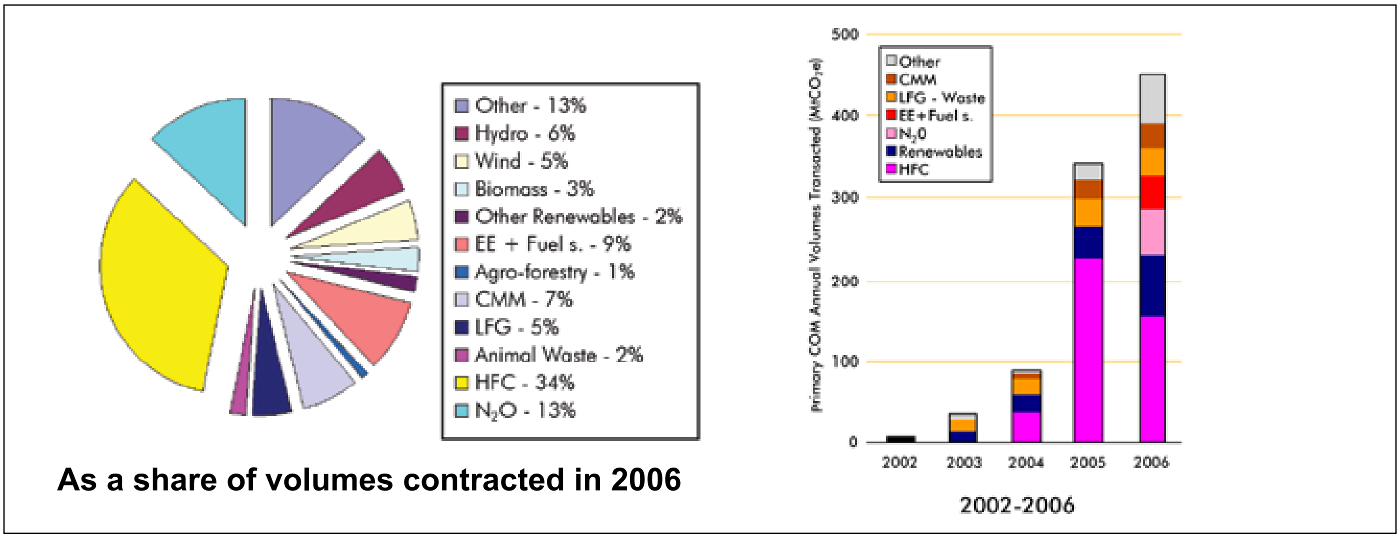



*Figure 2: Asset classes of CDM projects. Source:* State of Carbon Report 2007

Currently, forests play a very minor role, less than 1% in either the Clean Development Mechanism or Joint Implementation projects in the Kyoto compliant markets (Figure 2). In 2006, the volume of project-based emissions was nearly 500 $MtCO_2e$.

In the Kyoto alternative market, commonly referred to as the voluntary markets, there are indications of a strong preference for forestry projects, particularly in North America. In 2006, forest projects dominate in North American markets and overall (Figure 3) these resulted in 37% of all forestry carbon projects (Figure 4).

## Key Issues

Will the silviculture community, first nations, rural communities, industry and government see any benefit from the carbon stored in the forest? That depends on the answers to a number of key questions that Canadians are currently facing:

### Who owns the forest and soil carbon?

In Canada, there is no clearly defined owner of the carbon contained in forests and soils on either public or private land. Claims to ownership have been made by the federal government, the provincial government, some of the First Nations communities, and in the case of private land, by the private landowners themselves.

In order to create an air of certainty, legislation will be required to define ownership and how it relates to other economic and ecological values on the landscape. Other jurisdictions have created legal instruments and in BC, people are certainly accustomed to property rights allocation, such as what is done with various timber tenures. Tenure characteristics such as comprehensiveness, duration (length of contract), benefits conferred, exclusivity, and transferability are all applicable to forest and soil carbon.

### Who makes policy decisions?

In the Canadian landscape, there are a number of lobbyists vying to influence the policy decision. Even carbon scientists are frequently stepping outside of their traditional science role and into policy development. This is a dangerous precedent, since we have seen many notable figures reluctant to admit that they have moved beyond the boundaries of science, with an emphasis on facts, to promoting their values and opinions.

The other decision stakeholders are predictable and include industry, NGOs, private foundations, politicians, bureaucrats, and analysts. We are already seeing effort to develop policy at the national level with industry and NGOs, while analysts are lost in details and the rest of the stakeholders continue to wrestle for influence.

It is a challenge to develop clear policies for Canada. This should not surprise us given the complex financial implications of climate change policy. But we do need to see tangible steps taken and we do need the sense that political leadership has started. Finally we are seeing small steps being taken both federally and provincially.

### Who manages risks?

The normal forest risk factors discussed at the federal level are the losses due to fire, insect, and disease. In the Canadian forest context it is frequently assumed that Canadians will have to absorb all the risk in managing for forest carbon. The conclusion is that since forest carbon is so risky, we cannot manage it! Some have debated that if Canada's forests are "managed" under Kyoto rules, the federal government has to absorb all the risk. But it does not have to be this way.

There are alternatives, such as working with forest insurance or reinsurance companies that insure against losses, or use some model for managing risk in the agriculture or energy sector such as government-backed insurance schemes.

The point is, there are mechanisms to manage for risk and even if it is at the national scale, the losses from fire, insect and disease are equal to the growth. This does not have to be a constraint on the growth and development of project-based forest carbon projects where risks can be managed, for a price of course.

### Where are the institutions?

There continues to be an institutional vacuum in Canada and only now are we seeing jurisdictions such as BC start to fill the gap. Exchange mechanisms such as the Montreal Climate Exchange are emerging but are still fledglings. More energy and effort is required to get the institutional structure underway that will allow for the appropriate mix of taxation and market driven solutions.

### How do you make trade-off decisions between carbon, biodiversity, and timber?

Forests have far greater utility than for just timber and carbon; there are a host of other resources and values to be considered. So how does a manager make a trade-off decision between this broad array of values and interests? Currently, the decision support tools for such analysis are very primitive.

Further, even if we ignore the timber and carbon values, a move currently being contemplated in Canada, there is still much to be done to reach a goal of a sensible forest land management strategy in many parts of the country.

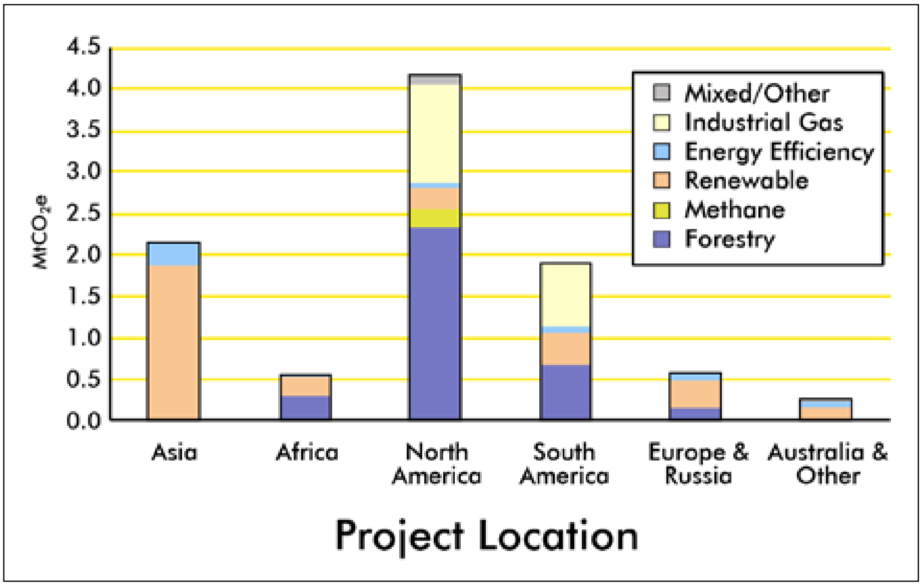



*Figure 3: Voluntary markets - transactions by project location, 2006 (9.7 Mt) Source:* Voluntary Carbon Markets 2007

### How do you manage transaction costs creep?

If anything can kill a deal, it is the cost of the "middle persons", who create what economists refer to as a transaction cost, and costs can exceed any potential project benefit. If the carbon markets are constrained to below $10 t $CO_2$e, for example, it is unlikely that the transaction cost of a project will be covered without government largesse. This means any potential carbon project at an unreasonably low price point should not be undertaken.

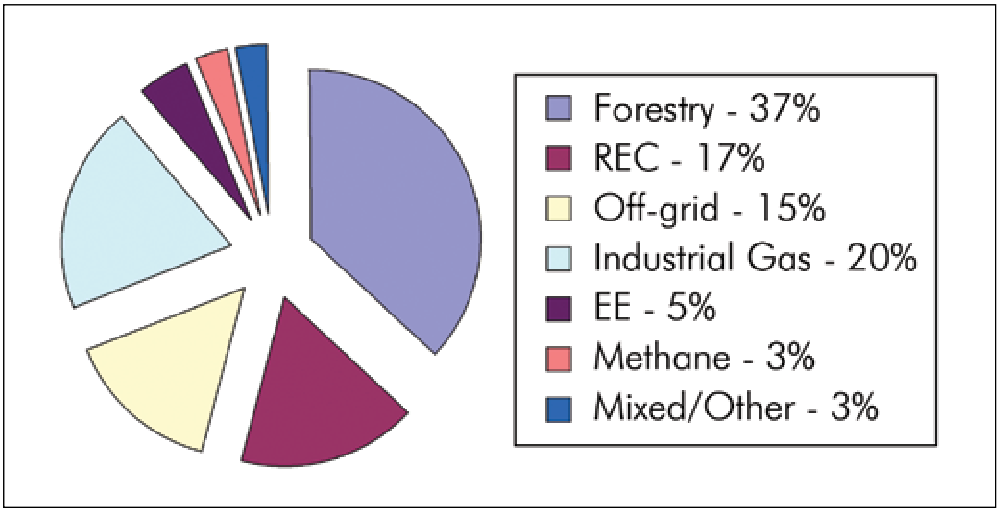



*Figure 4: Voluntary markets - transactions by project type carbon offset standards. Source:* Voluntary Carbon Markets 2007

Inefficient methods for carbon accounting are also a major contributor to the transaction costs. Canada has decision support tools in place, but they either need improvement, need uptake by users or need to readily reflect the reality of multiple land use objectives.

**How does BC stay competitive with other countries?**

It is clear that other countries, especially those with extensive forest plantation resources, will use the carbon market to partially or wholly finance further plantation establishment and plantation management. Are countries that have natural forests, such as Canada, going to sit idly by and watch our competitors further attack our competitive positions?



**How does the forest sector compete with other resource sectors?**

In addition to the competition from traditional forest products industries in other countries, there is competition from other industries, particularly the resource sector. For example, we have active competition from agriculture, which is laying claim to subsidies for the production of biofuels. We have competition from the non-renewable industries such as oil and coal in the development of carbon capture and sequestration (CCS) projects, and we have the nuclear industries looking for government subsidies to expand their facilities in provinces such as Alberta. Even the renewable energy industries such as wind and solar will require considerable government support, at least in the short run. In virtually all cases, the price per tonne of carbon emission reduced or sequestered is significantly higher than the cost of providing a tonne of carbon sequestrated in a forest. Marginal cost curves have been developed at both the local, regional, and global scales and they all demonstrate that forest projects - both afforestation and avoided deforestation projects - are attractive investments as compared to their counterparts.

A carbon constrained future is now widely accepted within the government, industry, and the financial sector. Canadian citizens will have to live in this brave new world. Currently, the forest sector is attempting to position itself as a useful contributor to dialogue on emission reduction, and the logical next step would be to contribute through carbon sequestration projects by growing more and better quality forests.

So what are the next action items? Since we reasonably understand the science of sequestration and have the decision support tools and accounting methodology to undertake the complex assessment of forest carbon balance, the next step is to systematically address all of the questions raised in this article.

For the silviculture community, carbon management does create additional business opportunities since it means we will have to deal with silvicultural slums, with afforesting more area, and with utilizing appropriate silvicultural practices that will enhance the carbon stored without creating negative impacts on other environmental values.

Gary Bull is Associate Professor at UBC in forest management and economics. He has a background in commerce as well as three degrees in forestry. With his research team he is currently focusing on timber supply and carbon/bioenergy economics, international trade in forest products, and the assessment of forest carbon payment schemes. He can be reached gary.bull@ubc.ca or 604-822-1553.

# Carbon & Nutrient Cycling

## Is Forest Bioenergy Sustainable?

*by Hamish Kimmins*

Bioenergy was one of the first values people harvested from forests. Firewood for heating, cooking, and, later on, energy for industrial and transportation needs has been a major component of human, social, and technological evolution. Firewood continues to be a major source of energy in developing countries that still have forests, although it's been displaced in most developed countries over the past half century by coal, oil, natural gas, nuclear, and hydro energy.

As the human population grew and the need for a variety of wood products increased, and as forest fuel was replaced by fossil fuel, timber became the major economic resource provided by most forests. Firewood became relatively unimportant and vast quantities of forest biomass remained in the forests following exploitative timber harvesting, or harvesting of old forests in which a large proportion of the tree biomass was unusable. However, with growing concerns about climate warming and its association with the almost exponential increase in fossil fuel combustion, forests are once again being valued as a source of biomass for energy, and as a way of sequestering and storing atmospheric carbon.

*1970s logging on northern Vancouver Island*

Without question, bioenergy and carbon storage are legitimate forest products just like water, wood, wildlife, and biodiversity. However, as we have learned so many times, excessive focus on any one forest value tends to result in negative impacts on other values, leading to problems with their sustainability. A preoccupation with timber economics can lead to problems with soils, water, wildlife, recreation and aesthetics. An uninformed preoccupation with certain aspects of biodiversity may lead to failures to sustain other measures of biodiversity, and several of the important social values provided by forests. Similarly, an excessive preoccupation with biofuel without adequate consideration of other forest values including the sustainability of tree growth would be unwise. All forest values are important, and while the relative ranking in importance varies from place to place and from time to time, it is a basic requirement of sustainable, multi-value forest management and stewardship today that the implications of management for any one resource on the sustainability of other resources be considered in developing forest management policy, plans, and practices.

There are two important questions that must be addressed in seeking assurance that the resurgence of interest in forests as bioenergy producers is consistent with sustaining the many other values desired from forests by society: (1) Is the harvest of forest biomass for bioenergy sustainable?; and (2) What is the best strategy with respect to optimizing the role of forests in carbon storage and sequestering? This article focuses on the first of these two questions.

Like so many questions in forestry and ecology, there is no simple answer to this question. Determining factors include:

- the type of forest (species, age, timber volume)
- the nutritional demands of the tree species involved
- the frequency of harvesting (the rotation length

*Early, exploitative logging on southern Vancouver Island*

in even-aged stands or the frequency of entry in partially harvested stands)

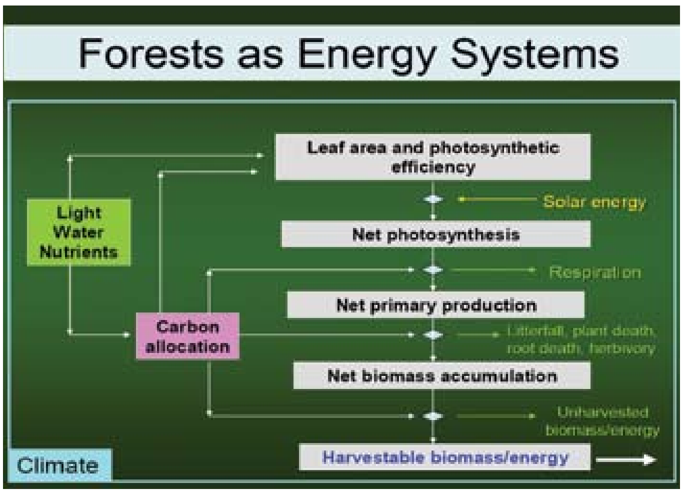
- what proportion of the tree is removed (only the stems, or stems plus one or more of branches, leaves, stumps and roots)
- whether slash and forest floor material is harvested
- the history of natural disturbance (as it has affected accumulation of organic matter and nutrients in the soil and vegetation)
- the risks of future natural disturbance that would remove organic matter and nutrients
- the depth, texture, geology, and fertility of the soil
- other values that are desired from forests
- the value tradeoffs implicit in managing forests for bioenergy

The broader question as to whether bioenergy harvesting is a component of sustainable forestry includes these factors, plus the effects on hydrology, soil erosion and slope stability, soil animals and microbes (and thus on soil fertility, plant growth, and productivity), and above ground diversity of plants and animals. The waste biomass in the forest is not ecological waste. Branches, leaves, stumps, roots, large decomposing logs, and standing dead trees (snags) are important components of the forest ecosystem, providing energy and habitat for soil animals and microbes, habitat and food sources for small and medium-sized vertebrate and countless invertebrate animals. They help to sustain soil humus levels, and supply nutrients slowly over time for uptake by trees to support their future growth and productivity.

The expression "no free lunch" comes to mind. Everything we take out of the forest prevents the use of the energy and nutrients contained therein by other forest organisms, removes the habitat contributions of those materials, and affects the important hydrological role of organic matter in forests. We know that a substantial amount of forest biomass can be harvested periodically without long-term negative consequences, but for every ecosystem and every value there will be some frequency of biomass harvest with some intensity of removal, beyond which forest ecosystem function and biological diversity will be impaired. Annual harvesting of branches and forest floor litter by landless German peasants in the early 1800s led to a yield decline in pine forest that was a major stimulus for the development of modern forest science. This resulted in a government-initiated study by an eminent chemist of the day who concluded in 1876 that excessive biomass removal will threaten future productivity on nutrient-poor soils, and that predictions of future stand growth should incorporate nutritional assessments.

Harvesting of bioenergy conducted at infrequent intervals on sites with fertile soils and high rates of re-accumulation of nutrients should not threaten long-term tree growth. If such harvesting of bioenergy, in addition to logs for timber, is conducted within a landscape pattern of forests of different ages, and "islands" of forest are left with high loadings of decomposing logs, snags and organic matter, it should sustain most values. Such "islands" (e.g. the retention patches in variable retention silviculture) provide reservoirs of organisms that can re-colonize intensively harvested areas once organic matter and nutrients have re-accumulated. In contrast, one or more of short rotations/frequent entries, low soil fertility, a lack of organic matter and low nutrient legacies from the past, and/or lack of retention patches may fail to sustain a variety of forest values and may not even sustain bioenergy production over the long term.

Considering the complexity of this issue, how can we evaluate the sustainability of bioenergy? Experience has often served forestry better than the results of disciplinary, reductionist science. While experience continues to guide farmers and fishermen in systems where the results of management changes can be detected empirically within a few years, the long time scale in forestry reduces the value of experience alone in the face of changing climates and new management systems for which we lack long experience. The best available solution at present is to combine what relevant experience we have with our rapidly increasing understanding of how ecosystems work - the key ecosystem processes that are responsible for sustainability. Only then can we make informed estimates and predictions of the relative sustainability for multiple values or the various ways we can manage forests, including harvesting them for bioenergy.




*Major determinants of primary production in forest ecosystems are tree and understory plant growth. Within the context of a given climate, both production and allocation of that production are closely related to the pattern of variation in availability of nutrients and water over the life of the plant community as well as light. Managing forests for bioenergy production must respect this basic production ecology.*

It has been argued that the environmental risks posed by climate warming and the urgent need to replace fossil fuel-based energy with renewable bioenergy sources outweigh concerns over the next few decades about the effects of forest bioenergy harvesting on soil fertility and biodiversity. With continued climate warming, these values are at risk anyway. Solar, geothermal, hydro, wind, and wave/tide sources of energy offer alternatives to fossil fuel, but many of these have significant environmental problems, require considerable capital investment, and will take years or decades to be brought on line. In contrast, unused forest biomass is seen as readily available, and requires little capital or technical development. The removal, reduction, or concentration of post-logging slash and/or the disturbance of deep, slowly decomposing forest floors by burning or mechanical means is sometimes needed before a harvested area can be regenerated, especially in old forests, and rather than disposing of this biomass, why not use it for bioenergy?

Agricultural crops, such as corn and soybean, which are grown for biofuel require fertilizers and fossil fuels to manage and harvest the annual crop. In the tropics, soybean production for biofuel has accelerated the clearing of tropical rainforests, and the fertilizer use for corn production in the southern US is contributing to the nutrient enrichment of the Mississippi River that it is thought to be causing a large and expanding "dead zone" in the gulf of Mexico. Growing food crops on agricultural land for biofuel is causing food shortages and increases in the price of basic foods such as corn and grains. In contrast, forests grown with low intensity management generally do not require fertilizers and have relatively little fossil fuel demand per

*Whole tree harvesting in New Brunswick*

unit of bioenergy produced. Unused forest biomass does not compete with food, and thus appears to be a much more environmentally and socially-friendly source of bioenergy than agricultural crops if managed with sensitivity to ecosystem function.

Acceptance of most alternative sources of energy (nuclear, hydro, wind, tidal) requires detailed environmental impact assessments. However, it seems that there is a readiness to rush into using forest bioenergy as a short-term way of contributing to a reduction in the release of greenhouse gases from fossil fuels without adequate assessment of the ecosystemic consequences. The harvest of unused forest biomass as biofuel is acceptable as long as appropriate environmental assessments are undertaken to define levels of organic matter and nutrient removal that are consistent with ecosystemic sustainability and acceptable value tradeoffs.

The Canadian Forest Service asked that such a capability assessment be developed in the mid-1970s (the FORCYTE model). Ecosystem management simulation models have been designed over the past thirty years specifically to assess the sustainability of multiple forest values under a wide range of alternative forest management systems interacting with natural disturbance agencies (e.g. fire, insects, wind, and climate change). This decision support system is based on our current understanding of the ecology of forest productivity. The key to assessment of the sustainability of bioenergy harvesting from an ecosystemic perspective is to base this on a model that represents the key ecosystemic processes that underlie the sustainability of ecosystemic primary production. Using forests as an energy system must incorporate this approach, as was asserted in Germany nearly 130 years ago.

The main model in this family of ecosystem assessment tools, FORECAST (FORestry and Environmental Change ASessmenT) can be used to examine stand-level sustainability questions - alternative scenario and value tradeoff assessments. The output from the model – forecasts of possible forest futures - can be used to replace the output concerning timber volume from conventional stand-level growth and yield models that is generally the driver of large landscape and management unit timber supply models. This converts a timber supply model from a simple timber inventory control tool into a landscape-level timber supply, wildlife habitat supply, aesthetics (through interactive, three-dimensional visualization), carbon budget (carbon storage in live vegetation, decomposing organic matter and soils; carbon sequestration and carbon release), fossil fuel energy requirement as well as employment and economic assessment decision support tool. Because such ecosystem-driven landscape models are multi-value, they can be used in multi-value scenario and value tradeoff analyses.

As ecosystem management models, the FORECAST family of decision support tools have proven valuable in forest certification, since they are able to assess the utility of various indicators of sustainability criteria, undertake credible analyses of value tradeoffs, and facilitate the transition from static, snapshot assessments of sustainability to assessments of the dynamic ever-changing character of stands and landscape that are the true objective of sustainability analysis.

The urgency of the climate change issue does suggest use of some proportion of unused forest biomass for bioenegy. However, using all the unused forest biomass would have little long-term impact compared with the carbon and climate consequences of burning all the world's coal, oil and gas. Rather than threatening the many other values of forests by harvesting waste biomass, it is better to work on reducing our consumption of fossil fuels. Like carbon credit trading, use of the remaining underutilized forest organic matter does not get to the heart of the problem, which is burning fossil fuels. In the short run there may be merit in using forest bioenergy to meet our national commitments, but this political expediency cannot be supported in the absence of a careful, ecosystem-specific assessment of the consequences for nutrient cycling and other forest values.

Hamish Kimmins is Professor Emeritus of Forest Ecology in the department of Forest Sciences at UBC, Vancouver.

WESTERN

SILVICULTURAL CONTRACTORS' ASSOCIATION

*by John Betts*

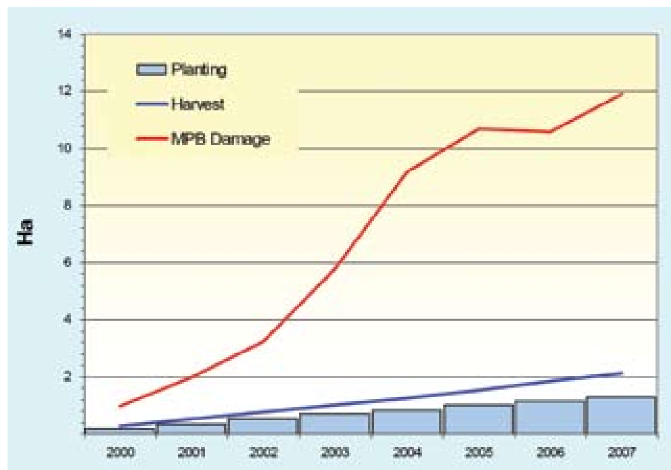
## Time to Act Decisively on MPB

It is widely assumed that because of the size of BC's mountain pine beetle (MPB) epidemic there is an equally massive reforestation response. There isn't. It is also widely assumed that there is a massive salvage effort to harvest the dead pine. There isn't. As for government investments, the provincial purse still only funds forestry at lower than pre-MPB epidemic levels. And the often-mentioned federal dollars have largely been diverted to small market airport improvements and infrastructure; things the beetles are not likely to notice. Of the hundreds of millions of dollars of government MPB funding promised, very little of it seems intended to restore the actual landscape.

Since the millennium, 12 million ha, an area representing one fifth of the province's forested land, has come under assault from the beetle. That sum doesn't include at least another one million ha suffering from other pests and blight. This has all occurred in the last decade as annual planting has steadily averaged around 250 million seedlings. If trees planted is a bellwether of the province's strategic response to the MPB, the evidence is we are not responding through a major ramping up of reforestation. This would seem to be supported by forecasts based on sowing requests that by 2009 the province will plant 70 million fewer trees than today; a 20% drop to the lowest planting levels in two decades.



The log harvest profile for the past decade suggests the strategy of uplifts has not succeeded in effectively directing the cut towards the heavily hit stands. Although exact figures on the pine salvage component are hard to find, it looks like restoring the MPB-attacked woods by harvesting is not happening because we are not extensively cutting the dead trees in the first place. Worse, the regeneration program is subject to the market for lumber, which answers to other imperatives far removed from forest health and the long-term considerations of British Columbians.




The government has committed to planting 20 million seedlings annually through Forests For Tomorrow, but at the end of 20 years this will only address approximately 440,000 ha. No one is proposing planting the whole plague, but this is a remarkably modest response compared to the size and scale of the attack.

It seems the current policy is to wait for two things: natural regeneration and a new bio-energy industry. Neither of these are inevitable. And even if they do occur, they will have to compete with some other biological effects gaining force across the landscape, the most principal one being fire. Leaving millions of hectares of contiguous MPB-attacked stands to go through the fuel succession process over the next few decades is likely to be catastrophic as our fire seasons lengthen with climate change.

The millions of hectares of beetle attack represent an array of values at risk unaddressed by our response to date. Hydrology, aboriginal rights, future lumber supply, wildlife habitat, public safety, parks, green house gas mitigation, existing plantations, and infrastructure protection all need to be considered as part of our lawful obligation to maintain abundance and diversity on the land. The current forest conditions won't lead to that unless we intervene soon and begin to strategically steward nature on a course we can live with. To not do this is to place a massive lien against the future of the province.

## ASSOCIATION DES ENTREPRENEURS DE TRAVAUX SYLVICOLES

*par Audrey Harvey, Responsable des communications, AETSQ*

# Québec Jette les Bases du Nouveau Régime Forestier

Décidément, ce fut une année faste pour la foresterie au Québec! L'année 2007 fut celle du Sommet sur l'avenir du secteur forestier québécois où, vous vous souvenez, les intervenants du milieu avaient convenu qu'il était temps de faire un virage pour remettre l'industrie sur les rails.

L'année 2008 a commencé sur le même ton alors que le ministre des Ressources naturelles et de la Faune, Claude Béchard, a lancé le très attendu Livre vert. Ce document contient une série de propositions visant à façonner le futur régime forestier du Québec qui entrerait en vigueur en avril 2013. Avec ce Livre vert, le gouvernement vise cinq grands objectifs :

1. Doter le Québec d'une véritable stratégie de développement industriel et d'une culture du bois

2. Bâtir le patrimoine forestier du Québec dans un contexte de gestion intégrée des ressources et de développement durable

3. Confier aux milieux régionaux de nouvelles responsabilités en matière de gestion des forêts du domaine de l'État

4. Offrir aux entreprises la possibilité de sécuriser une partie de leurs approvisionnements et créer un marché concurrentiel des bois en provenance des forêts du domaine de l'État

5. S'assurer que la gestion forestière s'inscrit dans la réalité des changements climatiques

Ces cinq objectifs sont appuyés de neuf orientations qui précisent davantage la direction dans laquelle le gouvernement veut amener les forestiers du Québec.

• Favoriser la mise en valeur des ressources par l'implantation d'un zonage du territoire forestier. Il s'agit en fait de dédier des portions de territoire aux aires protégées, à l'aménagement écosystémique et à la sylviculture intensive.

• On souhaite également recentrer le rôle du Ministère sur ses responsabilités fondamentales, c'est-à-dire sur des fonctions stratégiques, de manière à assurer une cohérence nationale.

• Confier à des acteurs régionaux des responsabilités en matière de gestion des forêts du domaine de l'État. Il est à noter toutefois que cette orientation suscite un bon nombre de questionnements puisque l'entité régionale dont il est question n'est pas définie, pas plus que ses responsabilités exactes.

• Confier à des entreprises d'aménagement certifiées la réalisation des interventions forestières. Par cette mesure, le MRNF dit vouloir « reconnaître l'industrie de l'aménagement forestier comme un agent majeur pour la planification opérationnelle et la réalisation des interventions en forêt en vue d'en accroître la qualité. »

• Promouvoir une gestion axée sur l'atteinte des résultats durables et la responsabilisation des gestionnaires et des aménagistes. Ici encore, puisque ces responsabilités découlent du rôle que joueront les régions, il est difficile de mesurer l'importance de cette mesure. Mais idéalement, il devrait en résulter un plus grand pouvoir de décision des professionnels sur le terrain.

• Favoriser un approvisionnement stable de matière ligneuse en instaurant un droit de premier preneur. Cette mesure est majeure pour l'industrie forestière. Concrètement, les bénéficiaires de CAAF actuels deviendraient des détenteurs de droits et pourraient acheter en priorité, au prix du marché, un volume spécifique de bois public. Ce volume correspondrait à 75% de leur volume actuel.

• Établir un marché concurrentiel des bois provenant des forêts du domaine de l'État. En clair, cela signifie que le 25% restant des volumes disponibles seraient mis aux enchères. Un bureau de mise en marché des bois des forêts publiques pourrait être créé afin d'en gérer le commerce.

• Créer un fonds d'investissements sylvicoles pour la sylviculture intensive. Bien sûr, il s'agit d'une mesure qui nous touche directement. Depuis 2002, l'AETSQ fait la promotion de la mise sur pied d'un tel fonds afin de permettre une stabilité des travaux sylvicoles.

• Se doter d'une stratégie de développement industriel axé sur des produits à valeur ajoutée. Il s'agit en fait de faire la promotion de l'utilisation du matériau bois dans les constructions non résidentielles et de favoriser la diversification des produits.

Comm vous pouvez le constater, nous aurons un menu chargé encore une fois cette année. Les consultations sont en cours dans les différentes régions. Le ministre souhaite pouvoir aboutir à un projet de loi en juin pour ensuite tenir une commission parlementaire à l'automne. Si tout se déroule comme prévu, le projet de loi serait adopté en décembre prochain. Rapide vous pensez ? Nous avons quelques mois à peine pour refaire un régime qui a mis des années à s'installer. Le train est en marche alors il faut embarquer!

Tous les détails sont disponibles en anglais et en français au http://www.consultation-regime-forestier.gouv.qc.ca/.

# QUEBEC

## ASSOCIATION OF SILVICULTURE CONTRACTORS

*by Audrey Harvey, Communications Coordinator, AETSQ. Translated by David Hayne*

## Quebec Lays the Foundations of a New Forestry Program

2007 was definitely an outstanding year for forestry in Quebec! We had the Summit on the Future of the Forestry Sector in Quebec, at which stakeholders in the milieu agreed that it was time to turn things around and get the industry back on the rails.

The year 2008 began in the same vein when the Minister of Natural Resources and Wildlife, Claude Béchard, issued his long awaited *Green Paper*. This document contains a series of proposals designed to shape the future forestry regime in Quebec, to take effect in April 2013. In the *Green Paper*, the government sets out five major objectives:

1. Provide Quebec with a real industrial development strategy and timber growth policy.

2. Increase Quebec's forestry heritage in a context of integrated resource management and sustainable development.

3. Grant regions new responsibilities for the management of forests on government lands.

4. Offer companies the possibility of protecting part of their stocks and of creating a competitive market for timber from forests on government lands.

5. Give assurance that forestry management takes account of the reality of climate change.

These five objectives are supported by nine guidelines that indicate more precisely the direction in which the government seeks to move Quebec's foresters:

• Encourage the development of resources by zoning the forestry territory. This means dedicating portions of the territory to protected areas, to ecosystem management, and to intensive silviculture.

• Refocus the role of the Ministry on its fundamental responsibilities, namely strategic concerns and assuring consistency throughout the province.

• Give regional officials responsibility for management of forests on government lands. It should be noted, however, that this guideline gives rise to a number of queries, because the regional entity in question is not defined, nor are its specific responsibilities.

• Entrust the carrying out of forestry activities to certified management companies. By this measure, the Ministry states that it wants to "recognize the forest management industry as a major agent in the operational planning and carrying out of forestry activities, in order to improve their quality."

• Encourage forestry administration to be focused on the achievement of sustainable results and the transfer of responsibilities to administrators and planners. Here too, since these responsibilities derive from the role played by the regions, it is difficult to measure the importance of this proposal. But ideally, it should give forestry professionals greater decision-making power.

• Ensure a stable stock of forestry products by establishing priority rights. This is a major measure for the forestry industry. In practical terms, the present holders of CAAF contracts would receive rights and would have priority in purchasing, at the market price, a specific volume of public timber. This volume would correspond to 75% of their present volume.

• Establish a competitive market for timber coming from forests on government lands. Simply put, that means that the remaining 25% of the available volumes would be auctioned. A sales office for public land timber could be set up to handle the transactions.

• Create a silvicultural investment fund to finance intensive silviculture. This is clearly a measure that affects us directly. Since 2002, the AETSQ has been urging the government to establish such a fund to ensure the stability of silvicultural activities.

• Provide a strategy of industrial development based on value-added products. This is a move to promote the use of forestry material in non-residential construction and to encourage product diversification.

As can be seen, we have a heavy agenda again this year. Consultations are already taking place in the various regions. The Minister would like to draft legislation in June as a preamble to holding a parliamentary commission in the fall. If everything takes place as expected, the draft legislation would be adopted next December. Is this too fast? We have only a few months to rebuild a regime that has taken years to become established. The train is leaving; we must get aboard!

Full information is available in both English and French at http://www.consultation-regime-forestier.gouv.qc.ca/.

# ONTARIO

## SUPERIOR-WOODS TREE IMPROVEMENT ASSOCIATION

*by Paul D. Charrette, RPF*

## Celebrating Twenty Years of Cooperation and Growing

It has been 20 years since the first cooperative tree improvement program was established in Northwest Ontario (NWO) and the trees as well as the cooperative spirit have grown steadily since then. The Ontario Ministry of Natural Resources (OMNR) and the forest industry in NWO have cooperated to increase forest productivity through establishing and managing tree improvement programs. In 1987, the first cooperative tree improvement program in the region was established through the foresight and efforts of staff at the OMNR and the forest industries in the Thunder Bay area. The initial cooperative efforts also received support from the federal government through the Canada-Ontario Forest Resources Development Agreement (COFRDA). From its start in the Thunder Bay area, the cooperative spirit spread across NWO until today, where all major forest companies and the OMNR cooperate in all tree improvement programs in the region.

The Superior-Woods Tree Improvement Association, which is part of Forest Genetics Ontario, heads up the cooperative tree improvement movement in NOW, and as with many successful organizations, has had to adapt with the changing times. The OMNR started the first tree improvement programs and the first cooperative programs were established five years later with the OMNR and industry partners sharing in all aspects of the program. However, in the mid-1990s the forest industry became responsible for all silvicultural activities, which included tree improvement. The OMNR and forest industry continue to cooperate and support the tree improvement programs although their respective roles have changed over time.

The cooperative tree improvement programs are now bearing fruit and are providing a large and increasing percentage of the seed demand for operational tree planting programs across the region. Thirty tree improvement programs have been established for the commercially important species - black spruce and jack pine, and to a lesser extent, white spruce. The black spruce and jack pine orchards were established with off-spring of 400 “plus-trees”, or trees selected from wild stands for superior growth and form. Over time the plus-tree families have been tested in over 65 field plantings. The information gained from the tests has been used to thin the orchards genetically, thereby maintaining only the most productive and highest quality families for seed production. The superior growth and form of trees retained in the orchards have resulted in improved seed, which is inherently more productive than wild seed. Based on test results, the use of improved seed will result in 5-8% greater volume over wild seed. In many areas of the region, improved seed from these orchards now supplies all the seed used by tree nurseries to grow black spruce and jack pine seedlings for operational tree planting programs. In this way the cooperative efforts in tree improvement contribute to an increase in forest productivity in the region, which benefits everyone. In addition, the success of the first generation tree improvement programs has led the forest industry and OMNR, with funding assistance from the Living Legacy Trust (LLT), to start work on the next generation of tree improvement programs. Cooperation between forest industry and OMNR has lead to 20 years of successful tree improvement, and it’s still growing.

# NOVA SCOTIA

## FEDERATION OF NOVA SCOTIA WOODLAND OWNERS

*by Andrew Fedora*

The program administrator described in the last issue of *Canadian Silviculture* for the Association for Sustainable Forestry (ASF) is receiving fewer applications for the uneven-aged management (Category 7) funding than what they hoped for. To put things into perspective, the province earmarked $443,000 specifically for Category 7. After the first few months of promotion, the ASF only received applications for roughly half of the funding. It is unclear how many of the sites will meet criteria and receive funding. Comparatively, funding allocated for intensive even-aged forest management (spray, plant, PCT, etc.) is typically spoken for on the first day applications are accepted. In 2005/2006, the ASF received applications for over $700,000; nearly double the budget.

There is much speculation over the obvious disproportion of silviculture treatments in Nova Scotia; insufficient funding assistance, inadequate forest stand composition and a poor understanding of silviculture options are possible contributing factors to the imbalance. To date there has been no real in-depth analysis, only speculation and opinion (informed and otherwise). We are all hoping the ASF's one-year education program and funding assistance will shed some light on this. For more information regarding the Category 7 program, visit www.asforestry.com or contact the Federation of Nova Scotia Woodland Owners (FNSWO) at info@fnswo.ca.

In the same vein of alternative silviculture in Nova Scotia, FNSWO has been taking a close look at riparian silviculture. Past and present land use practices have seriously degraded many riparian areas in Nova Scotia. It is clear that without intervention, Nova Scotia endangers the future health and sustainability of its riparian forests.

Intensive activities in riparian areas can lead to serious losses of habitat and water quality. Natural drainage is interrupted as riparian soils become compacted, sedimentation rates increase, solar radiation increases, and stream channels are altered. Removal of riparian vegetation and woody debris impedes riparian areas' ability to retain water, filter pollutants and sediment, and also compromises the habitat of many terrestrial and aquatic species.

While the overall goal of silviculture is to improve the health of a forest, most silviculture practices in Nova Scotia revolve around fibre production to support the forest industry. Riparian silviculture utilizes many of the practices used to promote fibre production, but the objective and motivation is different. The emphasis of riparian silviculture is on a diverse range of long-term environmental benefits such as water quality, habitat, and ecological diversity. Industrial silviculture may also generate some of these benefits, but they are often a positive by-product and not the focus.

Attributes of riparian forests most needed to affect restoration are large diameter trees, dead and dying trees, snags, trees with large live crowns, abundant coarse woody debris, multistoried and multi-species canopies, and increased diversity and cover of understory species (Sedell et al. 1997; Tappeiner et al. 1997). These characteristics can be maintained, improved, or created by using silviculture techniques.

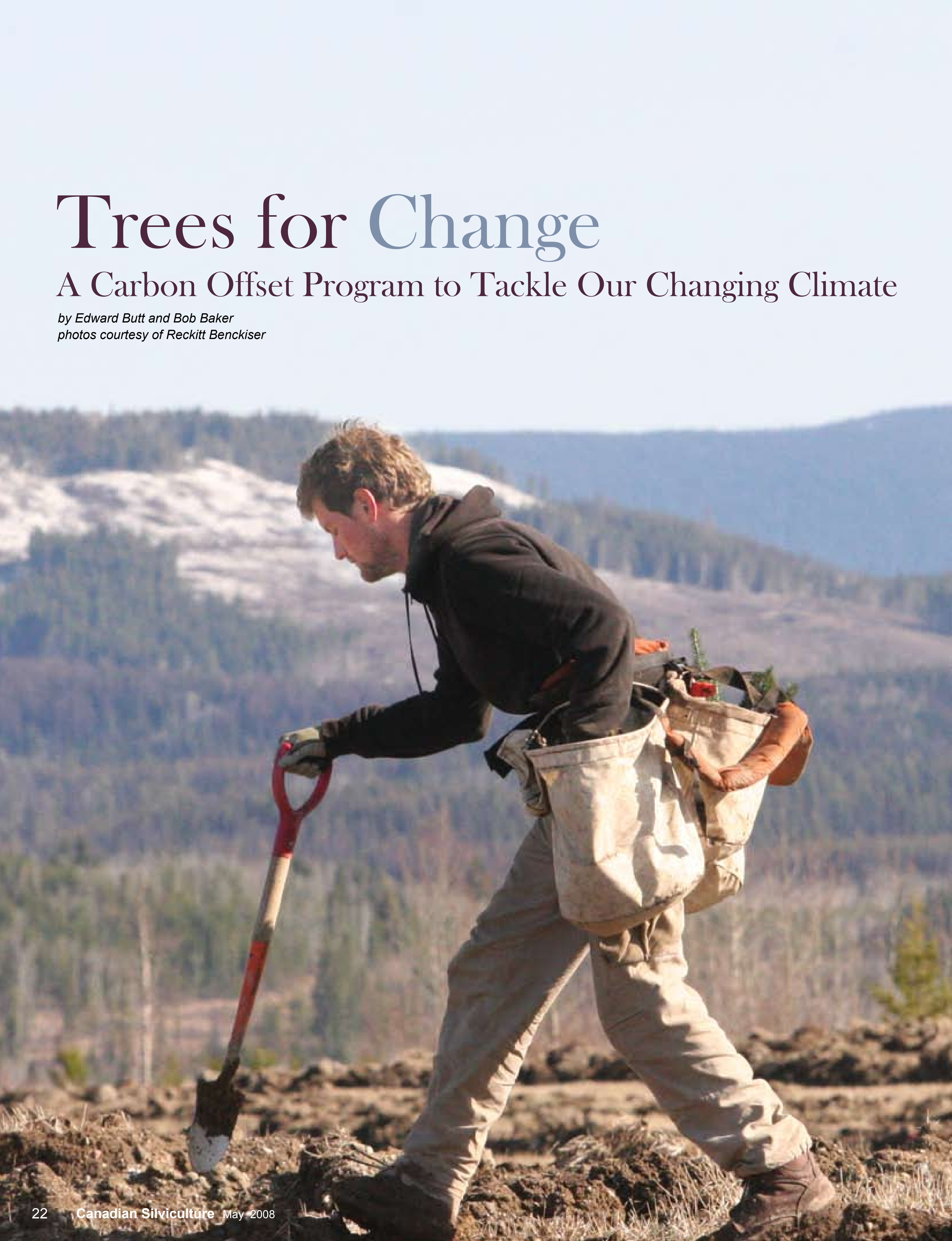
A reasonable amount of information pertaining to riparian silviculture exists. Most of it is hard to find and is often not in the context of Nova Scotia's Acadian forest type. The FNSWO has completed a substantial amount of research on riparian silviculture, but more work is required to determine which methods and practices are appropriate for Nova Scotia. FNSWO is currently examining new information, combining it with what we know, and seeking partnerships to develop riparian silviculture best management practices for Nova Scotia. Riparian silviculture has the potential to address a wide array of environmental concerns, generate employment, preserve natural heritage, and improve the overall health of Nova Scotia's forests.

Andrew Fedora is a forest technologist and the Executive Director of FNSWO. If you would like to learn more about riparian silviculture in Nova Scotia or have information to contribute, contact the FNSWO at info@fnswo.ca or at 902-639-2041.

# Trees for Change

## A Carbon Offset Program to Tackle Our Changing Climate

*by Edward Butt and Bob Baker*
*photos courtesy of Reckitt Benckiser*



Trees for Change is a major afforestation project that will offset at least two years of the greenhouse gas emissions from energy use at the global manufacturing facilities of Reckitt Benckiser, a world leader in household cleaning and health and personal care products. This means the more than 8 billion products that the company produced at its 44 factories during 2006 and 2007 will be effectively "carbon neutral" in terms of their manufacture. To achieve this more than one million tonnes of $CO_2$ will be removed from the atmosphere over the next 80-100 years.

This ambitious project will see the company plant more than two million trees on 15 $km^2$ of historically deforested land in BC. These new forests comprise locally grown seedlings that are indigenous to the area; predominantly white spruce, lodgepole pine and interior Douglas-fir.

Carbon credits/certificates are not being created, used, or sold as part of the project. Trees for Change is a wholly philanthropic initiative, being conducted to offset the greenhouse gas (GHG) emissions associated with Reckitt Brenckiser's energy use while other projects reduce those emissions. For example, the company reduced greenhouse gas emissions from energy use at its worldwide factories by 22% per unit of production (15% in absolute terms) between 2000 and 2006.

## Carbon Sequestration by Afforestation

Greenhouse gases such as carbon dioxide are released when fossil fuels such as coal and gas are burnt to provide energy and heat, and by other human activities. It is now generally accepted that the release of greenhouse gases into the atmosphere in this way is a major anthropogenic (human) cause of climate change.

Trees take carbon dioxide ($CO_2$) from the air and expel oxygen ($O_2$) through photosynthesis. Carbon (C) extracted from this process is turned into organic matter by the trees and used for growth. As a result, when forests grow they have the net effect of removing or "sequestering" carbon from the atmosphere, both within the trees themselves and in forest ground litter and soils. By growing new forests on historically deforested land Trees for Change takes $CO_2$ from the atmosphere in this way.

According to the *Stern Review on the Economics of Climate Change,* greenhouse gas emissions from current net global deforestation are very significant and estimated to represent more than 18% of worldwide emissions, more than that produced by the global transport sector.

However, the benefits of Trees for Change go beyond just sequestering carbon to help tackle climate change. The project is also making a positive contribution to local biodiversity and the protection of native wildlife because it is planting a mixture of three coniferous tree species (rather than a monoculture); some small-scale deciduous planting is also being conducted; existing stands of both coniferous and deciduous trees are being left intact; natural regeneration is being allowed to occur; and an effort is being made to generally encourage and protect local biodiversity and native wildlife. The project should also benefit the local economy because all land preparation, planting, monitoring, maintenance, and day-to-day project management work is being undertaken by local BC forest professionals. Meanwhile, through the carbon monitoring and modelling being carried out, Trees for Change is also contributing to the scientific understanding of carbon sequestration by afforestation.

## Site Preparation and Management

Two different methods of mechanical site preparation (MSP) were tested on the project's pilot planting area in October 2005, namely Donaren mounding and disk trenching. These trials and the initial response shown by seedlings planted in the pilot area in spring 2006 showed that for cleared meadowland the Donaren mounder achieved the best results.

The Donaren mounder produces an inverted mound of soil above the normal ground level, providing a nutrient-rich micro-site for each seedling to grow in. The mounded micro-sites will typically warm somewhat earlier and faster in the spring. These warmer soils allow the seedling root mass to initiate growth more quickly and so seedling growth is maximized in the first few years. It also provides better drainage for the seedlings as well as some protection from competing vegetation. Site preparation of the 2007 planting areas commenced in July 2006 and was completed in August 2006; preparation of the 2008 planting areas was carried out during 2007.

In addition to site preparation, various land management activities have been undertaken and are ongoing, both to assist seedling survival and forest establishment, and to generally improve the environmental quality of the project areas. For example, sheep grazing has been employed to assist natural rodent predation and therefore reduce seedling damage and mortality due to rodents by removing grass cover. Grazing also serves to reduce grass competition to the seedlings. Fencing of some project area boundaries (alongside public roads) has been undertaken to protect newly planted seedlings, and rehabilitation of riparian areas (creek crossings/culverts) has been undertaken and will continue to be practiced.

## Carbon Baseline Sampling and Monitoring

Baseline carbon sampling has been systematically undertaken, and permanent sample plots have been established across the project sites. This enables measurement of exactly how much carbon exists (both above and below ground) before the project starts, and therefore the increase in carbon over the life of the project can be determined. Permanent sample plots are established prior to any silvicultural activity commencing to allow the actual amount of carbon sequestered by the project to be monitored over time.

The carbon sampling work is being performed in line with NFI (National Forestry Inventory) standards, and each plot takes about 4 man-days to complete. The soil and vegetation samples taken are sent to an independent laboratory for analysis and the results are inserted into the project's carbon model along with site index information. The project is using the operational-scale Carbon Budget Model of the Canadian Forest Sector (CBM-CFS3) to forecast how much carbon will be sequestered across each location as the new forests grow to maturity.

Trees for Change meets relevant guidelines for measuring and accounting for GHG emissions based on their carbon dioxide equivalent ($CO_2e$) as applied to carbon offsetting and land/forestry management practices. Reckitt Benckiser's annual GHG emission reports conform with the Greenhouse Gas Protocol of the World Resources Institute and the World Business Council for Sustainable Development. The company is a long-term participant in the Carbon Disclosure Project and publicly reports on its GHG emissions every year in its annual sustainability reports.

## Pilot Planting - April 2006

In April 2006, 45,000 native species trees were planted across 28 ha in the projects' pilot planting area. The seedlings, a mixture of interior Douglas-fir, white spruce, and lodgepole pine, were grown by BC seedling nurseries for approximately 8 months from local wild seed sources, then placed in cold storage so that they would be ready for planting in the spring. This pilot planting enabled the testing of different aspects of the project, such as the baseline carbon monitoring and mechanical site preparation. What was learnt from this initial pilot has helped to better prepare for and carry out the main project planting, which started in 2007.

## Main Planting

In April and May 2007, almost 700,000 trees were planted across approximately 426 ha, comprising a mixture of the same stock types as used in the pilot planting. All this stock was grown in BC seedling nurseries from local wild seed sources as well as some improved seed from seed orchards.

This spring more than 1.3 million trees of the same stock types are being planted across approximately 970 ha.

A natural regeneration component exists on the project sites, which is estimated to comprise approximately 120,000 seedlings, the growth of which would likely not have been allowed to continue under the previous land management regime.

## Project Locations

The project is being run on historically deforested land across about 20 individual sites, ranging from about 30-400 ha in size. The sites are broadly located in two areas, in the general vicinity of Prince George in central BC and near Fort St. John in northern BC.

## Other Programs of Interest

Trees for Change is just one part of Reckitt Benckiser's much larger climate change strategy. Other elements include:

• The achievement of a 22% reduction per unit of production (15% in absolute terms) in greenhouse gas emissions from the company's global manufacturing facilities energy use, between 2000 and 2006 (reaching the company's 2010 target of a 20% per unit reduction four years early).

• Carbon 20, a newly announced target to achieve a 20% reduction in the company's products' total carbon footprint from "cradle-to-grave" across their complete lifecycle, per unit of production, by 2020 versus a 2007 baseline (www.carbon20.info).

• Encouraging consumers to reduce their own greenhouse gas emissions when using the company's products, through initiatives such as the European detergent industries' Save Energy and Water Project (www.saveenergyandwater.com).

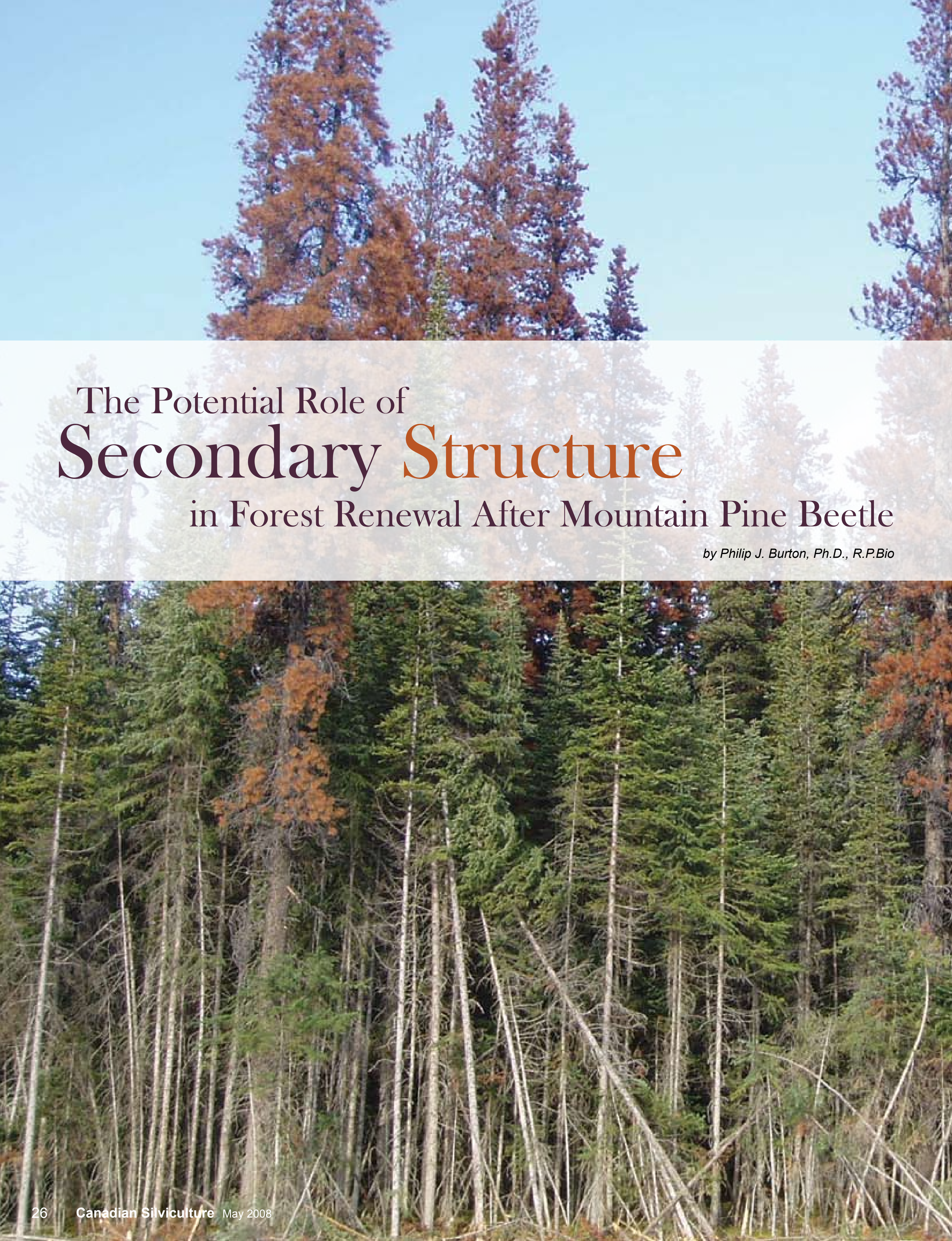
• Optimizing the way products are transported (from factories to distribution centres and from distribution centres to trade customers) to reduce the greenhouse gas emissions that come from the product distribution.

• Reducing energy use and installing highly efficient conventional energy systems (Combined Heat and Power - CHP), and renewable energy systems such as solar electric and solar hot water arrays, across the company's global factories and offices.

• Membership in the Corporate Leaders Group on Climate Change, an initiative of the University of Cambridge Program for Industry and the Prince of Wales Business and Environment Program (www.cpi.cam.ac.uk/programmes/energy_and_climate_change/clgcc.aspx).

Latest information on Trees for Change can be found on the project website (www.treesforchange.com).

Edward Butt is Vice President, Sustainability at Reckitt Benckiser Group plc; Bob Baker is a BC Registered Professional Forester (RPF) and a member of the Trees for Change project team in BC. All inquiries regarding Trees for Change should be sent to sustainability@reckittbenckiser.com



# The Potential Role of Secondary Structure in Forest Renewal After Mountain Pine Beetle

*by Philip J. Burton, Ph.D., R.P.Bio*

The term “secondary structure” has been coined recently to refer to all trees in pine-dominated stands that will be left alive in the wake of the mountain pine beetle (MPB) outbreak that has been racing across BC and into Alberta. Although specific to pure stands or forest cover types dominated by a single tree species that finds itself susceptible to a particular pest or disease, the concept is simply an extension of the term “residual structure”, which refers to the remaining woody material (live or dead, upright or downed) after forest disturbances such as fire or logging.

Secondary structure has two main components: (1) mature or canopy trees (Figure 1); and (2) understory trees, including seedlings, saplings and poles (Figure 2). Canopy trees that survive the insect outbreak are typically of non-host species (spruce, Douglas-fir, or broadleaf trees in the case of MPB), but also include the odd individual of the preferred host species that has exceptional genes, ideal microsite conditions, or unexplained luck. The abundance of mature trees likely to survive the MPB outbreak can be estimated from forest cover maps and air photos. Understory trees, on the other hand, are largely ignored in our forest inventories. This means that the abundance of seedlings, saplings and poles in most pine-dominated stands is unknown. Some of those understory trees consist of lodgepole pine individuals (especially on dry and open sites) too small to be attacked by MPB, but most of them consist of more shade tolerant fir and spruce species. Research is underway at the University of Northern BC and elsewhere to estimate understory tree densities from LiDAR and low-altitude aerial photography, and to use statistically-based spatial modelling to predict where we are likely to find full stocking of this unseen cohort of trees.

*Figure 1: Overstory secondary structure: aspen, spruce, and even a few pine trees in the forest canopy will survive the beetle outbreak.*

*Figure 2: Understory secondary structure consists mostly of shade tolerant tree species.*

Forest planners and managers in central BC are now paying attention to secondary structure as a key consideration in planning for the sustainability of timber and non-timber values. The last few years have seen several uplifts in allowable annual cut (AAC) levels in order to facilitate sanitation harvesting (to control beetle populations) or salvage harvesting (to capture economic value before the beetle-killed timber deteriorates). A consequence of the beetle outbreak combined with these uplifts will be a drop in the mid-term timber supply as the beetle and the mills consume, in just a few years, the pine we had been planning to harvest over the next several decades. For any given management unit or timber supply area severely affected by MPB, we are expecting to see a decrease in harvest rates and the availability of mature forest habitat starting 5 to 15 years from now, and lasting for up to 70 years. This gap in the mid-term timber supply represents the period of time after salvage logging is completed and until second-growth stands (primarily managed plantations) come on-stream. Most planners and managers recognize that the depth of this mid-term timber supply drought can be reduced by careful harvest scheduling. Harvesting priority is given to those stands with the greatest proportions or volumes of mature pine trees (dead, dying, or soon to die anyway). The key is to leave mixed stands and those dominated by non-pine species for logging only after the pure pine and pine-leading stands are harvested.

The benefits of protecting secondary structure dominated by understory trees and advance regeneration are less obvious.  Many of these trees germinated at the same time as the overstory pine, however, the more shade-tolerant spruce and fir have been suppressed by the fast-growing pine for decades. Alternatively, some of these small trees may have established in the last few years as the forest has undergone succession - as canopy gaps have formed, and as seeds have drifted in from a few non-pine seed trees or adjacent stands. There are questions about how well these smaller trees will grow once they are freed from competition with the mature pine. Foresters in BC and elsewhere have often observed browned (sun-scalded) seedlings, toppled thickets of saplings and poles, or arrested growth when such advance regeneration is left after clearcut logging. But the fate of this secondary structure might be different after the MPB outbreak than after clearcutting, because the overstory is dying and opening up gradually, with mortality typically occurring over two or three years, and the loss of needles and fine branches taking another two to five years. As a result, the interior spruce, subalpine fir, and Douglas-fir found in the understory of these beetle-killed stands seem to have time to adjust to an environment that has less inter-tree competition, more light available, and often more soil moisture available. In more westerly portions of the current MPB outbreak, where the pine was killed eight to ten years ago, we are now seeing good leader growth  (Figure 3) and survival on the part of that advance regeneration. Many lodgepole pine forests (e.g. on the Chilcotin Plateau, in the Flathead Valley, and in Colorado) have undergone severe MPB outbreaks in the past, but understory spruce and even small lodgepole pine trees have released and grown to maintain continuous forest cover.

It remains to be seen whether the release of natural regeneration, the normal successional sequence in the life cycle of old lodgepole pine stands, can be repeated under management. Research trials coordinated by FP Innovations–Feric Division have been initiated in the Prince George area, where harvesting operations designed to protect secondary structure are being monitored. Operating costs, harvesting productivity and impacts, and the survival and growth of regeneration are all being measured. Regardless of the efficacy of these “careful harvesting” trials, another concern is the fact that this understory regeneration is often clustered, with dense pockets of seedlings and saplings in some spots, and bare moss or dense shrubs elsewhere in the same pine stand. Over the course of natural stand development, some competitive dominance is usually expressed among the trees that start growing in dense thickets (though they may not exhibit optimal growth), and they eventually sort themselves out and grow into canopy trees. The spots not occupied by trees, however, mean that stocking (the full occupancy of growing space by desired tree species) is often incomplete or unreliable. If timber is harvested from such stands and the release of advance regeneration is counted on for stand renewal, fill planting may be needed to fill those holes, or modified stocking standards and greater regulatory latitude may be needed to allow such heterogeneity (which nevertheless has value to biodiversity).

The greater value of secondary structure, whether found in the canopy or the understory, may be in facilitating the natural, unassisted recovery of beetle-disturbed forests. Even with the AAC uplifts and before the current downturn in lumber markets, it was estimated that about one-third of MPB-affected forest would not be harvested. Despite some non-renewable forest licenses being issued to industries interested in the production of wood pellets and biofuels, it is expected that large areas of dead pine will not be logged and managed under normal silvicultural practices. This is the especially true for unroaded watersheds, areas zoned for high non-timber values, stands with low volumes, and stands in which wood value has already deteriorated. If we are leaving some pine trees unlogged, wouldn’t it make sense to leave those surrounded by live trees, large or small, so that forest cover can continue without management expense? There are

*Figure 3: Released leader growth by a spruce seedling in a stand where most pine trees were killed by MPB.*

plans under the BC Forests for Tomorrow program to rehabilitate (underplant, or knock down and then plant) some dead stands that are not commercially desirable, often at great expense. This may be a sound decision where the advance regeneration is so small or sparse that a new plantation of vigorously growing seedlings will outpace the naturals in a few years. But where the saplings, poles or non-pine canopy trees already have volumes equivalent to a few decades of plantation growth, it would be more prudent to hold such stands in reserve, for they will achieve operability for future harvest sooner than a new plantation. As indicated by a retrospective analysis of the last spruce budworm outbreak in New Brunswick, strategic harvest scheduling and deferrals can significantly offset losses to the timber supply.

A final consideration in looking at secondary structure in the lodgepole pine forests of BC is the pervasive background of climate change. The MPB outbreak itself is partially due to milder winters and subsequent reductions in overwinter mortality on the part of beetle larvae. At the same time, there are rising concerns about the potential effects of warmer and moister summers on the incidence of fungal diseases (needle blight, stem rusts) in second-growth stands and plantations of lodgepole pine. In many ways, large parts of BC now occupied by mature lodgepole pine (perhaps an historical anomaly related to fire history) may soon no longer be optimally suited for growth by this tree species. Let's be careful to not just plant all MPB-killed harvest blocks back to pure lodgepole pine, or we may set ourselves up for more widespread tree mortality in the near or distant future. Perhaps it is better to let nature present and filter an array of species to see how forest ecosystems maintain themselves over the next few decades. We don't want to quash those natural experiments. The diversity of tree species and sizes that we call secondary structure are a big part of the raw material that will provide forest continuity into the future.

Phil Burton is Manager of Northern Projects, Pacific Forestry Centre, Canadian Forest Service and Associate Professor (Adjunct), University of Northern British Columbia, in Prince George. Thanks to Dave Coates, Ken Hodges, Al Mitchell, Grant Nishio, and Roger Whitehead for the comments they provided. The recommendations presented here are solely the opinion of the author, and do not represent the policy of the Canadian Forest Service, Natural Resources Canada, or the Government of Canada.

## Editor's Note:

### Haida Gwaii project still on the path to market

In the November issue, *Canadian Silviculture* magazine featured a story on a proposed Haida Gwaii carbon funded forest enhancement project. This obvious opportunity to employ local First Nations people to restore some of Haida Gwaii's degraded lands may have left the reader with the impression the project is already underway. It is underway, but is still on the critical path to market and is not yet operational. As all pioneering projects must do, it has recently defined a section of the path that was not clear in BC for carbon silviculture treatment proposals on Crown lands. Since the Haida Gwaii application for treatment approval was submitted to the government, BC's new climate initiative has added the requirement that all projects on Crown land are approved by the Ministry of Forest and Range local district manager - in this case the district manager of the Haida Gwaii Forest District. Perhaps logically, the government has recognized that silviculture treatments on Crown land, whether they are to improve the carbon sink value or the timber value, or both, have to demonstrate that the forest science and ecosystem dynamics have all been taken into consideration within the Forest & Range Practices Act and other related regulations. This may be the first such approval by the Ministry of Forest and Range and it will open the way for other projects.

# Focus on Safety

by Roger Harris

## Help Silviculture Workers Survive Resource Roads

Few people experience the hazards of bush roads the way silviculture workers do. Fully-loaded, tree-planting vehicles are filled with workers, so the potential consequences from any single crash are significant. Compounding that risk factor is the fact that drivers typically tend to be 20-year-old summer students, used to driving no more than their parent's sub-compact. Suddenly they're operating crew cabs carrying a half dozen people and a canopy filled with a heavy load of trees. It's an alien environment, and on top of that they are using roads that are not maintained to familiar standards. They must deal with logging trucks barreling around corners and other hazards. Crews move from region to region throughout the season, with local practices and conditions changing dramatically.

Of course, it's no surprise that what the province calls resource roads are hazardous for everyone traveling them, not just silviculture workers. The problems are well-documented.

This February, a report on resource road issues in BC was released that went beyond forestry, since our logging roads serve other industries including mining, gas, oil, tourism, and more. These roads may also be the only access to the public highway system for some isolated communities. This study led to 17 recommendations, and following are three of the most important ones:

• Through its Ministry of Forests and Range, the BC government should establish regional road safety management groups to oversee effective problem-solving for specific resource roads.

• The province should also designate resource roads as public highways where they serve as primary or secondary access routes to communities.

• All resource road users must be trained for a driving environment that is much more hazardous than public highways. The Forest Safety Council should take the lead in developing an industrial driver's certification program that includes the full range of commercial vehicles and trailer configurations on resource roads, no matter what their industry. Training should be given to drivers of light vehicles such as pick-up trucks, passenger vans, ATVs, and four-wheel-drive vehicles.

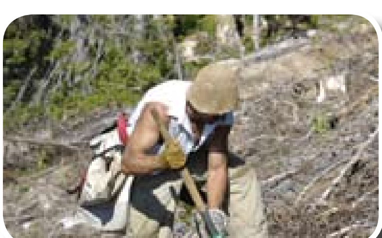
Probably of most interest to the silviculture industry is the third recommendation, which the Western Silvicultural Contractors' Association had anticipated with its ongoing efforts to develop and introduce separate training programs for drivers of ATVs and light vehicles.

Initiatives like those are crucial if employers are to assure the resource road safety of silviculture drivers, their passengers, and the occupants of other back-country vehicles.

The demand for better resource road management can only grow. Prime factors in BC range from inland port development to steadily expanding activity in industries such as mining, oil, and gas. Similar issues are undoubtedly in play across Canada.

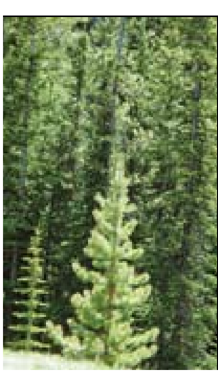
Everyone agrees that action is needed now because time is not our friend. It is a mortal enemy of all the men and women who drive our resource roads every day. For them, this is truly a matter of life or death.

Roger Harris is BC Forest Safety Ombudsman. His first two reports are at www.bcforestsafe.org/nav-ombud.html.



### Addendum: Getting Tree Planting Fit

We would like to acknowledge the contributions that Dr. Delia Roberts made to the Getting Tree Planting Fit article in the February issue of *Canadian Silviculture* as well as the photos supplied by Dave Gluns. We would also like to give credit to FRIAA and FERIC who funded the study, Weyerhaeuser that developed the program, and Selkirk College that continues to provide free delivery of the Fit to Plant program.



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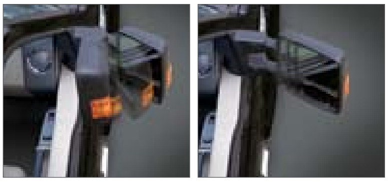

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