Climate Justice Project

Managing BC's Forests for a Cooler Planet

CARBON STORAGE, SUSTAINABLE JOBS AND CONSERVATION

by Ben Parfitt

JANUARY 2010

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Contents

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Ben Parfitt is the resource policy analyst with the Canadian Centre for Policy Alternatives –BC Office. He is a long-time writer on natural resources, co-author with Michael M'Gonigle of *Forestopia: A Practical Guide to the New Forest Economy*, and author of *Forest Follies: Adventures and Misadventures in the Great Canadian Forest*. His most recent CCPA report is *Shortchanged: Tallying the Level of Waste in BC's Logging Industry* (March 2009). The report's findings on rampant wood waste at BC logging operations prompted an investigation by British Columbia's Forest Practices Board.

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Summary

CLIMATE CHANGE HAS HIT BC FORESTS HARD. A billion or more pine trees are now dead in the interior of the province, the result of an insect attack of unprecedented proportions, made worse by warmer than average winter temperatures. Meanwhile, due to unusually dry conditions, forest fires burn with increasing intensity.

As greenhouse gases continue to accumulate in the Earth's atmosphere, there is a pressing need to manage our forests in new ways. Properly done, management techniques that maximize carbon storage both in our forests and forest products can go a considerable way to counteracting greenhouse gas emissions elsewhere in society. Such efforts can also create a stronger, more diversified and more sustainable forest economy.

Climate change also brings the opportunity to create new alliances—as we've done with this study, bringing together environmentalists, loggers, and pulp and paper workers as co-publishers to jointly present a new model for forest management.

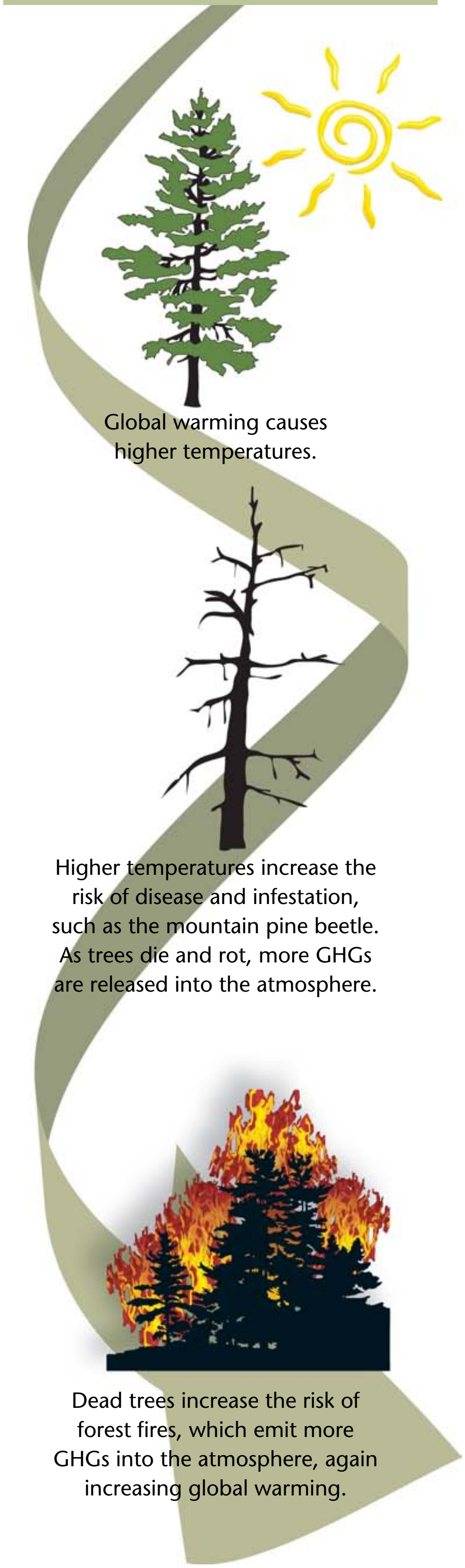
Traditionally, discussions of forest usage have been arguments between two polar opposites: conservation versus human use. We propose instead a model where forest managers choose from an array of options, with the bottom line being vastly improved carbon storage in our forests and forest products.

BC is blessed with an abundance of forests that store tremendous amounts of carbon. The longer these trees live, the more CO_2 they pull out of the atmosphere and store, thus offsetting greenhouse gas (GHG) emissions.

Forest conservation is a powerful and much needed tool as societies struggle to lower overall GHG emissions. In that regard, it's particularly important to conserve more of BC's older coastal temperate rainforests, with their disproportionately large pools of stored carbon, and the rarer and smaller interior temperate rainforests. Conservation is also one of the best ways to give trees a more than fighting chance to adapt in the face of changes in average temperatures and site-specific rises or declines in precipitation.

Properly done, management techniques that maximize carbon storage both in our forests and forest products can go a considerable way to counteracting greenhouse gas emissions elsewhere in society. Such efforts can also create a stronger, more diversified and more sustainable forest economy.

DOWNWARD SPIRAL



At the same time, there is growing awareness that some forests no longer do a very good job of storing carbon. Studies suggest that in much of the interior of the province forests have switched from carbon storehouses to GHG emissions sources. One billion or more pine trees stand or lie dead following the epic beetle attack that began in the 1990s and is only now coming to an end. As the dead trees decay, GHGs will be released back into the atmosphere. Making matters worse, many such forests may be at increased risk of catching fire due to these same warmer and drier conditions and the abundance of beetle-killed trees. Such fires result in uncontrolled, large pulses of GHG emissions into the atmosphere, which then increases the risk of future fires, and so on.

Making matters more complex, logging forests—even dead forests—has implications for our climate. Whenever trees are removed, logging sites become sources of CO_2 emissions for years, due to the release of the stored gas from exposed forest soils.

But this does not provide a compelling reason to stop all logging. Most of us live in houses or apartments that are built, in part, from wood. Wood is also put to many other uses that most of us, most of the time, see as good. And, crucially, every solid piece of wood utilized continues to store the carbon from the tree from which it came. This storage only ceases when renovations or demolition result in the wood going to bioenergy plants, recycling depots or landfills.

This is just one of the many points of tension in an ongoing debate over how best to manage our vitally important forest resources in light of the challenges posed by climate change.

This paper advocates for a broad approach to managing our publicly-owned forest resources. It invites us to re-imagine forestry in BC, not through the traditional (and opposing) lenses of either maximizing human use, or maximizing protected areas, but rather, with a view towards maximizing carbon storage. This approach includes:

- Conserving more forest;
- Increasing the age at which the forests we use for sources of lumber and other wood products are logged;
- Eliminating egregiously high levels of wood waste at logging sites;
- Charting a new way forward for reforesting and rehabilitating forestlands;
- Promoting solid wood products as the first and best use of the wood coming out of our forests, because of their carbon-storing capacity;
- Carefully weighing under what circumstances wood-based energy may make sense from a climate change perspective; and
- Fully accounting for all forest carbon in both forests and forest products.

A carefully coordinated approach to managing BC's public forests ensures that a natural wall of defence against climate change is maintained. Critically, it also ensures that realistic prospects continue for forestry-derived jobs in our province. With public investment in reforestation leading the way, the foundation for a strong forest economy in future years is possible. But that economy rests, more than ever, on a healthy environment. Such will be the case only with a coordinated approach to addressing the tremendous challenges that global warming poses for BC's forests.

THE CARBON FOREST: 10 STEPS FORWARD

Maximizing the carbon stored in BC's forests and forest products requires a coordinated, multifaceted effort. This report lays out a 10-point plan for doing so.

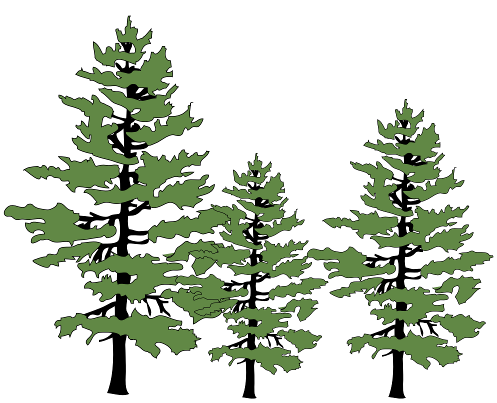
1. CONSERVE MORE FORESTS. In light of the stresses that forests face as a result of climate change, BC should increase the area of old-growth and, in some cases, second-growth forests conserved. Where such increases occur and by how much should be decided by a provincially appointed, independent science panel that reports publicly.

2. DELAY OR REDUCE LOGGING ACTIVITIES IN CERTAIN FORESTS TO INCREASE CARBON STORAGE. BC should pioneer a new system for deciding what forests are logged and when, called the Carbon Cut Calculation or CCC, replacing the existing Annual Allowable Cut (AAC).

3. LET MANY TREES LIVE LONGER BEFORE THEY ARE LOGGED. More time should pass between logging cycles in certain managed forests so that trees are allowed to grow older and store more carbon.

BC should pioneer a new system for deciding what forests are logged and when, called the Carbon Cut Calculation or CCC, replacing the existing Annual Allowable Cut (AAC).

MOVING FORWARD



Conserve more forest, allow trees to live longer before they are logged, and promote carbon plantations.

Limit wood waste and proceed with caution when using waste wood for energy.

Count the carbon stored in wood products. Promote solid wood manufacturing for carbon storage and jobs.

4. ACCOUNT FOR CARBON IN THE "URBAN FOREST." All carbon temporarily stored in forest products should be accounted for in a broad strategy to optimize carbon storage in both forests and wood products.

5. LIMIT WOOD WASTE. A zero tolerance policy on usable wood waste at all logging sites should be mandated.

6. ESTABLISH CARBON PLANTATIONS. Well-managed carbon plantations should be established on a portion of the land base, first for their carbon-storing properties, and second, where appropriate, as supply sources for new bioenergy facilities.

7. PROMOTE WOOD. Wise use of lumber and other solid wood products is the smart choice from a carbon storage perspective, and should be promoted as such.

Bioenergy opportunities do exist and should be pursued. But scale is important, as is linkages with other activities that turn logs into lumber and other solid wood products that store carbon.

8. PROCEED WITH CAUTION WHEN BURNING WOOD FOR ENERGY. Bioenergy opportunities do exist and should be pursued. But scale is important, as is linkages with other activities that turn logs into lumber and other solid wood products that store carbon.

9. COMMIT FULLY TO A TRUE NO NET DEFORESTATION POLICY. With one notable exception, BC should lead by example and have a true no net deforestation policy. The one exception being on the edge of communities where fewer trees may be precisely what is needed to reduce the risk of catastrophic forest fires.

10. ACCOUNT FOR ALL FOREST CARBON DEBITS AND CREDITS. All forest carbon credits bought and sold in a regional market for tradable carbon credits must account for all debits and credits. Only when the carbon stored is in addition to the carbon that would be stored in the course of normal events should a marketable credit be claimed.

PART 1

Introduction

THIS PAPER PROPOSES A NEW WAY FORWARD for BC's forests and forest industry, based on the need to respond to the threats posed by climate change. It looks broadly at five topics:

- Forest conservation and its role in carbon storage;
- Forest products and their role in carbon storage;
- The rapidly emerging interest in wood as a source of "green" bioenergy;
- Tree planting and carbon storage; and
- Embracing a more carbon neutral philosophy in our managed forests or plantations and forest products.

The paper concludes with 10 recommendations that would set BC on a new course in managing its forests, one in which the carbon-storing capacity of natural forests, second-growth forests and plantations, and forest products is more fully embraced.

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THE STARK CHALLENGES POSED BY THE UNFOLDING CLIMATE CRISIS are most evident in BC when one looks at its forests. Although not, necessarily, at first glance. According to the most recent estimate of the province's greenhouse gas emissions, net emissions associated with forest-related land-use changes in 2007 were 3.2 megatonnes. This translated to roughly 4.7 per cent of the province's reported emissions of 67.3 million tonnes.[1]

Such figures are, however, narrowly focused on two land-use changes that must be reported and that count toward the official tabulation of GHG emissions. The first of those changes—*afforestation*—involves lands that have not been forested since the beginning of 1990. (Afforestation is distinct from reforestation, which generally involves the replanting of trees on lands that have only recently been logged.) Such lands subsequently become reclassified as forested through human replanting efforts or natural tree colonization. Lands typically afforested are marginal farmlands. The second of those changes—*deforestation*—involves lands that are converted permanently to other human uses. Such uses may be subdivisions, roads or agriculture. According to the estimates, approximately 6,220 hectares of land was deforested in BC in 2007. While a corresponding figure for afforested land that year was incomplete, in the most recent year reported—2005—the estimate was approximately 2,430 hectares.

With deforested lands continuing to outstrip those that are afforested, the provincial government has committed to a no net deforestation policy as one means of reaching its GHG emissions reduction goals. If met, this would result in close to a 5 per cent reduction in the province's overall emissions.

This is a commendable goal, one that this report supports. However, there are much more significant challenges that confront us when we think beyond the narrow focus of the province's emissions reporting.

About 60 million hectares of BC is considered forested, with much of it consisting of forests managed primarily for timber production. A smaller, but significant chunk of that land is officially conserved or protected as parkland. And another significant chunk is considered forested, but outside of parkland and essentially unavailable to log because of its remoteness or inoperability.

With deforested lands continuing to outstrip those that are afforested, the provincial government has committed to a no net deforestation policy as one means of reaching its GHG emissions reduction goals. If met, this would result in close to a 5 per cent reduction in the province's overall emissions.

In BC as elsewhere in Canada, such forested lands are exempt from current GHG emissions reduction requirements. The primary reason for this is that forest fires, insect attacks and tree diseases can result in huge increases of greenhouse gas emissions that are considered largely beyond our control. Be that as it may, if the overarching goal is to reduce the greenhouse gas emissions that are pushing average global temperatures dangerously high, the emissions from such lands must be addressed.

In 2007, it is estimated that the approximate emissions from these exempted lands were 52.1 million tonnes of CO_2 equivalent. This would add another 77 per cent to the 67.3 million tonnes of GHG emissions officially reported for the province in 2007. The present high forestland emissions are explained by several factors. The first relates to the massive tracts of land in the interior of the province now riddled with dead trees as a result of attacks by mountain pine beetles and other forest pests. The second involves the large areas of forest that have burned in recent years due to warmer than average temperatures and drought-like conditions. And the third major factor is all of the additional logging that has occurred in response to the aforementioned beetles.

The cumulative effect of these and other events is that the forests' ability to store carbon has been outstripped by the release of greenhouse gasses.

For this reason, there is an urgent need to develop new, coordinated responses for addressing the carbon balance in our forests, both at home and abroad. This is essential when viewed against the growing scientific consensus articulated forcefully by BC scientists that we must lower anthropogenic greenhouse gas emissions by as much as 90 per cent by 2050.[2] Failure to do so courts a grave 2 degree Celsius average temperature increase, or, as an increasing number of scientists fear, a catastrophic 4 degree Celsius rise. The 2050 timeline is particularly germane when forests and forest carbon budgets are considered. A hectare of forest not logged today—assuming it remains so—has immediate benefits because of the carbon stored. A forest logged, on the other hand, becomes a new CO_2 source and remains so for many years. In fact, by 2050, many lands logged 40 years earlier would only just be coming into their own as significant carbon storehouses. As we will see, this is not a reason to stop logging or other management activities. Rather, it challenges us to chart a new course. One that maintains—and hopefully builds—carbon stores both in our forests and in our forest products.

The silver lining is that things do change with time. The forests of tomorrow are, in many cases, already rising from the shadows of the dead pine trees that now blanket swaths of the province's interior. With proper care and attention, the stage can be set for a more resilient environment and economy where the carbon balance of our forests and the products we derive from them are in a healthy, near neutral state.

CONSERVATION AND FOREST CARBON

British Columbia's old-growth forests play a crucial role in the storage of carbon.[3] Some of the highest per-hectare forest carbon stores found anywhere in Canadian forests occur in BC. Some scientists maintain that older forests may store only marginally more carbon each year or be close to carbon-neutral in terms of additional carbon stores, while others argue somewhat differently saying that older forests generally "continue to accumulate carbon."[45] Nevertheless, there is general scientific acceptance that the total carbon stored in older forests is what makes them vitally important to overall global carbon budgets.

On average, BC's forests store 311 tonnes of carbon per hectare, while some coastal forests, with their older and larger trees, store between 600 and 1,300 tonnes per hectare. Accumulated over the course of many decades or centuries, the combined carbon stored in BC's forests amounts to 88 times Canada's, and nearly 1,000 times the province's, annual greenhouse gas emissions.[6]

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For these reasons, many scientists believe that dramatic increases in the area of forest conserved is a vital component in any credible strategy to address the threats posed by climate change.

"Conversion of forests to non-forest land use rapidly releases stored carbon as carbon dioxide impacting the atmosphere and climate for centuries," note Sara Wilson, an ecological economist, and Richard Hebda, curator of botany and earth history at the Royal BC Museum.[7] Moreover, the team conclude in a 2008 report, the total carbon stored in such forests is reduced "for at least 250 years."

Aside from the obvious ecological benefits attached to increased forest conservation, Hebda and Wilson argue that with the growth in markets for tradable carbon credits, BC's coastal forests may come to have increasing economic value in future years precisely because of their immense carbon stores.[8]

However, as events in other BC forests attest, dramatic changes are underway that throw into question what conservation actually means in a world where the climate is changing. These change may mean that many forests lose their ability to be significant carbon storehouses.

The most obvious example of this involves BC's most common interior tree species—lodgepole pine, which is currently under attack by mountain pine beetles throughout its range. While global warming is one of the causal factors behind the outbreak, it is not the only one. Equally significant is that over the course of the past century the proportion of older pine trees on the landscape has exploded, due in large part to fire suppression efforts. The mushrooming number of older pine trees sets the stage for the intensity and scale of the beetle attack, with warmer than average winter temperatures then exacerbating the problem. This reinforces the idea that some forests may be far better candidates than others for increased conservation because of how they behave as they age.

That some forests may be far more vulnerable than others to releasing greenhouse gasses in response to forest fires, insect infestations or blights is well understood by forest scientists. This has led some of them to conclude that it is unrealistic to think that large volumes of carbon (C) can be stored for lengthy periods of time in all forest types.

"As stands develop into an old-growth condition they eventually become C-neutral with respect to net atmospheric exchanges. Furthermore, since natural disturbances can never be completely eliminated, accumulated living biomass C stocks are vulnerable to rapid release into the atmosphere," notes Graham Stinson, with the Canadian Forest Service, and Dalhousie University's Bill Freedman.

> *Over much of the Canadian forest estate, therefore, it may not be feasible to establish forest-C reserves for the purposes of sequestering and maintaining C on the landscape. However, in settings such as the coastal temperate rainforests of British Columbia, where natural stand-replacing disturbances are rare, there may be more realistic opportunities to sequester C through the establishment of protected forest-C reserves.*[9]

That certain forest ecosystems may also be prone to unravelling or changing in the face of climate change has prompted an increasing number of scientists to focus on how certain trees will fare in the face of higher temperatures and dramatically altered precipitation patterns.

That certain forest ecosystems may also be prone to unravelling or changing in the face of climate change has prompted an increasing number of scientists to focus on how certain trees will fare in the face of higher temperatures and dramatically altered precipitation patterns. Some tree types will adapt better, and continue to occupy their ecological niches. Others will "migrate"—move south to north or from lower to higher altitudes. And still others will be extirpated, or face localized extinctions.

For these reasons, Sally Aitken, a University of BC forest geneticist, believes that "bigger and more diverse" conservation areas will increase chances for certain tree species to "migrate to new locations that have more favourable habitats." Bigger reserves allow for movement within them, she says, while smaller reserves, with bigger spaces between them, may prevent tree migration and adaptation.[10]

Having said that, Aitken and many forest scientists believe that traditional notions of conservation will be sorely tested as climate change accelerates. Nature is never in a steady state. As temperatures change and local precipitation patterns alter, ecosystems will face new stresses. For that reason, long-term monitoring of conservation areas will be required. "Will mature, well-established forests, be more resilient? Probably," Aitken says. "But monitoring will be critical to determine whether or not that's the case. And if and when unravelling occurs, plans will have to be in place to possibly intervene." This might include planting trees in some forests to assist them in transitioning to a new environment, or employing other tools in the forest manager's kit.

Intervening to assist in the conservation of so-called protected areas or parks has already happened in response to the mountain pine beetle. Following the development of a regional forest management strategy for Banff National Park in 2002, for example, Parks Canada undertook a series of "direct actions" on the eastern flank of the park. These included "intensive monitoring, cutting and removal or burning" of trees recently attacked by beetles to "reduce beetle populations and habitat."[11] It also embraced a program of deliberately set or prescribed fires on the western flank of the park. The burning program was seen as essential because decades of fire suppression had allowed pine trees to live longer. As the number of older pine trees increased, the threat of a catastrophic beetle outbreak rose exponentially.

Conservation will have to be thought of much more broadly in a world in which local climates and landscapes are changing. Hands-on conservation, in other words—not hands-off.

In other cases, deliberately set fires have been used to clear away some trees and expand grasslands in an effort to create a more open, savannah-like habitat more suitable to wildlife species such as mule deer and bighorn sheep. In BC's south Okanagan region, where such prescribed burns occurred in 2003, the biggest problem from a wildlife perspective was too many trees, not too little. Comparisons of aerial photographs taken 60 years apart showed that trees had expanded in number from roughly 70 per hectare to, in some cases, 700.[12]

All of which is to say that conservation will have to be thought of much more broadly in a world in which local climates and landscapes are changing. Hands-on conservation, in other words—not hands-off.

PART 2

Building Green: The Case for Wood

If procured from forests or plantations that are managed sustainably, wood products are among the most desirable of all building materials. Not only are they made from renewable resources that store carbon, but they are durable. That durability means they continue to store carbon for decades if not centuries.

IF PROCURED FROM FORESTS OR PLANTATIONS that are managed sustainably, wood products are among the most desirable of all building materials. Not only are they made from renewable resources that store carbon, but they are durable. That durability means they continue to store carbon for decades if not centuries.

This is not the only climatic advantage of wood products. It takes, for example, 2.9 times more fossil fuel energy to produce the equivalent amount of concrete slabs, 3.1 times more energy to produce the equivalent amount of clay bricks, and 17.3 times more energy to produce the equivalent amount of steel studs as it does softwood lumber.[13] While steel can be recycled, tremendous amounts of energy are required to do so. Such energy far exceeds that expended to grow seedlings and transport them to logging sites, where the seedlings soon offset all of the energy required to produce them by pulling CO_2 out of the atmosphere. Even when the so-called "embodied emissions" in home construction materials are included in such calculations—in other words, all of the GHG emissions generated by producing, transporting, installing, maintaining and disposing of materials typically used to construct houses—wood components typically fare better than vinyl, stucco, brick, aluminum and other products.[14]

When considering the built environment, however, it is important to look beyond just the GHG emissions associated with the production and usage of materials. How are buildings constructed? What types of buildings are they? Where are they built?

While wood products have inherent climatic advantages over other products, great care is required to ensure they are used correctly. New wood-frame buildings or renovations that are not built to last, are over-built, or are energy inefficient are bad from a GHG emissions perspective. In America, the US Green Building Council, which promotes environmentally well-designed and constructed buildings through the LEED certification system, estimates that buildings account for 72 per cent of electricity consumption. They also account for 39 per cent of energy use, 38 per cent of carbon dioxide emissions, 40 per cent of raw material use, 136 million tons of waste output annually, and 14 per cent of potable water consumption.[15] It is important, then, to get it right, when buildings are constructed so as to reduce GHG emissions.

Beyond that, however, are critically important decisions about where buildings are located and the size of their physical footprints.

In BC, research on behalf of the aggregate or gravel industry, for example, points to huge savings in energy and building materials as the move is made from single-family to multiple-family dwellings. On average, 340 tonnes of gravel is required for the average 2,000 square foot single family home. This compares to 200 tonnes, or 40 per cent less, for the average three-storey townhome, and just 50 tonnes, or 85 per cent less, for a unit in a three-or four-storey condominium.[16]

Expanding on this theme, a recent study in the Greater Toronto area compared GHG emissions in high-density versus low-density residential developments. The study considered many things including:

- Construction materials for the respective housing developments;
- Related infrastructure, including roads;
- Ongoing building operations; and
- GHG emissions associated with daily transportation to and from each development.

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It found that low-density suburban developments were more energy and emissions intensive than high-density developments in the urban core by a factor of roughly 2 to 2.5 times.[17]

In BC, the provincial government has effectively twinned the objectives of increased housing density with greener building materials, although somewhat indirectly. In January 2009, it announced it would raise the limit on wood-frame construction from four to six storeys.[18] The announcement was part of a package aimed more broadly at trying to assist the province's beleaguered forest industry with policies to increase wood usage, and did not speak—although it certainly could have—to either the GHG implications of using more wood and less steel in multiple-family housing, or the broader GHG emissions benefits of increased housing density and less urban sprawl.

Also not mentioned is that a move to higher-density housing has important social dimensions. Smaller housing units in multiple-family buildings sell for less than single-family homes, thus increasing the pool of more affordable housing. This initiative, plus others aimed at fostering a more diversified provincial forest industry that produces higher-value solid wood products, could dramatically lower GHG emissions through product substitution.

Finally, while wood is demonstrably better for our environment when compared to other building materials, it may all come to naught if the buildings themselves are not built to last. Improperly built housing has been a sad reality of life in coastal BC and in the Greater Vancouver region in particular, home to the so-called "leaky condo crisis." Improper construction methods and, at times, ill-chosen building materials, result in massive "reconstruction" efforts where the exterior walls of buildings are re-sheathed at enormous cost in terms of new materials and energy output. In 2008, total repair costs for improperly built strata title apartments and condominiums alone was estimated at $3 billion to $4 billion.[19] An analysis of the greenhouse gas implications of this reconstruction effort would no doubt generate similarly sobering numbers. And the problem with troubled buildings doesn't end there. A disturbingly large number of new houses in the United States, built in part with BC lumber, have also been constructed improperly and now face similar reconstruction efforts with all of the unnecessary greenhouse gas emissions such efforts imply.[20]

A recommitment to building quality housing that lasts is essential if the true carbon-storing capacity of forest products is to be fully realized.

PART 3

Wood as Energy: Promises and Pitfalls

WHILE USING WOOD INSTEAD OF STEEL OR CONCRETE in construction projects can help to reduce GHG emissions, it is less clear that using wood for energy will deliver net climatic benefits. Burning fossil fuels such as oil, natural gas and coal carries obvious costs both economically and environmentally. Burning wood is frequently touted as an alternative to fossil fuels, because, in theory, the carbon stored in new trees offsets the GHGs emitted when wood is burned.

Burning wood is frequently touted as an alternative to fossil fuels, because, in theory, the carbon stored in new trees offsets the GHGs emitted when wood is burned. This thinking has led to a surge of interest in plant life as a source of "green" renewable energy.

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Influential bodies, including the US Department of Energy, advocate a surge in bioenergy developments—in particular, because of that country's desire to reduce its dependence on Middle East oil supplies. In a 2008 report,[22] the DOE notes the "biofuel feedstock potential" of key countries, including Canada, saying:

> *Canada has one of the world's leading forestry industries. Wood processing industries in several provinces produce residues in sufficient quantities to generate 1.5 billion litres of ethanol per year or more. Considering these and other "realistic" recovery rate estimates for forestry residues identified an additional 22 mmt [million metric tons] of cellulosic feedstock potential…*[23]

Notably absent, however, was a discussion of on-the-ground realities in specific Canadian provinces; for example, BC's epic mountain pine beetle attack and the proliferation of lesser, but no less troubling, insect infestations and blights affecting the province's vast, biologically rich and diverse forests. Such events have assumed critical importance in the BC government's eyes as it wrestles with a host of challenges confronting its forests and forest industry.

PINE BEETLE DRIVES BC'S FOCUS ON WOOD-BASED ENERGY

With pine beetles alone having killed trees across a swath of BC's interior roughly equivalent in size to England, it was perhaps inevitable that the province would seize upon bioenergy as key to revitalizing its forest industry.

In January 2008, this was confirmed in the province's bioenergy strategy.[24] The plan committed BC to self-sufficiency in electricity production, lowering GHG emissions to "zero" through new energy projects, and making the burning of diesel and gasoline somewhat less harmful by increasing the biofuel content in such fuels.[25] It also explicitly linked meeting these objectives to increased usage of dead trees—which would stimulate investment, economic diversification and clean energy.[26]

With pine beetles alone having killed trees across a swath of BC's interior roughly equivalent in size to England, it was perhaps inevitable that the province would seize upon bioenergy as key to revitalizing its forest industry.

The increased focus on dead trees was understandable.

First, if new energy companies could be enticed to use a portion of the dead trees either as raw material for wood pellets (used to heat homes and businesses) or in new wood-fired electrical generating systems, then they, like their counterparts in the forest industry, would be compelled to replant or replace what they logged.

Second, the bioenergy push fit with the province's and BC Hydro's broader plans for increased electrical production from new "green" power sources. This included a specific "Call for Power" by BC Hydro in which the Crown Corporation sought expressions of interest from private power producers interested in utilizing wood or biomass as a new energy source.

Significantly, the first four projects approved following that call did not require companies to log more trees, but rather to use wood waste that already existed at sawmill and pulp and paper facilities or that could be retrieved from wood left behind at logging sites.[27] Also of note, three of the four projects involved existing pulp and paper facilities, participants in an industry that is both a major power user and power generator. In total, BC Hydro said, the four projects combined would generate 579 gigawatt hours of new electricity annually, enough to power more than 52,000 homes.[28]

In March 2009, BC Hydro announced its second Call for Power. The call again focused on wood as an energy source. Only this time, the wood could come from new forest tenures the province made available for the express purpose of converting "wood waste" to power. This made the second call significantly more controversial. It implied that logging might occur directly in support of energy production. This marked a radical departure from the norm, wherein the "fallout" or byproduct from sawmills—wood chips and sawdust—became the feedstock for the pulp and paper industry, wood pellet producers, wood boilers, and the occasional wood-fired electrical generating facility. It raised the alarm of the province's pulp and paper industry, which worried about increased competition for finite wood supplies. Environmental groups also expressed concern. They worried both about the consequences to carbon storage and cycling as a result of a dramatic increase in the logging of dead trees, and what would happen when the readily available supplies of dead trees dwindled. Would bioenergy producers start logging healthy, green forests to meet their needs? Finally, First Nations expressed strong reservations about the call and its potential to further alienate lands and resources to which they laid claim.

BC's "Dead" Pine Forests Not So Dead After All

With one billion or more pine trees in BC killed as a result of the mountain pine beetle, made more ferocious by warmer temperatures, many scientists believe a significant line has been crossed. Forests that once stored carbon are now major sources of greenhouse gas emissions. Nature's carbon bomb, as it were.

Using sophisticated computer models that project what will happen to carbon stocks as trees in pine forests live and die, a group of federal and provincial forest scientists reported in 2008 that the widespread tree mortality caused by an epic mountain pine beetle infestation had turned BC's interior pine forests to a large net carbon source both during and immediately after the insect attack.

The findings, reported in *Nature* magazine, captured headlines across Canada.[a]

But the early results of an ongoing study that measures actual inflows and outflows of CO_2 from forests filled with dead pine trees suggests things may not be near so dire.

At first glance, a forest attacked by pine beetles appears to be a sea of dead trees. And indeed, that is the case, at least for the older, most visible trees. As predicted, the beetle attack that began in the late 1990s and stretched through the first decade of the new millennium killed, on average, four out of every five older pine trees, with the death toll on some sites exceeding nine in 10.

On second glance, many "dead" pine forests turn out to have lots of living trees. They're just smaller and growing beneath the crowns of their dead counterparts.

GOH IROMOTO PHOTOS

But on second glance, many such forests turn out to have lots of living trees. They're just smaller and growing beneath the crowns of their dead counterparts.

In a study led by scientists at the University of British Columbia, two such stands in northern BC have been studied since 2007.[b] Both were found to be net carbon sinks, despite the fact that at one site 80 per cent of the older pine trees were dead while at the other 95 per cent were killed. The study concluded that the large number of living trees and shrubs below the dead trees stored increasing amounts of carbon. Why? In a nutshell, because more light reached the forest floor as the older dead trees lost their needles and branches. This so-called "canopy mortality" boosted the photosynthesis of the remaining healthy trees, allowing them to store more carbon.

By contrast, the same study concluded, areas of adjacent logged forest were still net sources of carbon emissions, in one case 10 years after logging.

[a] Kurz 2008b. [b] Brown et al., in press.

Despite such concerns, the provincial government continued to maintain that a "real opportunity" existed to turn "underutilized" wood into "clean, carbon-neutral electricity,"[29] a view supported by BC Hydro.

A third reason for the province's interest in wood as an energy source was its Climate Action Plan, which committed it to reduce GHG emissions. Wood, because of its renewable properties, was viewed as a natural fit in an integrated GHG emissions reduction strategy.

Finally, the province wanted to link the increased use of wood for energy with the mountain pine beetle attack. Its thinking here was informed in part by a report in the influential science journal, *Nature,* which concluded that BC's pine-dominated interior forests had flipped from being carbon storehouses to CO_2 emitters. This was mostly because the attack was "an order of magnitude larger" than all previously recorded infestations. The widespread scale and severity of the attack meant that the forest's ability to uptake carbon had been reduced, while future GHG emissions would result as the carbon stored in the decaying trees was released.[30]

The article's lead author, Werner Kurz of the Canadian Forest Service, argued that given the extent of the massive beetle attack some usage of a portion of the dead trees for energy purposes made sense, since for an estimated 20 years or so, the province's interior forests would be significant sources of CO_2. However, Kurz and others cautioned that not all such forests should be considered for biomass collection and conversion to energy. In particular, forests with significant numbers of understory trees (healthy trees growing beneath the taller dead trees) should be left to continue growing. This qualifier is important because the results of actual, on-the-ground measurements of carbon storage and CO_2 release in so-called "dead" pine forests reveals that at least some such forests continue to store carbon after the vast majority of older pine trees have been killed (see *BC's "Dead" Pine Forests Not So Dead After All* on page 19).

For wood-fired energy to be considered truly green, the source for such wood would best be dead trees certain to become sources of greenhouse gasses, and the GHGs released as dead wood was converted to energy would have to be offset by a comparable or greater number of carbon-storing trees on the landscape.

WOOD AS A NEW ENERGY SOURCE: WHY THE BURNING ATTRACTION?

There are two principle reasons that wood-fired energy has such cachet in forestry circles these days. The first is as an alternative revenue stream for the forest industry. The second is its so-called green energy characteristics. While CO_2 is released when wood is converted to energy, the carbon eventually stored in new trees potentially "neutralizes" such emissions.

There are other reasons too that wood has cachet as a bioenergy source. First, you can't eat it. Thus, the messy "food versus fuel" debate that swirls around corn-derived ethanol is neatly avoided. Second, forest carbon is already part of the biosphere and can, with care, be renewed. Third, lots of wood is burned today with little if any energy capture, a prime example being the droves of "waste" wood burned at logging sites across BC each year. If some of this energy was captured instead and used for heat or electricity, it could displace the burning of non-renewable fossil fuels.

But in order for such energy to be considered truly green, a number of things would have to happen. First, the source for such wood would best be dead trees that were certain to become sources of greenhouse gasses anyway. Second, the greenhouse gasses released as dead wood was converted to energy would have to be offset by a comparable or greater number of carbon-storing trees on the landscape. And third, there would have to be some demonstrable substitution of non-renewable fossil fuels for wood-derived energy.

WOOD ENERGY AND THE EUROPEAN UNION

How and why wood came to be regarded with such keen interest as a new green energy source has much to do with recent events in the European Union.

In 2005, the European Commission launched a renewable energy plan that called for a doubling of biomass use, so as to blunt the economic pain of volatile oil prices.[31] The EU's Biomass Action Plan was subsequently supported by calls for increased logging by the Union of European foresters.[32]

Such initiatives built on an already significant fuel-switching movement, one where wood pellet use in particular skyrocketed.[33]

And it had implications far beyond the EU, extending all the way to BC. In 2007, Canada's westernmost province produced 900,000 tonnes of wood pellets, most of which went to the EU, where BC has a 16 per cent share of the pellet market.[34] But the international trade was not without its environmental costs, not the least being the fuel and associated GHGs required to move that mass of pellets nearly halfway around the world — a journey of some 15,000 kilometres.[35]

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WOOD ENERGY IN THE BC CONTEXT: THE PRESENT

Wood as an energy or heat source is also well entrenched in BC, most notably in the province's pulp and paper industry. At present, BC's pulp and paper industry is both the largest industrial consumer and producer of electricity. In 2007, its pulp and paper mills purchased 8.3 million megawatt hours of electricity while producing 4.3 million megawatt hours through burning biomass.[36]

BC is also home to one of the largest wood-fired electrical generating facilities in North America. Owned by EPCOR, the 16-year-old facility has historically relied on 2,000 tonnes per day of sawdust and chips from sawmills in Williams Lake. This material is then burned under intense heat to spin electrical turbines.[37] The 66-megawatt facility produces enough electricity to power about 52,800 households. Much of the wood now fed into the facility originates from dead pine trees that would otherwise release greenhouse gasses if left to rot in the forest.[38]

A growing market is also developing in the province for wood as a heat source. This has potentially positive GHG emissions reduction implications as the increased use of wood-fired boilers displaces the use of natural gas. An example of this occurs in the Fraser Valley, where three dozen commercial greenhouse operators have switched largely to wood heat since 2000–2001.[39] At least one of those owners has been cleared to market carbon credits based on switching from a non-renewable to a renewable energy source.[40]

Another example of where wood heat has displaced the need for energy from another source is found in Revelstoke. There, a new 1.5-megawatt wood-fired boiler was installed at a local sawmill. The mill got steam to work with from the new boiler, while the community gained a new source of hot water heat for use in a local school, community and aquatic centre, motels, stores, a church, municipal and other buildings.[41]

New "green" urban developments also employ sophisticated wood-fired gasification technology. This is similar to that used by more advanced pulp and paper mills in the province. In a new high-density housing and commercial development in Victoria known as Dockside Green, wood waste that would otherwise be land-filled and emit potent GHGs such as methane is instead turned into a synthetic gas much like natural gas. The wood-derived fuel will eventually heat buildings housing 2,500 people, and while it will produce GHG emissions in the form of CO_2, its emissions will be lower than the equivalent amount of landfilled wood.[42]

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WOOD ENERGY IN THE BC CONTEXT: THE FUTURE

BC was already well down the path of using wood to generate energy when, in January 2008, it released its Bioenergy Strategy. The strategy:

- Provided $25 million to a new Bioenergy Network that would invest in bioenergy projects and technologies in the province;
- Provided $10 million to promote biodiesel fuel production in BC;
- Mandated a two-part "Bioenergy Call for Power" by BC Hydro (discussed above);
- Called for half or more "renewable fuel requirements" to come from biofuels; and
- Called for 10 community energy projects to be fired by biomass by 2020.[43]

The strategy raised a number of questions. First, can such increases occur, as the province suggests, with "zero" net GHG emissions?[44] Second, can new players be accommodated to compete for limited amounts of wood? Third, what are the implications if we move away from what has been the traditional source of wood for energy purposes—sawmill waste—to mining logging sites of their waste wood and debris, or logging trees with the express purpose of burning them to generate heat or electricity?

The latter question is most significant. Every time a portion of a log is turned into a solid wood product, that product continues to store carbon.[45] Only when that product decays or burns are GHGs emitted. Wood burned for energy has no carbon storage value. However, it can have value if it is shown to displace the burning of non-renewable fossil fuels. Such displacement, however, is only truly valuable if the GHG emissions associated with wood-burning are fully offset, over time, by the carbon stored in new trees.

In addition to the climate benefits of locking up carbon in forest products are the economic plusses associated with moving sawmill waste to nearby plants that turn that waste into other products. If the traditional source of sawdust and wood chips is severed either because of increased competition for resources or because of sawmill closures, companies that rely on others' waste must pay for trucks, mobile wood chippers and work crews to go onto old logging sites to retrieve and process logs, broken branches and other woody debris that have been left behind. The further away such logging sites are, the higher the transportation costs and associated GHG emissions. In 2009, this is precisely what EPCOR and a number of BC's wood pellet producers did when numerous sawmills closed.[46] This raises an important question moving forward.

For obvious reasons, the province's pulp and paper industry, with its historic links to the sawmill sector, hopes to exploit the benefits of this "symbiotic relationship."[47] In a presentation to an international bioenergy conference in Vancouver in June 2008, a task force representing BC's pulp and paper mills noted that BC Hydro had issued a Call for Proposals from independent power producers to supply new power to the grid from biomass sources. As discussed earlier, half a year later, three pulp and paper companies received approval from BC Hydro to supply new power based on their proposals. At the bioenergy conference, the task force noted that the future competitiveness of BC's pulp and paper mills, which have historically not provided large returns on capital invested, essentially depended on increasing energy efficiency and diversifying revenue streams to include selling power to the grid. Given the green light by BC Hydro to do so, the task force estimated that up to $800 million in new investments would soon follow.[48]

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As a model to emulate, the task force noted that a mill in Varo, Sweden produced 15 per cent more wood-derived power than it consumed. By emulating such a model—which some domestic mills, such as one in Kamloops, are well on the way to doing—the task force concluded that BC companies could improve on an already enviable record in terms of cutting their GHG emissions by 62 per cent or 2.5 million tonnes since 1990.[49] This means that the 20 mills in the province account for roughly just 2 per cent of the province's total GHG emissions. However, the task force warned, "if a policy is put in place that causes biomass fuel supplies to be restricted, our sector's carbon footprint could jump from 2% to 10% of BC's entire emissions."

It remains to be seen what increased competition for wood from the bioenergy industry will mean in BC and elsewhere in Canada. Burning wood to spin steam turbines and make electricity is already established, and could potentially expand. But other usages are also being actively explored, including converting wood to fuel. In Quebec, a province that has experienced some of the sharpest declines in Canada's pulp and paper sector, Montreal-based AP Fuels Inc. made business news headlines recently with a proposal to build five large-scale wood-fired biorefineries, each at a cost of $1.2 billion and each capable of producing 630 million litres of biodiesel fuel per year.[50] The project's proponents note that their fuel, when burned, would have 90 per cent fewer CO_2 emissions than conventional diesel fuels. But what was not discussed, in an otherwise quite positive article on the proposed Quebec project, was the number of trees that would be required to produce so much "green" fuel. What would the CO_2 emissions associated with converting all those trees to fuel be? How long would it take a new generation of trees to sequester the carbon stored in the first batch of trees?

There are other things to consider as prospective wood-based bioenergy opportunities are contemplated. First, the energy density of wood is such that it generates roughly the same GHG emissions as coal when burned, and roughly twice that of natural gas. Second, the costs to provide wood-based energy to the grid may not be as price-competitive as hydroelectricity.

Third is the central question of where the wood to feed new bioenergy facilities ought properly to come from and what long-term guarantees, if any, ought to be made to new entrants to the industry. Fourth, there are many who question the practicality and expense of burning wood to make electricity. At far less cost, clean burning technologies are available to burn wood for home and business heating purposes, as is increasingly common in Europe.

The overwhelming amount of forest in BC is publicly owned. Much of it is allocated under long-term, renewable licences that give individual companies exclusive logging rights on specific tracts of land. The pine beetle attack provides a potential one-time opportunity to use a portion of dead trees for purposes other than lumber making. But those dead trees will not last forever as a dedicated source of raw material for bioenergy companies. For that reason, legitimate questions are raised by environmental groups and forest companies over what the future holds as far as new allocations of forest to bioenergy companies are concerned. New bioenergy industry entrants, particularly those proposing to invest large amounts of money in big physical plants like those along the EPCOR line, will want guaranteed supplies of wood over the long-term. But if the province extends such guarantees, that might ultimately mean that when the dead pine wood runs out, the bioenergy industry then switches to utilizing healthy, green, trees. Is this the best use of publicly-owned resources, either from an environmental or economic perspective?

When the dead pine wood runs out, the risk is that the bioenergy industry will then switch to utilizing healthy, green, trees. Is this the best use of publicly-owned resources, either from an environmental or economic perspective?

For the time being, the Ministry of Forests appears to heed those concerns. Aware that the beetle-killed trees it promotes as a raw material source for the bioenergy industry are finite, the ministry is only offering time-limited rights of access to the dead trees. Don Gosnell, manager of the Ministry's Bioenergy Initiatives program, said such licences will likely take the form of non-renewable forest licences or NRFLs.[51] One such licence has already been allocated to a consortium of First Nations, in BC's Shuswap region. Although it was not officially touted as a bioenergy tenure, the licence gave the First Nations access to 200,000 cubic metres of timber per year over 15 years.[52] If logging occurs under the licence, Gosnell said, it will come from the time-limited pool of approximately 3 million cubic metres of additional timber per year that the ministry estimates is available as a result of the mountain pine beetle outbreak. This is the same pool of wood from which allocations would be made should future logging rights be awarded as a result of a new call by BC Hydro for proposals from prospective bioenergy proponents.

In conclusion, there are many unanswered questions concerning the relative merits of bioenergy proposals versus other uses of our forests as energy diversification and climate change initiatives continue to unfold in BC.

PART 4

Tree Planting: Building BC's Forest Carbon Sink

CANADA'S MORE THAN 400 MILLION HECTARES OF FOREST are an enormous carbon sink, absorbing up to 20 times the amount of CO_2 emitted from fossil fuels each year in the country.[53] As areas of that vast forest are logged or burned, however, they switch from being significant storehouses of carbon to sources. Pest attacks or diseases that kill large numbers of trees complicate matters further by increasing the stock of dead trees that release CO_2 and by elevating the risk that such forests may burn.

Forests and tree plantations can and often do naturally regenerate following major disturbances. Tree planting can often assist in such areas becoming "reforested" faster.

Climate change, a principal contributing factor to the massive pine beetle outbreak in BC's interior forests, is widely expected to accelerate such events. This makes it imperative that a coherent course is steered in reforesting or rehabilitating such areas. This will not be easy, and will demand careful forethought. Which native species ought to be planted where, given changing temperatures and precipitation patterns? What native species are most resilient in the face of climate change? Which species provide the most immediate benefits from a carbon-storage perspective?

These and other questions are important because, while forests and tree plantations can and often do naturally regenerate following major disturbances, tree planting can often assist in such areas becoming reforested faster.

In the lead-up to Canada's ratification of the Kyoto Protocol much attention focused on the role that forest management, including tree planting, might play in reducing or stabilizing GHG emissions.[54] Not surprisingly, uncertainties associated with largely uncontrollable events such as forest fires and pest and disease outbreaks led Canada to reject forest management's inclusion in the options at its disposal to meet its Kyoto obligations.[55] In the lead-up to a renewed round of commitments under the protocol, Canada is once again considering whether to include forest management in its toolkit. Once again, some prominent scientists warn against such a move given ongoing worries about natural disturbances such as forest fires.[56]

Meanwhile, other countries such as New Zealand have plans to derive economic benefit from the carbon-storing capacity of their forests and plantations. In August 2006, New Zealand announced its Permanent Forestry Sink Initiative, a plan whereby individual landowners will derive economic value from carbon stored in "new forests."[57] The value will come in the form of carbon credits that qualifying landowners can sell on the international market to buyers who want to "offset" their GHG emissions. Businesses that demonstrate through their actions that they reduce such emissions will qualify to sell credits to companies that fail to sufficiently lower their GHG emissions below a certain threshold.[58]

Such initiatives have not gone unnoticed in BC. Already, private companies in the province have purchased tracts of land and planted trees in large afforestation projects in their own internally-driven efforts to partially or wholly offset their GHG emissions. One such project covers a combined 15 square kilometres of marginal farmland in the Prince George and Fort St. John areas. UK-based multinational Reckitt Benkiser, maker of Lysol household spray, has planted two million fir, lodgepole pine and white spruce seedlings. The company claims the carbon sequestered by the planted trees will offset all of the GHG emissions associated with its production of 8 billion units of cleansers and other products over a two-year period.[59]

Planting trees and later selling their carbon storing capacity in a market for tradable carbon credits is also a cornerstone of the Western Climate Initiative, of which British Columbia is a major player. What form a comprehensive accounting of forest credits will take in such a future market remains a subject of hot debate, as does the linked issue of what constitutes "additionality" where forest carbon credits are concerned.[60] In other words, can it be demonstrated that the planted trees were in addition to trees that would have been planted anyway? Once it is proven that the planted trees truly are additional, companies or individuals claiming credit for planting them will have to ensure they remain on the landscape for a given period of time. If the planted trees die prematurely due to insect attacks or fires, funds will have to be there to plant a new crop of trees to replace those just lost.

BC's First Nations' leadership asserts that in any emerging market for tradable carbon credits First Nations should rightly be the beneficiaries.

As events unfold and a new, potentially large market opens for tradable carbon credits derived from forest conservation, tree planting and other land management activities, questions loom over who, rightly, should be able to claim, market and economically benefit from such credits. BC's First Nations' leadership, for example, asserts that in any emerging market for tradable carbon credits First Nations should rightly be the beneficiaries.[61]

Putting aside who markets and derives benefits from such forest carbon credits, there is no question that substantial tracts of BC forestland may now be at risk of turning from carbon storehouses to carbon sources. The scale of the mountain pine beetle outbreak and a host of other less-reported but nonetheless significant insect outbreaks and tree-killing blights, moreover, means that large tracts of forestland with dead trees will not be reforested by conventional means.

The conventional means by which forests are replanted is that they are first logged. Under provincial laws, when companies cut down trees on public lands they are required to "reforest" such lands. Generally, this involves planting new seedlings to replace the trees. It can also involve waiting to see if logged lands naturally regenerate following logging. But regardless of the method, the logging companies must bring the lands they log back to "free to grow" status, meaning that a new generation of trees is established.

As the pine beetle outbreak attests, however, these are unconventional times. And unconventional times call for unconventional responses.

A most obvious example is in the explosive growth of young forest plantations that have been killed by beetles. These plantations were successfully planted by logging companies, but later prematurely killed by pests.[62] Once seemingly robust, they now sit on public lands as a liability and may be at increased risk of becoming net sources of carbon, not sinks. Furthermore, such plantations pose both short-term fire risks (while the trees retain their needles) and long-term fire risks (after the dead trees topple over, providing fuel loads for ground fires, which can burn the top organic layers of soil, making it more difficult to establish future forests).

Rehabilitating such sites would make sense from a carbon storage perspective, just as would tree-planting activities on other sites. With the pine-beetle attack spread across a land base larger than England, logging companies will be unable to log more than a fraction of the dead trees before they deteriorate to the point where they have little or no commercial value.

Again, on lands that the companies log, the companies bear legal reforestation activities. But on unlogged public lands, it falls to the Crown to make investments. Planting trees on a portion of such lands could, once again, be "additional" to normal tree-planting efforts and result in greater carbon storage or sequestration that might eventually be marketed as credits.[63] Although, even there, legitimate questions arise about whether planting trees on such lands would truly be additional to what might occur naturally over time. A sound choice for investing public dollars in reforestation efforts might be those lands with "mixed forests." In mixed forests attacked by pine beetles and unlikely to be logged before the dead pine trees lose their economic value and/or fall down, the dead pine trees are interspersed with other non-pine species such as spruce. A portion of such forests could be "fill planted" with tree-planting crews planting carbon-storing seedlings amidst the standing dead trees. This would have the effect of speeding up natural processes by putting more trees on the ground and would counteract the effects of greenhouse gasses later released into the atmosphere by the dead pine trees.

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For obvious reasons, moving forward with any escalated tree-planting program requires careful forethought. With tree-killing beetles, other forest pests and blights all displaying anomalous behaviour in response to climate change, the big challenge will be what trees to plant, where, and under what circumstances.

Complicating matters is that climate models predict "wholesale redistribution of trees in the next century" as local and regional temperatures change along with precipitation patterns.[64] (How rapidly and where such turnovers occur will be critical factors in determining what scale of human intervention, if any, makes sense. For example, climate change-related tree mortality in coastal old-growth forests may occur far more slowly than in some interior forests.) Some tree species will likely adapt to changing circumstances while others have a much harder time of it. Careful decisions will need to be made based on verified field observations and educated guesses about what genetic variations of trees are most resilient in the face of a changing climate.[65]

Once such decisions are made, time will be needed to grow a new generation of hardier seedlings based on careful genetic selection, and investments made at nurseries to grow such trees.

PART 5

Embracing Carbon Neutrality in Managed Forests and Forest Products

CONSERVING FORESTS ENSURES THAT LIVING TREES photosynthesize and that vast amounts of carbon continue to be locked up in the trunks, branches, needles and leaves of trees as well as in the underlying plants and soils that support them.

As the mountain pine beetle outbreak and a rash of recent and severe forest fires attests, natural events may lead to dramatic reversals whereby forests switch from carbon storehouses to GHG emission sources.

But as the mountain pine beetle outbreak and a rash of recent and severe forest fires attest, natural events may lead to dramatic reversals whereby forests switch from carbon storehouses to GHG emission sources. When insect attacks or forest fires kill trees, CO_2 and other GHGs enter the atmosphere. Global warming increases the likelihood that such events will occur.

There is no such thing as a steady state in nature.

Just as so-called "natural" forests store and release carbon, so too do managed forests or plantations. The bigger and generally older trees in managed forests are, the more carbon they store. However, unlike forests where conservation is the objective, there is greater variation over time in carbon flow from managed forests due to logging and other related activities.

BC is fortunate to have had one of the most sustained on-site monitoring programs ever conducted on "carbon fluxes" in managed forests. In 2006, a team of researchers led by Elyn Humphreys and Andrew Black at the University of British Columbia reported on on-site measurements of carbon flows into and out of a number of previously logged forests on Vancouver Island. By monitoring carbon cycling on lands that were logged quite recently, versus lands that were logged earlier, the researchers showed that the age of managed forests was critical to the carbon balance.[66]

Upon being logged, lands denuded of trees are significant CO_2 sources, as the carbon stored in the exposed soil releases. How much so, surprised even the scientists themselves. The youngest stand of managed forest, dominated by Douglas fir trees, and logged three years previously, released 22 tonnes of CO_2 per hectare annually, making it "the largest carbon source ever measured for a terrestrial ecosystem."[67] Another stand, logged 12 years prior, was also a sizeable source of CO_2 emissions, albeit much less so than the first site. There, the CO_2 emissions averaged 5 tonnes per hectare per annum.[68]

The picture was decidedly different, however, when a nearby tract of forest logged 53 years earlier was examined. On that site, the forest sequestered an average of 9 tonnes of CO_2 per hectare per year.

Such findings assume greater significance with context. Canada's more than 400 million hectares of forest are an enormous carbon sink, capable of absorbing the equivalent of up to 20 times the amount of CO_2 emitted from fossil fuels each year. But every year, "one million hectares of that forest is harvested for timber," while up to 7 million more are killed by fire or insects.[69] "It is critical [then] that we identify how carbon sink/source dynamics change as forest communities regenerate following disturbance," Black and others noted.

If carbon storage is a priority, then the length of time between when forests are logged and logged again must be considered. This conclusion is particularly germane to the very forest ecosystem in which Black and his colleagues did their measurements. Virtually all of southern Vancouver Island's original Douglas fir forests were long ago logged. Second-growth and third-growth fir forests are now the order of the day, with many slated for logging at 40 years of age. On such short rotations, however, it is possible that these sites may be close to perpetual sources of CO_2 emissions. But if rotations are to be extended, what would be an "optimal" rotation? While older managed forests have generally accumulated and stored more carbon than their younger counterparts, lengthening rotation ages and delaying logging has consequences. The number of humans on the planet continues to grow. Until such time as the global population stabilizes and declines, demand for new housing will remain. As previously noted, wood is a desirable building material. It not only requires less energy to produce, but comes from a renewable resource. If a consequence of longer rotations is that builders use more non-wood construction materials, then there may be a net increase in GHG emissions.

While older managed forests have generally accumulated and stored more carbon than their younger counterparts, lengthening rotation ages and delaying logging has consequences.

This does not mean, however, that short rotations must be embraced. For one, changes in house design could lower the amount of materials needed, thus allowing rotations to be extended without worry of builders switching to more GHG-intensive construction materials. For another, there are serious ecological consequences associated with short rotations, principally soil erosion and depletion. Finally, there are economic consequences to such activity. Older and bigger trees have more "mature" wood, which can be turned into a wider and more valuable array of forest products. All of this bears consideration as plans to maximize carbon storage in managed forests are implemented.

So what might an "optimal" rotation age be if carbon storage is the objective? Eric Neilson of the Canadian Forest Service addressed that question in a recent study that applied computer modelling to different logging scenarios over time.

The team concluded that by extending the rotation age from a "business as usual" scenario where trees were cropped every 59 years, to a rotation age of 80 years, an additional three tonnes of carbon were stored per hectare, or nearly 1.3 million tonnes overall.[70] However, this carbon benefit could be maintained only if the overall volume of timber logged did not increase substantially after the rotation age was increased to 80 years. If, for example, the logged volume doubled, the forest's overall carbon pool was decreased by five tonnes per hectare, or roughly 2.1 million tonnes. Modest 10 per cent increases or decreases in logging over the same timeframe, however, resulted in increased carbon storage of 1.6 tonnes per hectare and nearly 2.7 tonnes per hectare respectively. Thus, a longer rotation age of 80 years, combined with reasonable controls over the number of trees subsequently logged, appeared optimal if increased carbon storage was the goal.

What might an "optimal" rotation age be if carbon storage is the objective? By extending the rotation age from a "business as usual" scenario where trees were cropped every 59 years, to a rotation age of 80 years, an additional three tonnes of carbon were stored per hectare, or nearly 1.3 million tonnes overall.

Perhaps the team's most important conclusion was that when the carbon stored in lumber and other products made from logged trees is considered, the carbon storage potential of forests improves dramatically. That's because up to half of the carbon logged and later removed from managed forests ends up in products used in long-lasting applications such as the lumber in wood-frame houses. Such carbon remains locked up until houses are torn down many decades later and the wood (if not salvaged) later burned or left to rot.[71] On the basis of their findings, the scientists concluded that it was likely that a majority of managed forests would be on the positive side of the carbon ledger once the carbon stored in forest products was accounted for.[72]

Such accounting is complex due to the large number of "product pools" that must be considered. But computer models have been developed that account for the carbon stored in various forest products. The models consider the type of wood involved (hardwood is denser than softwood and therefore stores more carbon) and emissions at various stages along the life cycle of such products. Once entering landfills, for example, decomposing forest products may be significant sources of CO_2 as well as methane (CH4), a greenhouse gas 23 times more potent than carbon dioxide.[73]

Currently, when trees are logged in BC and elsewhere the carbon removed from the forest is reported as if it had been immediately released to the atmosphere as CO_2.[74] According to Caren Dymond, who has contributed to Canada's GHG report to the United Nations and who works on climate change and carbon issues for BC's Ministry of Forests, this approach to carbon accounting needs to be rethought.

> *This accounting rule was negotiated in the early 1990s when people thought that new harvested carbon stored in wood products would simply compensate for emissions of CO_2 from landfills and other waste streams. We now know that a significant portion of wood never decays in landfills that are carefully managed such as in Canada. That means the current accounting rules are an overestimate of GHG emissions.*[75]

These rules are the subject of ongoing international negotiations. Even if the outcome of future negotiations is that BC has to report GHG emissions associated with the wood products it exports, Dymond believes they will still be "less than under the current rules."

PART 6

Recommendations: 10 Principles Going Forward

ONLY A COORDINATED, MULTI-PRONGED APPROACH that is flexible in the face of changing circumstances will ensure that maximum benefits to our climate are realized from our forests and forest products. No single action will do the job. As set out in this report, and as BC's Climate Action Team acknowledged in its 2008 report outlining how the province might meet its GHG emissions reduction targets, there is a great deal of complexity in choosing among the various actions that might be taken and in assessing their carbon benefits over time.[76]

The Climate Action Team said reducing forest-related emissions might be achieved by:

- Less slash burning at logging sites;
- Logging less old-growth forest and more second-growth; and
- Logging trees killed by mountain pine beetles or fire and using the wood from such trees to make lumber, other wood products, or energy.

Or, the CAT said, "increased uptake" of carbon in our forests might be achieved by:

- Planting trees on insufficiently stocked lands;
- Increased tree planting following insect attacks and forest fires;
- Tree fertilization; and
- Longer rotations (timeframes) between when trees are logged.

Significantly, the Climate Action Team did not favour one proposed action over another, something this report does as well. However, unlike the CAT report, which called for "further analysis" to determine which steps to follow, this report advocates for launching an action plan immediately.

In the following pages, each proposed action and relevant context is described by way of suggesting how such a coordinated approach might be undertaken.

In considering what follows, it may help to think of a hierarchy of preferred uses as far as our forests and forest products and their respective carbon storage are concerned (see *The Carbon Forest: A Hierarchy of Uses* on pages 32 and 33).

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The Carbon Forest: A Hierarchy of Uses

Given that trees store carbon and that older trees have accumulated vast stores of it, conserving older forests makes sense and should be given priority.

But not all forest types will reliably store carbon for lengthy periods of time. Natural events including forest fires, insect attacks, tree diseases and blights ensure that. So only some forests may be ideally suited for what might be called "old-growth carbon storehouses" and should therefore be given priority for conservation.

Where logging activities occur, lengthening the time between when forests are logged and when they are logged again — the "rotation" — increases carbon storage. Therefore, rotation ages should be extended where possible to maximize such storage.

But there's a caveat. The longer-lived some forests are, the more at risk they become to catastrophic natural events such as fires that result in massive releases of greenhouse gasses.

The most obvious example of this is BC's lodgepole pine forests. Ironically, fire prevention allowed the standing stock of older pine trees to mushroom in number, making them vulnerable to the epic mountain pine beetle outbreak now well underway. This suggests, then, that logging or some other human intervention such as deliberately set fires (prescribed burns) makes sense if natural events capable of sending huge volumes of greenhouse gasses into the atmosphere are to be avoided.

Where logging occurs, carbon storage needs to be considered both in the forest and in the products derived from it. Selective logging, where some trees are logged and others left standing, is possible in many forests, although it must be done carefully to ensure worker safety. The obvious climatic benefit of selective logging, versus clear-cuts where all trees are cut down, is vastly improved carbon storage at the logging site.

When trees are logged and their wood used, the highest and best use is as solid wood products that lock carbon up for decades if not centuries to come.

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Whatever wood is left over following the manufacture of solid wood products then becomes a feedstock for pulp and paper companies, wood pellet producers and other bioenergy users, including companies that gasify wood waste or that use it as a power and a heat source.

To the fullest extent, direct use of forest resources for bioenergy should be avoided in favour of a solid-wood-first strategy. Even then, the type of bioenergy facility built must be considered.

A bioenergy facility that replaces a system that is totally reliant on fossil fuels may be of net benefit to the environment. A facility such as EPCOR's Williams Lake plant that is built simply to burn wood to create electricity may be far less so. For one, it will be a significant new source of greenhouse gas emissions. Second, it may be completely unnecessary if a) conservation or efficiency gains under-cut the need for such electricity or b) other energy sources, such as wind, solar and tidal, can be developed instead.

Where direct use of forest resources for bioenergy is pursued, the large amounts of wood waste at BC logging sites should be given priority use, as much of this material is currently burned in waste piles. The end result: zero energy capture and significant greenhouse gas emissions.

If trees are logged directly in support of bioenergy uses, dead trees that will emit greenhouse gasses anyway should be the only trees so used. Green, carbon-storing trees should be avoided in virtually all cases as a supply source. Consequently, no "evergreen" or renewable forest tenures should be issued to new entrants to the bioenergy industry.

In all cases where forests are cleared or partially cleared of trees, the highest priority must be given to their prompt replanting with species that are reliably predicted to have the best chance to survive in a changing climate and that are capable of storing the most carbon.

Forestlands that are insufficiently stocked with trees following logging, forest fires or insect attacks should be targeted for tree planting and other interventions to ensure they are fully stocked with healthy numbers of carbon-storing trees.

1. CONSERVE MORE FORESTS

In light of the stresses that forests face as a result of climate change, BC should increase the area of old-growth and, in some cases, second-growth forests conserved.

Where such increases occur and by how much should be decided by a provincially appointed, independent science panel that reports publicly.

Conservation of large tracts of forestland is vital to ensure that biological diversity is maintained and that different forest ecosystems have the best chance to adapt to changing climates.

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Older forests also store far more carbon than do younger forests, making them an important natural asset in efforts to lower atmospheric greenhouse gases. Just as old-growth forests are important for the total carbon they store, second-growth forests also present significant opportunities to boost carbon stores: such forests grow vigorously and store maximum amounts of carbon on an annual basis. Given the short, 40-year window we face to dramatically lower greenhouse gas emissions, more second-growth forests ought to be conserved for carbon storage purposes. Or, at the very least, the date at which they are slated for logging should be pushed back (see Recommendation 3). All of this and more ought best be weighed by a scientific panel that considers input from various interests with a stake in forest conservation and forest use, but that at the end of the day makes its recommendations based on the best available science.

In reaching its decision, such a panel will undoubtedly have to think creatively about what conservation means. Natural or protected areas do not guarantee the survival of some or all the species found within them. They assist in doing so, but often require management interventions within them or on their peripheries to ensure desired outcomes.

With climate change stressing some of BC's forest ecosystems, interventions in conserved areas may, from time to time, be necessary. Such interventions may involve selective logging and tree-planting efforts or controlled burns, to name but two.

In cases where new conservation areas are established, carbon credits may be generated as a result of avoided deforestation. The value of such credits may increase dramatically in coming years as more countries support "cap-and-trade" systems. In such systems, carbon emissions are capped. Those who exceed such caps are required to "offset" their emissions by purchasing carbon credits from companies or individuals whose actions result in additional volumes of carbon being stored. In coming years, conserving certain tracts of forest for purposes of generating carbon credits may prove to be among the highest and best economic uses of forest resources, although only time will tell if this is the case. In such cases, First Nations in whose territories such conservation areas are found ought to derive economic benefit on at least a 50-50 cost-shared basis with the province or relevant forest tenure holder.

In coming years, conserving certain tracts of forest for purposes of generating carbon credits may prove to be among the highest and best economic uses of forest resources, although only time will tell if this is the case. In such cases, First Nations in whose territories such conservation areas are found ought to derive economic benefit on at least a 50-50 cost-shared basis with the province or relevant forest tenure holder.

Finally, while more forest conservation will undoubtedly limit where logging occurs, it is important to acknowledge that in many cases significant tracts of provincial forest have been no-go logging zones for quite some time, although they did not appear as such on provincial government "protected areas" maps.

This includes numerous areas on Haida Gwaii, which members of the Haida Nation have declared Haida Protected Areas.[77] The largest of those areas, Duu Guusd, is 148,000 hectares in size, and has, essentially, been off-limits to logging for several years thanks to temporary protections under Part 13 of the Forest Act. Yet, Duu Guusd remained an area that could, theoretically, be logged. Only in April 2008, was it declared a conservancy area by the provincial government.

Another relevant example is on BC's central coast—the so-called Great Bear Rainforest. While much attention has focused on the large conservation areas recently established there, there is a correspondingly large area of land—700,000 hectares in size—where industrial logging activity is severely constrained because a new management regime, Ecosystem Based Management or EBM, is in place. EBM places serious constraints on logging activities because it essentially requires that the existing characteristics and functions of a forest be maintained. This is generally accepted to mean that where logging occurs it is highly selective and results in lots of trees—representative of their age and species diversity—being left behind. In this way, the forest's important natural functions, such as rainfall interception and water moderation, are unimpaired.

If the end result of EBM is that old-growth forests are essentially maintained in significantly large chunks over time in quasi-protected zones, a more flexible definition of conservation is warranted. Under such circumstances, the area of forest officially delineated on maps as "conserved" might not expand. But it would expand where it matters most from a forest carbon perspective: on the ground. And, at essentially no further loss to the forest industry.

2. DELAY OR REDUCE LOGGING ACTIVITIES IN CERTAIN FORESTS TO INCREASE CARBON STORAGE

BC should pioneer a new system for deciding what forests are logged and when, called the Carbon Cut Calculation or CCC.

Many jurisdictions, including BC, use tree growth or timber yields to set how much timber may be logged over time on public lands. In BC, such decisions are known as Allowable Annual Cut (AAC) determinations.

Importantly, AACs often fail to correspond to what may be logged sustainably over time. A present-day example of this is the rapid run-up in AACs in response to the mountain pine beetle. Such increases were approved by the provincial government on the grounds that hundreds of millions of trees were dead, and a one-time opportunity existed to extract economic value from a portion of them before they deteriorated. The increases will inevitably be followed by sharp reductions because a scarcity of older trees looms.

For that reason, such temporary increases have met with criticism. In 2007, for example, the CCPA co-published a report with unions representing BC's forest industry workers and some of the province's prominent environmental organizations. The report flagged concerns with the escalation in logging.[78] A primary concern was that a one-size-fits-all approach to logging had dire economic and ecological consequences. That is because only some of the attacked forests—perhaps one quarter, as identified in studies in north central BC—were truly dominated by dead pine trees.[79] In many cases, older pine trees killed by the beetles were sprinkled among healthy trees such as spruce. In others, large numbers of younger trees grew in the shaded ground below the dead pine trees. Logging such forests in the name of salvaging value from their dead trees was an "insult." It threatened wildlife habitat and ecosystems at a time when the forest was already under stress, and it prematurely wiped out trees that could, with time, be considered for logging.[80]

A Carbon Cut Calculation (CCC) as opposed to an Allowable Annual Cut (AAC) would by its very nature focus more on what types of forest were affected to what degree by natural events such as insect attacks and would attach greater value to delaying the logging of mixed forests or forests with healthy numbers of young trees because of the carbon-storage capacity of the living trees.

This prompted woodworking unions and environmental organizations alike to call for an end to escalated logging of mixed forests in response to the beetle attack.[81]

One might say that a get-it-as-quick-as-you-can approach to salvaging beetle-attacked forests is also an insult from a carbon storage perspective. A Carbon Cut Calculation (CCC) as opposed to an Allowable Annual Cut (AAC) would by its very nature focus more on what types of forest were affected to what degree by natural events such as insect attacks and would attach greater value to delaying the logging of mixed forests or forests with healthy numbers of young trees because of the carbon-storage capacity of the living trees. A new approach to setting logging rates based more on questions of carbon balance would by necessity increase rotation ages (see Recommendation 3).

The likely result of this new approach would, at least initially, be a reduction in logging rates. Such a reduction is, however, coming anyway, as newsprint demand continues to fall in the digital age and as logging rates are scaled back to make up for record-high log harvests over the last decade in response to the pine beetle.

This does not necessarily have to mean additional hardship for resource communities or the province's forest sector. As a leading forest industry analyst correctly foresaw in the lead-up to the beetle-related increases in logging rates, there were significant economic risks to the provincial forest industry should the net effect of the additional logging be a spike in softwood lumber production. The risk was a US housing market oversupplied with BC lumber products, which would trigger a new, and exceedingly costly, cross-border trade dispute over US-bound Canadian softwood lumber.

An over-reliance on producing a limited number of commodities in disproportionate numbers for one market has not served rural BC communities particularly well. And it will serve them even poorer in an environment where there are restrictions on the overall number of trees that may be logged. If, however, such a reduction is viewed as an opportunity to diversify both product lines and markets, then jobs lost in logging and lumber mills can be offset by jobs gained re-cutting boards into higher value products.

3. LET MANY TREES LIVE LONGER BEFORE THEY ARE LOGGED

More time should pass between logging cycles in certain managed forests so that trees are allowed to grow older and store more carbon.

Credible rotations from a carbon-storing perspective must account for all of the emissions associated with logging and post-logging activities, as well as the carbon storing capacity of new forests over time. By increasing the age at which some forests are logged, more carbon will be stored.

As noted above, some of BC's managed forestlands may be close to perpetual greenhouse gas emitters because their trees are logged too early. Currently, some trees in coastal forests are logged on rotations of just 40 to 50 years. While such short rotations may be the exception to the rule in BC, they highlight an important point: What constitutes a reasonable age at which to log managed forests? If 40 years is not ideal in coastal Douglas fir-dominated forests, what might a more appropriate age be? And what might optimal rotations be in other forests dominated by other tree species?

Credible rotations from a carbon-storing perspective must account for all of the emissions associated with logging and post-logging activities, as well as the carbon storing capacity of new forests over time. By increasing the age at which some forests are logged, more carbon will be stored. Elsewhere in Canada, models designed to optimize forest carbon suggest that increasing the rotation age of managed forests by approximately a third ensured that forests were net sinks of carbon.[82]

Computer modelling, backed by actual on-the-ground field measurements of carbon fluctuations, should be the foundation upon which logging rates are set in BC's diverse forest ecosystems and will be critical to the success of the Carbon Cut Calculation (Recommendation 2). This does not mean that rotation ages in *all* managed forests will necessarily increase. In some cases, they may not and with good reason. For example, one significant factor in the current mountain pine beetle outbreak is a preponderance of older pine trees. At some point older trees in certain ecosystems become highly susceptible to pest and disease outbreaks that kill trees and cause significant upswings in greenhouse gas emissions. This is far from unique. Some forest scientists say that beyond 200 years in age, most forests are at increased risk of emitting larger numbers of GHGs in response to forest fires, pest and disease outbreaks.[83] Thus, rotation ages will vary, in some cases increasing in others, perhaps, decreasing, with the overall objective being a more balanced forest carbon budget.

In cases where longer rotations result, there may be a reduction in the timber available to log. But this effect may be counteracted in a significant way by an increase in the overall value of the wood coming out of such forests. Bigger and older trees have more mature wood, capable of being turned into a wider array of solid-wood products—an obvious benefit both from a carbon storage and economic perspective.

Among the most important regulatory powers of the province's Chief Forester is the authority to set rates at which tracts of public forest may be logged. This power assumes critical importance in light of climate change, because of the role that forests play in carbon cycling. Longer rotations and generally lower volumes of timber annually logged may have important ecological benefits. But they will, without question, pose challenges to the province, which historically has collected hundreds of millions of dollars annually in stumpage fees from logging companies based on the volume and value of the trees they log.

For that reason, the province may wish to move to more transparent forms of timber pricing such as regional log markets. Such markets, where logs would be transported for subsequent sale by auction, would stimulate local economic activity while also ensuring that the general public, First Nations and resource communities, in particular, had a higher degree of confidence that the best prices were paid for raw resources. Creating such a network, moreover, might also serve as an inducement to increased milling activity in various communities throughout the province based on their proximity to individual markets, something which is badly needed given the large number of jobs lost in the forest industry over the past few years.

Presently, the UN Framework Convention on Climate Change and the Kyoto Protocol, to which Canada is a signatory, exclude from carbon accounting all carbon stored in forest products. This, many scientists say, makes little sense.

4. ACCOUNT FOR CARBON IN THE "URBAN FOREST"

All carbon temporarily stored in forest products should be accounted for in a broad strategy to optimize carbon storage in both forests and wood products.

Presently, the United Nations Framework Convention on Climate Change (UNFCCC) and the Kyoto Protocol, to which Canada is a signatory, exclude from carbon accounting all carbon stored in forest products. This, many scientists say, makes little sense.[84] A recent report funded by BC's Forest Investment Account notes that up to half "of the carbon harvested *and removed* from the forest is stored in long-lasting structures such as houses [emphasis added]. This carbon is not released back into the atmosphere until, for instance, a house is torn down many decades later and the wood is burned or sent to landfills."[85] Why should this source of carbon storage be treated differently than the carbon temporarily stored in a tree? (see sidebar *Why Not Count Lumber Used in Buildings?*).

A more all-encompassing carbon accounting program is thus needed, one that tracks all the forest carbon stored and released during the life cycle of forests and forest products.

Why Not Count Lumber Used in Buildings?

Imagine, for a moment, that all of your savings sit in one bank account. One day, you pull half of those savings out and put them in another account. The funds in both accounts represent your total accumulated wealth, but only the funds in the first account are counted. In current carbon accounting, the funds sitting in the first account, the forest, are counted but not the funds in the second, our built communities, where massive amounts of lumber in homes and other structures store carbon. Not only is this urban CO_2 storage not counted, but it is deemed to have already been converted to CO_2 and vented to the atmosphere. It is like saying that all of that money of yours sitting in the second account has already been spent. Perversely, in the current context of warmer and generally drier conditions, the carbon stored in trees in some forests may be at far greater risk of burning and emitting GHGs than the wood in buildings in cities with their demonstrated records of fire prevention and control.

5. LIMIT WOOD WASTE

A zero tolerance policy on usable wood waste at all logging sites should be mandated.

Healthy amounts of broken logs and other woody debris left on the ground following logging are essential: they provide nutrients to the soil, moderate water flows and provide habitat for various fungi, plants, insects, birds and animals. Indeed, the presence of woody debris in sufficient volume is critical to the rate at which forests recover following logging. However, in recent years in BC the amount of usable wood left behind at logging sites has been excessive. A recent accounting of all "merchantable" or usable material left behind at BC logging sites found that in a five-year period enough usable wood was abandoned to fill a logging truck convoy that would stretch bumper-to-bumper from Vancouver to Halifax and almost all the way back again.[86] Such waste was in addition to the wood that companies were required to leave behind to fulfil the ecological roles described above.

Rather than hauling this wood into towns where it could have been turned into forest products that locked carbon up for decades to come, this usable material was often pushed into piles and burned, sending massive amounts of CO_2 into the atmosphere. Or, in other cases, it was left to rot, leading to the release of GHGs over time.

A zero waste policy would require companies to bring all usable wood beyond what is needed to replenish forest soils into mill towns or First Nation communities. Logging companies would then have the option to use that material or, failing that, make it available to other parties to bid on.

A zero waste policy would require companies to bring all usable wood beyond what is needed to replenish forest soils into mill towns or First Nation communities. Logging companies would then have the option to use that material or, failing that, make it available to other parties to bid on. There will, undoubtedly, be further costs associated with a zero waste policy, and for that reason the province will have to consider whether lower stumpage or timber-cutting fees are appropriate in some cases, as well as whether log or log waste auctions might result in the desired outcome.

Currently, companies wishing to utilize others' abandoned wood waste must first gain the permission of the logging companies themselves as well as the Ministry of Forests (similar permissions must be secured by homeowners salvaging logging sites for firewood). Once permission is granted, companies salvaging others' waste burn more fossil fuels driving out to logging sites, retrieving and then chipping the wood they want, and then hauling the processed wood back to mill towns for manufacturing into wood pellets or other products, than would be the case were the logging companies, which already had the log processing equipment on site, to do the job.

A zero waste policy would also ensure that when wood is burned following logging its heat and energy is actually put to use rather than wasted, thus displacing the usage of non-renewable fossil fuels.

Finally, a rigorous effort to eliminate egregiously high levels of waste would go a long way to offsetting the effects of the first three recommendations of this report: more conservation, a new approach to determining what is logged when (the Carbon Cut Calculation), and longer rotations. This is particularly significant on BC's coast where the most troublingly high levels of wood waste have been recorded.

6. ESTABLISH CARBON PLANTATIONS

Well-managed carbon plantations should be established on a portion of the land base, first for their carbon-storing properties, and second, where appropriate, as supply sources for new bioenergy facilities.

A common criticism of plantations is that they are "biological deserts."[87] If single-species plantations are replicated across a vast landscape, such criticisms have merit. But at a reasonable scale, dispersed plantations, particularly those where care is taken to diversify what is planted, will be of net environmental benefit.

For example, plantations of willow—a rapid-growing tree that is coppiced, meaning that after it is cut, a new stem emerges from the original root structure, which remains intact—have been found in a number of studies to increase bird life and, in some instances, rare bird life.[88]

Coppiced hardwood plantations of willow or hybrid poplar also have advantages from a carbon-storage perspective, in that hardwoods, with their greater wood density, store on average between 10 and 20 per cent more carbon per unit of wood than do softwoods.[89]

Some hardwoods are also extremely good at taking up nitrogen, meaning that organic fertilizers—for example, treated sewage—can be applied to them with relatively little risk of damage to groundwater. Fertilizer applications, moreover, boost tree growth and boost carbon storage.[90]

In BC, the growth of hardwood plantations has been limited primarily to private forestlands and has usually occurred in the service of producing new sources of cheap fibre for conversion to wood pulp and later high-value papers. There is no reason, however, that hardwood plantations could not be established on a *small* percentage of the land base at strategic locations with carbon storage potential and, perhaps, bioenergy in mind.

Willow crops are capable of being coppiced seven to eight times following the initial planting. Unlike conventional logging, there is far less soil disturbance during coppice harvests and the costs are much lower because the ground does not have to be prepared and replanted following each harvest. And, because of willow's rapid growth, after just three or four years, large volumes of wood can be harvested and used for bioenergy purposes.[91]

Interest in willow and other hardwoods for bioenergy plantations has grown since the energy crisis of 30 years ago, particularly in European countries with a long history of forest management. In Sweden, willow plantations went from zero in the 1970s to 17,000 hectares by the early years of the new millennium. By 2020, it is estimated the country could have 200,000 hectares in production.[92] In upstate New York, after nearly two decades of study, forest researchers have concluded that the "amount of carbon released during the production, harvest, transportation, and conversion of the biomass [from willow plantations] is equal to the amount taken up by the growing crop. The production and conversion of willow biomass can therefore produce electrical energy with no net addition of CO_2 to the atmosphere."[93]

In BC, the growth of hardwood plantations has been limited primarily to private forestlands and has usually occurred in the service of producing new sources of cheap fibre for conversion to wood pulp and later high-value papers. There is no reason, however, that hardwood plantations could not be established on a *small* percentage of the land base at strategic locations with carbon storage potential and, perhaps, bioenergy in mind.

Good candidates for hardwood plantations might be over old landfills where nitrogen fixing is of immense value, along waterways to act as riparian buffers, in pockets of the interior where they could act as buffers in fire-prone ecosystems, on marginal farmlands not presently utilized for forage or crop production, or as replacements for some of the very young pine plantations that have been killed by pine beetles.

The latter possibility may offer the most tantalizing prospects from a carbon storage perspective. Many of BC's young, beetle-killed pine plantations have comparatively little to offer by way of biodiversity. Their dead trees have failed to reach a height and age where a healthy diversity of younger plants and trees grow underneath the pines. The dead pine trees, moreover, are too young and small to attract cavity-nesting birds or other wildlife. Finally, dead plantations of young pine trees may over time become net sources of GHG emissions.

Establishing carbon-storing hardwoods on some of these lands would be of benefit, as would softwood carbon plantations. If care was taken to locate new carbon plantations in proximity to certain isolated communities, moreover, they might serve as cost-effective sources of fibre for new, community-based heating and energy systems.

A focus on promoting the growth of native hardwoods and carefully selected softwoods in mixed forests would also be of immense benefit in BC, in particular in light of science, which indicates that hardwoods may be more resilient in the face of climate change than some of their coniferous cousins.

For obvious reasons, careful attention would need to be paid to ensure that to the fullest extent possible native hardwoods and hybrids were chosen, so as to avoid the potential for problems with introduced species. More broadly, a focus on promoting the growth of native hardwoods and carefully selected softwoods in mixed forests would also be of immense benefit in BC, in particular in light of science, which indicates that hardwoods may be more resilient in the face of climate change than some of their coniferous cousins.[94]

Finally, there is a need to think more broadly about carbon plantations in light of emerging markets for tradable carbon credits. Forestry activities will likely play a significant role in such markets, including the anticipated market for western North America, in which BC will be a participant.

Protocols now under development for forest-based carbon credits in British Columbia have currently identified three qualifying activities.[95] The first is afforestation, or the planting of trees where trees historically did not exist. The second is the use of select tree seeds for planting, based on their demonstrated ability to store carbon (faster tree growth, increased tree size) and higher resistance to insect attacks and diseases. The third is fertilization, which boosts tree growth and therefore the carbon-storing capacity of trees.

The latter two qualifying activities are a natural fit with carbon plantations, provided that carefully controlled usage of select tree seeds is pursued and that fertilizer applications are not overdone and do not adversely effect biological diversity and other important resources such as groundwater and surface water supplies.

7. PROMOTE WOOD

Wise use of lumber and other solid wood products is the smart choice from a carbon storage perspective, and should be promoted as such.

Wood is far less energy intensive than most other typical building materials. Its increased use in place of steel, concrete and other high-energy-intensive materials can play a positive role in lowering GHG emissions.

Wood products also have enormous social and economic benefits, which have historically been most keenly felt in rural resource communities. Without question, the significant collapse in global commodity lumber prices, led by the spectacular downturn in the US housing market, has wreaked havoc in many communities from 2006 onward. Rural resource towns are reeling in the face of sawmill and pulp and paper mill closures. Many face further dislocations as logging rates decline due to the deteriorating quality of just about all of the province's older lodgepole pine trees.

Bioenergy is touted as an emerging and significant opportunity to fill the void. But there are reasons to be concerned that go beyond questions of its implications for the carbon balance, to issues of social and economic justice. People in rural communities count, disproportionately, on natural resources for employment opportunities, with the products they make largely consumed in cities.

Historically, different jobs in the forest industry have been linked. Logs from the forest became the feedstock for lumber mills. Chips and sawdust from the lumber mills became the feedstock for pulp and paper mills and, in more recent years, pellet and power plants.

The three historic cornerstones of BC's forest industry — logging, sawmilling and pulp and paper production — have supported tens of thousands of jobs, most paying well above average wages, with about 1,006 cubic metres of timber cut per year generating one full-time job or its equivalent in the industry (based on employment and logging statistics between 2004 and 2008).[96] While various critics note that this level of employment could be even higher were the industry to shift output to higher-value, finished wood products and building components, the focus on moving wood from one stream to another, with the first stream making solid wood products, ensured that the forest industry was one of the largest employers in the province for decades on end.

A fear from a jobs and community stability perspective is that a focus on using wood solely for bioenergy purposes lowers the employment bar significantly. In this regard, the EPCOR power plant in Williams Lake is worth considering. Every year, the plant, which historically relied on wood waste from local sawmills (mills now closed due to exceedingly low lumber demand), consumed 600,000 tonnes of wood. The full-time jobs at the facility are 30, meaning that for each employee, the equivalent of 28,000 cubic metres of logs must be found, or roughly 28 times that which is needed, on average, to sustain one forest industry job in BC.

A fear from a jobs and community stability perspective is that a focus on using wood solely for bioenergy purposes lowers the employment bar significantly. If logging rates decline, a prudent policy from a climate change as well as jobs perspective would be one where lumber and solid wood forest products are deemed the highest and best use of forest resources, and bioenergy uses given last priority.

It remains to be seen whether the facility can sustain operations during prolonged sawmill closures. But if it can, questions must be asked: Is this the highest and best use of publicly-owned resources? How does this make any sense from a carbon storage perspective?

If logging rates decline, a prudent policy from a climate change as well as jobs perspective would be one where lumber and solid wood forest products are deemed the highest and best use of forest resources, and bioenergy uses given last priority.

The provincial government, as overseer of public forestlands, has the power to ensure that priority is given to solid wood products as the highest and best use of forest resources. Vitally important, it has the ability to make this so by implementing policies that demonstrably improve the prospects for enhanced forest industry employment and renewed hope in resource communities (see *Reinvigorating the Rural Forest Economy: Needed Reforms* pages 42 and 43).

Government controls the awarding of forest tenures. As such, it should carefully consider the long-term ecological and economic consequences associated with turning large tracts of public forestland over to bioenergy proponents.

Reinvigorating the Rural Forest Economy: Needed Reforms

Since the heady days of record forest industry profits in 2004, tens of thousands of jobs in BC sawmills, pulp mills and value-added mills have been lost.

The pain has been most acute in the province's rural communities, many of which disproportionately count on the forest industry to drive their economies.

It is unfair, however, to ascribe all of the pain to a global economy gone sour. The provincial government also shares responsibility.

Since the heady days of record forest industry profits in 2004, tens of thousands of jobs in BC sawmills, pulp mills and value-added mills have been lost. It is unfair, however, to ascribe all of the pain to a global economy gone sour. The provincial government also shares responsibility.

In the past decade, the government has:

- Rescinded clauses in agreements that required logging companies to operate mills in return for access to publicly-owned trees;
- Ended timber auctions that limited bids to companies that added higher value to logs, thus ensuring higher numbers of jobs per unit of wood processed;
- Dropped regulations that limited the number of usable logs left behind at logging operations;
- Endorsed a Canada–US Softwood Lumber Agreement that imposed high taxes on US lumber shipments, but no such taxes on unprocessed logs;
- Deleted tens of thousands of hectares of private forestland from "managed" status, paving the way for subsequent sale for residential development; and
- Approved unsustainable logging increases that harmed rural communities and led to a surge in US-bound two-by-four shipments, which exacerbated trade tensions with BC's biggest trading partner.

Given the generally bleak economic picture in many rural communities, policies must be pursued that bring a renewed sense of economic hope. The good news is that there are several tangible actions the provincial government can take that would restore such hope. These include:

- A zero wood waste policy that requires all usable logs from logging sites to be delivered to mill towns (see Recommendation 5);
- A revised timber-pricing system that replaces a top-down, bureaucratic administered system with transparent log auctions at a network of community or regional log markets;
- Targeted research and development funds and tax write-offs to companies making higher-value, finished wood products such as wood trusses, I-joist beams, window and door frames, which are not subject to export taxes under the Canada–US Softwood Lumber Agreement;
- Sharing a portion of all timber-cutting or stumpage fees with the communities closest to where the logging takes place, or, in the event timber auctions are instituted, a portion of all auction proceeds;

- Taxing all log exports to discourage shipment of unprocessed logs and encourage the maximum amount of local manufacturing;
- Awarding more secure, long-term forest tenures to communities and First Nations so they are able to capture more economic value from the forests surrounding them;
- Requiring the holders of new or transferred long-term forest tenures to manufacture products, which would encourage higher-value forest product manufacturing by targeting the wide range of finished products not subject to the Canada–US Softwood Lumber Agreement; and
- A clear commitment to a "solid wood first" strategy that ensures that a premium is placed on solid wood products before all else. This would both maximize employment opportunities in the forest industry and ensure lower greenhouse gas emissions (see Recommendation 7).

These and other policy changes are vital if communities and workers are to successfully transition to the more diversified, lower-volume, higher-value forest industry that a low carbon future demands.

8. PROCEED WITH CAUTION WHEN BURNING WOOD FOR ENERGY

Bioenergy opportunities do exist and should be pursued. But scale is important, as are linkages with other activities that turn logs into lumber and other solid wood products that store carbon.

Bioenergy is not new. For decades, BC's pulp and paper mills have used large amounts of wood to generate heat and power, thus offsetting the need to use as much natural gas and electricity. The province also has a significant wood pellet industry and one of the world's largest wood-fired electricity plants. In all three cases, the wood used to supply these ventures has routinely been sawmilling waste.

In the midst of the current economic downturn, pellet producers, wood-fired electrical plants, and even the odd pulp mill have been forced to get some or all of their wood by other means because of the closure of many sawmills. This has meant paying contractors to drive trucks, log retrieval and log processing equipment onto old logging sites to haul in and process wood waste. This is far costlier than paying for wood waste from nearby sawmills. The economic downside to paying for the gathering of wood waste is mirrored in higher environmental costs—the added GHG emissions associated with transporting and processing the waste.

As the economy rebounds, demand for lumber will likely increase. However, the supply of BC trees capable of producing lumber will decrease, thanks to interior BC's preponderance of dead and deteriorating pine trees. This means that at least some sawmills will not come back on-line, and that some pulp and paper mills will likely not re-open either. For those pulp and paper mills that remain, the industry association representing them has made clear that it believes the continued economic viability of those mills will depend on their ability to produce more wood-fired electricity.[97] This raises the prospect that pulp and paper mills, pellet plants, and stand-alone wood-fired power plants will compete for a finite amount of

For those pulp and paper mills that remain, the industry association representing them has made clear that it believes the continued economic viability of those mills will depend on their ability to produce more wood-fired electricity.

wood chips and sawdust from a smaller sawmilling sector. Only time will tell whether a smaller sawmill waste stream can meet such demand.

With the traditional supply chain weakened, the government should proceed with extreme caution in awarding new forest tenures specifically for bioenergy purposes out of a concern that supplies could become seriously constrained for existing players in the industry. In particular, it should resist awarding large volumes of timber under renewable licences, which essentially guarantee companies exclusive access to the trees on defined tracts of land over time. That is because so much of the current focus on bioenergy opportunities is around utilizing the one-time resource of dead pine trees, killed by the mountain pine beetle. Again, the province's pulp and paper sector has warned that increased competition for scarce resources could have unintended GHG implications. The sector has dramatically reduced its emissions over the course of the past decade by becoming more efficient in its own power consumption and generation. If the end result of new bioenergy tenures is that the pulp and paper sector cannot get enough wood waste to generate heat and electricity, it will be forced to purchase more power, a move that will reverse its enviable record in reducing GHG emissions, while increasing its costs.

The government should proceed with extreme caution in awarding new forest tenures specifically for bioenergy purposes. Much of the current focus on bioenergy opportunities is around utilizing the one-time resource of dead pine trees, killed by the mountain pine beetle.

Care is also required on another front. In March 2009, a panel appointed by the provincial government and tasked with coming up with recommendations for a stronger, revitalized forest industry in BC, flagged several concerns with regard to provincial relations with First Nations and the sharing of forest resources. The report specifically noted the need to:

- Create more long-term, area-based forest tenures of an economically viable size for First Nations;
- Share forest revenues with individual First Nations in a manner commensurate with the value of timber harvested from their territories; and
- Encourage businesses and First Nations to become full partners in forestry businesses, in particular emerging areas of opportunity including biofuels, bioenergy, carbon and reforestation.[98]

Since bioenergy projects may require the awarding of new forest tenures, the provincial government has a golden opportunity to act on the recommendations of the panel either by making available new bioenergy forest tenures directly to First Nations or by requiring bioenergy proponents to enter into partnerships with First Nations before any such tenures are awarded.

Cautions aside, there are realistic opportunities for bioenergy projects in the province; projects that could provide important economic and environmental benefits to isolated rural communities in particular. Such opportunities would likely focus initially on dead pine trees as a source of fibre and later, perhaps, new plantations of rapidly growing trees capable of sequestering maximum amounts of carbon (see Recommendation 6). If a concerted effort is made to link such plantations to new, community-based, wood-fired heating and power systems, the result could be reliable and relatively carbon-neutral energy sources that displace the burning of non-renewable fossil fuels. Prime candidates for such plantations would be some of the sizeable First Nations communities in BC that are not connected to the main BC Hydro grid, and that currently rely on the burning of large volumes of diesel fuel to fire electrical generators.

In April 2009, one such off-grid community, Atlin, came on line with a new power source. The community's large First Nations population, through its economic development arm, owns the new power facility, a run-of-river hydroelectric facility, which has successfully displaced the burning of 1.2 million litres of diesel fuel per year.

But for other off-grid First Nations communities, such green power sources may not be readily available. For some, surrounding forests might be a desired energy source. Among the potential energy systems for such communities would be those that do not require wood to be burned under extreme heat to produce steam that spins turbines. Low-heat energy systems, such as those employing Organic Rankine Cycle turbines, can produce sizeable amounts of power at relatively low cost. In addition to spinning turbines, the heat from the burned wood can be channelled into community heating systems and/or used to heat greenhouses. If the latter occurs, the GHG benefits associated with growing food locally are obvious.

In short, a cautious bioenergy strategy that focuses on building the self-sufficiency and sustainability of isolated, off-grid communities and that reduces their reliance on imported fossil fuels would have obvious social, economic and environmental benefits. Such benefits might only increase with the advent of a market in tradable carbon credits, particularly if fuel switching (ending diesel burning in favour of bioenergy) qualified for such credits.

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If the foundation for building such energy systems were relatively small, intensively managed plantations of rapidly growing trees, such systems could be truly carbon neutral.

9. COMMIT FULLY TO A TRUE NO NET DEFORESTATION POLICY

With one notable exception, BC should lead by example and have a true no net deforestation policy. The one exception being on the edge of communities where fewer trees may be precisely what is needed to reduce the risk of catastrophic forest fires.

In January 2008, BC Premier Gordon Campbell, speaking before the Conference Board of Canada, said:

> *I think we should be looking at our forests across our country and saying how do we make sure that we know the kind of forests we should be replanting, how can we stop the level of deforestation we've had and move closer and closer to [no] net deforestation across the country.*[99]

The Premier's objective is laudable. But it is not being reflected in serious efforts to quantify exactly how much forest in the province is "not satisfactorily restocked" due to fires, pest and disease outbreaks, or logging. In the absence of a rigorous accounting of these so-called "not satisfactorily restocked" (NSR) lands, there is simply no way to know whether the objective is anywhere close to being met. Furthermore, there is a decided lack of flesh on the bones in the Premier's vision. The daunting challenges posed by climate change demand bold responses, especially when considering natural assets such as forests and the critical role they play in the global carbon balance. Why not, for example, state that urban sprawl, with its dire implications for increased greenhouse gas emissions, be contained and that it be linked expressly to forest conservation? Why not talk about the need for forest reserves, similar to the province's Agricultural Land Reserve, so that we cut out the possibility that forestlands may be permanently converted to other land uses, which would likely be heavy carbon emitters as opposed to carbon storehouses?[100] A good example of this is on southern Vancouver Island, where privately managed forestlands may soon give way to sprawling, low population, rural suburbs that will be linked to Greater Victoria not by rail lines, but roads for cars.

Back, however, to the issue of NSR, because it is crucial to a discussion of a healthy carbon balance in our forests. BC's Ministry of Forests did, until the 2000/2001 fiscal year, publish information on *gross* NSR lands, after which the responsibility for tracking such information shifted to a new, short-lived government ministry, the Ministry of Sustainable Resource Management (MSRM). No such figure on the total extent of NSR was published thereafter, nor was such reporting resurrected after the Forests Ministry reassumed responsibilities following MSRM's demise.

The true reforestation challenge may be far more serious than that presented by the province.

The Ministry of Forests has tracked information on what it calls *net* NSR, the area of forest deemed by surveys to be the most economical to replant. But even here there is a noticeable discrepancy between the rise in net NSR and the rise in the total area of provincial forest attacked by pests. Between the 2001/2002 and 2007/2008 fiscal years, the area of forest attacked by pine beetles and other forest pests rose from 3.91 million hectares to 12.78 million, a more than 300 per cent increase. While it is important to note that much of that increase included tracts of forest where only a small percentage of the standing trees had been killed by beetles, the increase is far greater in magnitude than that reported for net NSR over the same timeframe. That increase was on the order of just 19 per cent, a rise from 633,903 hectares to 725,528 hectares. This strongly suggests that the true reforestation challenge may be far more serious than that presented by the province.

The Premier's comments on the need to replant forests and avoid deforestation, as opposed to planting trees on marginal farmlands (afforestation), are instructive. They suggest the need for a broad, concerted effort to maintain a healthy forested land base. Strictly speaking, NSR lands are still considered forestland. However, they are forests without sufficient numbers of trees. Such lands include those previously logged but in a poor state of recovery, as well as forests burned or attacked by insects or blights. Planting such lands would not, under current global climate change conventions, be "additional" in the true sense of the word. Additional trees in that case are those planted in urban settings or on lands historically denuded of trees, such as farmlands. Nevertheless, there is little doubt that planting the right trees on NSR lands would boost carbon sequestration, assist in forests adapting to new climates, and improve water capture and storage.

While logging companies bear legal responsibility for replanting or reforesting what lands they log, the massive area of public forestland attacked by pests and not logged by the industry is a potential public liability that the provincial government, as overseer of Crown forestlands, logically bears responsibility for rehabilitating. Present plans call for publicly-funded planting of around 20 million seedlings per year on NSR lands. But critics of the planting program and the surveying that supports it say that for the $50 million budgeted to be spent on such efforts, up to 75 million seedlings could be sewn and planted by the province's nursery and tree planting companies.[101]

And this is not the only outstanding public reforestation liability. For several years, companies involved in "small-scale salvage logging" or the logging of small patches of forest, have borne no legal responsibility for reforesting such lands. With the massive amount of additional logging that has occurred in response to the pine beetle, it is conceivable that several hundred thousand hectares may be so affected. Arguably, these lands are the responsibility of the landowner—the province—to rehabilitate. But there is no public accounting of them.

Given a looming reforestation crisis, the CCPA recommended in 2005 that the province spend $118 million per year over an initial five-year period on tree-planting and forest restoration, and that having committed to such funding it seek matching federal support.[102]

While the provincial government has been criticized for a relatively anemic response to the present reforestation challenges, the federal government did come forward in 2006 with a promise to invest $1 billion in pine beetle-related responses in BC. Unfortunately, the commitment fizzled, with only a fifth of the promised funds spent.[103] Moreover, much of the $200 million that was spent went not to reforestation efforts, but to infrastructure investments, including $44 million on Transport Canada's Asia-Pacific Gateway and Corridor initiative, one, ironically, that further increases GHG emissions.[104]

Given the growing stock of NSR lands, there is a pressing need to ramp up public reforestation investments. Once again, the province as owner of Crown forests bears the greatest responsibility for making such investments and should do everything in its power to ensure the federal government lives up to commitments it has made as well.

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From a climate change perspective, reforestation offers a tremendous opportunity to increase the carbon-storing capacity of BC's forests. A carefully thought out, publicly-funded reforestation program beyond the modest one underway could, among others things:

- Target lands of lower value to commercial logging interests for planting in rapidly growing, carbon-sequestering native hardwoods and other species. These lands could become new and permanent carbon plantations.
- Rehabilitate a portion of pine plantations filled with dead young pine trees and potential carbon sources, with new pine and other trees drawn from carefully selected seed stock deemed to be more resistant to insect attacks.
- In-fill plant large areas of mixed forest where dead pine trees are intermingled with healthy trees of other species. Such planting would, by necessity, have to consider the shade tolerance of the trees selected for planting because of where they are planted. It would also make sense to select those species both ideally suited to the sites they were being planted in and that had the highest carbon-storage potential, as some tree species store more carbon than do others.
- Restore riparian forests, which shade and protect water courses.
- Replenish denuded lands in watersheds to restore hydrological regimes and protect against downstream flooding.

Just, however, as there is a crying need to put more trees on the landscape, there is a corresponding need to *reduce* their number in key areas. While it may seem counterintuitive, too much forest poses major problems when it comes to the current climate crisis. For example, consider that decades of successful fire suppression efforts in BC actually set the stage for the massive mountain pine beetle outbreak, which left millions of dead pine trees in its wake—trees that will slowly decay, releasing millions of tonnes of greenhouse gasses into our over-heating atmosphere. Complicating matters further, generally hotter and drier conditions in forests filled with dead, fallen-over pine trees may pave the way for future fires of great intensity. Such fires will be a pronounced threat for a number of reasons. First, they will generate significant greenhouse gasses. Second, they may damage the top layers of precious organic soil that support trees in the first place. Third, they may significantly alter hydrological processes, posing a potential flood threat to downstream communities. Finally, they may damage surface water bodies, including those that supply drinking water to communities.

Just as there is a crying need to put more trees on the landscape, there is a corresponding need to *reduce* their number in key areas. For example, consider that decades of successful fire suppression efforts in BC actually set the stage for the massive mountain pine beetle outbreak, which left millions of dead pine trees that will slowly decay, releasing millions of tonnes of greenhouse gasses.

A no net deforestation policy, then, must make room for fewer trees and less brush in certain forest settings. The most important of those settings are on the periphery of human settlements surrounded by forest. In such areas, which might extend several kilometres out from the edges of towns, cities, and First Nations communities, an aggressive program of thinning trees and brush would reduce the severity of future fires, thus lowering the risk of catastrophic greenhouse gas releases while safeguarding communities. In future months, the Climate Justice Project will have more to say on the social, environmental and economic gains that could be realized through a concerted effort to thin certain forests.

Less truly can be more.

10. ACCOUNT FOR ALL FOREST CARBON DEBITS AND CREDITS

All forest carbon credits bought and sold in a regional market for tradable carbon credits must account for all debits and credits. Only when the carbon stored is in addition to the carbon that would be stored in the course of normal events should a marketable credit be claimed.

British Columbia has signalled its intention to join a regional market where carbon credits will be bought and sold. It has also indicated that certain forest-related activities such as tree fertilization, afforestation and the planting of genetically selected tree stock may result in additional carbon being stored and therefore available to market as credits. Other interests are championing the idea of forest conservation or “avoided deforestation” as potential carbon credit activities.

The challenge with all such proposed activities and the credits derived from them is that they can be undone by subsequent events, for example forest fires or forest insect attacks. Thus accounting for forest carbon credits over time is a challenging proposition. During the life cycle of a natural forest and in particular a managed forest, there is wide variation. When a forest is logged, it is a net source of carbon for many years. As it ages it eventually switches from a carbon source to a carbon sink. In older forests that have been undisturbed for centuries, the total amount of carbon stored is vast. If logged, it will take a corresponding amount of time, perhaps more, to store such quantities of carbon again. In a younger forest, the time lag will be correspondingly shorter.

In advancing a credible carbon accounting program, BC must consider these factors, as well as the uses to which we put forest resources. If we take most or all of the resources from forests and burn them to create electricity or refine them to make biofuels, the immediate release of GHG emissions to the atmosphere is far, far greater than if we take the trees we log and use a good portion of them to make lumber and other solid wood products that continue to store carbon for decades to come. In light of the provincial government's advocacy of using forest resources as sources of new bioenergy projects, it is vital that a total rather than partial carbon accounting framework is developed.

A credible accounting of carbon would track the release of CO_2 and other GHGs from the products derived from forests and would also track how long it took naturally re-seeded or freshly planted trees to recapture what had been emitted. Full carbon accounting would, then, consider both what happens in forests over time and what happens to the forest product stream over time.

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A full accounting of all forest and forest product debits and credits over time would also establish a baseline from which claims of "additional" carbon storage could legitimately be made.

Afforestation, or the planting of trees on non-forested lands, is an obvious case in point of additionality. A land with no trees subsequently has trees.

Where things get complicated is in scenarios involving large tracts of forestland that may, at present, be GHG emissions sources because of a preponderance of dead trees and which will not be logged by the forest industry. If some such lands were in-fill planted such that a new generation of young trees was established in the understory of the dead pine trees, would this represent "additional" carbon storing activity? Similarly, if hardwoods were planted to replace softwoods, and hardwoods store more carbon than softwoods, would the increased carbon stored be in addition to that which would have been stored under normal circumstances?

Such questions need to be answered well before markets for tradable carbon credits are established. Otherwise, they will lack credibility and fail to build public trust.

IN CLOSING, A COORDINATED, MULTI-FACETED APPROACH to forest carbon accounting must be embraced if such an accounting program is to be credible. A commitment to a new form of forest conservation is a critical component to a successful carbon-storing strategy. So too, is reforestation and the choices we make about what we do, and do not do, with the trees we log.

1 BC Ministry of Environment 2009.

2 Canwest News Service 2007. The article cites a report published in the journal *Geophysical Research Letters* by University of Victoria climate scientists led by Andrew Weaver. "Our results suggest that if a 2.0-degree C warming is to be avoided, direct CO_2 capture from the air, together with subsequent sequestration, would eventually have to be introduced in addition to sustained 90 per cent global carbon emissions reductions by 2050." Since then, climatologists have warned that an even more devastating 4.0-degree C rise may be unavoidable without such deep cuts.

3 For a general discussion of forests and their role in moderating climate change, see the US Environmental Protection Agency website www.epa.gov/sequestration/faq.html#top, or the Canadian Forest Service website http://cfs.nrcan.gc.ca/news/473, both of which contain many interesting links.

4 Stinson and Freedman 2001; Freedman et al. 2009.

5 Luyssaert et al. 2008.

6 Wilson and Hebda 2008.

7 Ibid.

8 Ibid.

9 Stinson and Freedman 2001.

10 Aitken 2009.

11 Dalman 2003.

12 Habitat Conservation Trust Fund 2006.

13 Koch 1992; Kunniger 1995.

14 Carnow 2008.

15 U.S. Green Building Council 2009.

16 Levelton 1996.

17 Norman 2006.

18 Campbell 2009.

19 Boei 2008.

20 McQueen 2009.

21 Wisner 2009. By the end of 2009, the State of California mandated that the average gasoline blend in the state would have to be 10 per cent ethanol—up from 5.7 per cent at the beginning of that year.

22 Kline et al. 2008.

23 Ibid.

24 Province of British Columbia 2008.

25 Office of the Premier 2008.

26 Ibid.

27 BC Hydro 2008.

28 Ibid.

29 BC Hydro 2009.

30 Kurz et al. 2008b.

31 European Commission 2005; Sustainable Energy Ireland 2005.

32 Union of European Foresters 2007.

33 Egger and Oehlinger 2009. As of 2008, European countries consumed 6 million tonnes per year of pellets—near triple that of North America—and key countries like Germany and Austria were predicted to increase their consumption by between 25 and 30 per cent in 2009. By 2008, Upper Austria, home to 1.4 million people, drew a third of its primary energy consumption from renewable energy sources and was committed to ensuring that by 2030 all space heating and electricity use in homes came from renewable sources, including biomass. The region boasted 16,000 wood pellet-fired central heating installations in homes and businesses, plus thousands of pellet stoves in low-energy homes.

34 Province of British Columbia 2008.

35 Kotrba 2009.

36 BC Pulp and Paper Task Force 2007.

37 EPCOR 2009.

38 Independent Power Producers Association of British Columbia 2009.

39 Gaye 2009.

40 Woollard 2009. Donovan Woollard is chief operating officer of Offsetters, a carbon offset provider. During a telephone interview, Woollard stressed that the source of wood being burned by the greenhouse operator is central to the decision to allow it to market carbon credits. In this case, the wood comes either from wood waste destined for landfills or from sawmill waste or logging waste sourced from dead, beetle-killed pine trees. No further trees, dead or living, are logged directly in support of providing fuel to heat the greenhouse.

Very importantly, this waste will be a source of GHGs. If the wood is left to rot, methane, a far more potent greenhouse gas than CO_2, will be released. If it is burned at a landfill or at a logging site, it will release CO_2. In neither case will the energy be captured. By burning such wood in a boiler instead, energy is captured and used while negating the need to burn non-renewable fossil fuels. Meanwhile, no new GHGs are added to the atmosphere.

"Preventing new (GHG) emissions from taking place is *the* issue for Offsetters," Woollard said.

On the Offsetters website, more information on the offset program is presented in a short video clip (www.offsetters.ca/themes/offsetters/sunselect.html). The video notes that between 10,000 and 20,000 tonnes of carbon credits may ultimately be generated at the greenhouse facility. The credits will come as a result of fuel switching and the installation of heat trapping screens that close over top of plants during cloudy weather to slow heat loss. The credits will be sold to the Pacific Carbon Trust, a BC Crown Corporation.

41 Revelstoke Community Energy Corporation, undated.

42 Dockside Green 2007.

43 British Columbia 2008.

44 Ibid.

45 The issue of whether wood left behind at logging sites should be automatically considered for use as a source of bioenergy is one that ought to be carefully considered. If much of that wood is deemed capable of being turned into solid wood products that serve to lock carbon up, then such a usage has obvious benefits from a GHG emissions perspective and ought to be promoted. According to logging data filed with the Ministry of Forests by companies logging Crown forest lands, much of the so-called “waste” left at logging sites is “merchantable,” in other words capable of being utilized as a forest product. Not all wood left behind fits this description and, indeed, a growing volume of it may not be merchantable, given the progressive deterioration of beetle-killed pine trees. The challenge is how best to ensure that all usable wood beyond that required to replenish forest soils is brought from logging sites to processing centres following logging.

46 Hunter 2009.

47 Adams 2008.

48 Ibid.

49 Ibid.

50 Yakabuski 2009.

51 Gosnell 2009.

52 British Columbia Ministry of Forests and Range 2009a.

53 Humphreys et al. 2006.

54 Willliams 2007.

55 Kurz et al. 1998.

56 Kurz et al. 2008a.

57 Government of New Zealand 2006.

58 Ibid.

59 Parfitt 2007a.

60 Greig and Bull 2009. To obtain credits, forest managers will be required to demonstrate that the carbon or carbon dioxide equivalents generated from management actions such as tree planting are "in addition to" actions that would have been taken in the normal course of events, in other words had no change in management strategy taken place.

61 Barrett 2007.

62 In a sign of the troubles in store for forests as average temperatures climb, mountain pine beetles and other forest pests may build to such spectacular numbers that they attack trees they otherwise would not. Normally, mountain pine beetles favour attacking trees of 80 years in age and up. In the case of BC's current mountain pine beetle attack, young stands of pine in the 10 to 15-year range are being killed by the beetles.

63 Parfitt 2007b. The provincial government, through its Forests For Tomorrow (FFT) program, currently has a goal of planting somewhere between 17.5 million and 20 million seedlings per year at a cost of approximately $50 million per year. Because this program is already in place, it is unlikely it would be considered "additional" planting and therefore would be ineligible for carbon credits. Critics of the program say that more than three times the number of trees could be planted for the same money. At what point more tree planting might be considered additional to status quo efforts, however, remains to be determined.

64 Aitken et al. 2008.

65 Yanchuk et al. 2007; Wang et al. 2006.

66 Humphreys et al. 2006.

67 Biocap Canada 2006.

68 Humphreys et al 2006.

69 Ibid.

70 Neilson et al. 2008.

71 Greig 2009.

72 Ibid.

73 Neilson et al. 2008. A table listing 21 different forest product pools, their carbon content and "residency" over time following logging is presented in the Neilson report and derived from the work of Apps et al. 1999 and Hennigar et al. 2008.

74 International Panel on Climate Change 1996.

75 Dymond 2009.

76 BC Climate Action Team 2008.

77 Council of the Haida Nation website, *Haida Protected Areas*: www.haidanation.ca/Pages/Programs/Forests/Forest%20Guardians/Land%20Planning/HPA%27s.html

78 Parfitt 2007b.

79 Coates et al. 2006.

80 Burton 2006.

81 Parfitt op. cit.

82 Neilson et al. 2008.

83 Stinson and Freedman 2001.

84 Hennigar et al. 2008.

85 Greig 2009.

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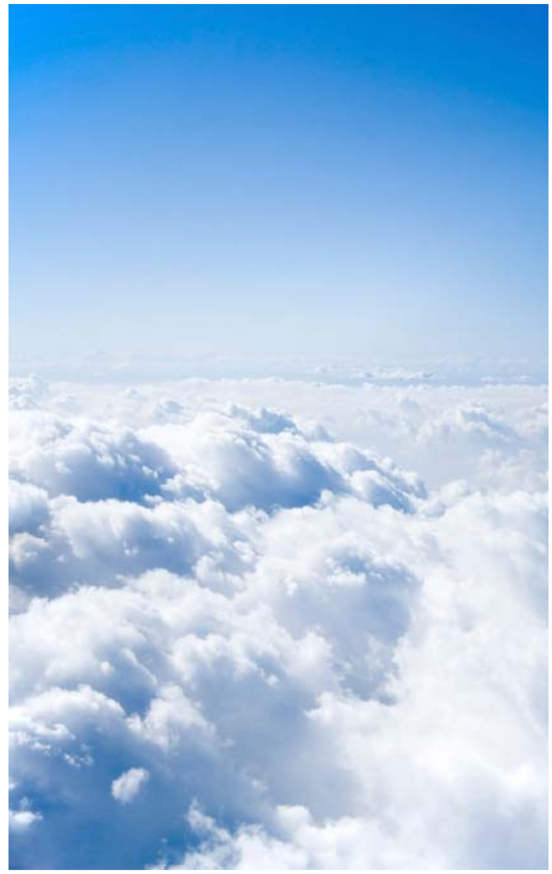
THE CLIMATE JUSTICE PROJECT

The Climate Justice Project is a multi-year initiative led by CCPA and the University of British Columbia in collaboration with a large team of academics and community groups from across BC. The project connects the two great "inconvenient truths" of our time: climate change and rising inequality. Its overarching aim is to develop a concrete policy strategy that would see BC meet its targets for reducing greenhouse gas emissions, while simultaneously ensuring that inequality is reduced, and that societal and industrial transitions are just and equitable.



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The Canadian Centre for Policy Alternatives is an independent, non-partisan research institute concerned with issues of social and economic justice. Founded in 1980, it is one of Canada's leading progressive voices in public policy debates. The CCPA is a registered non-profit charity and depends on the support of its more than 10,000 members across Canada.

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