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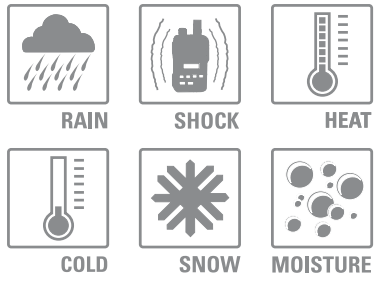

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Publisher Joyce Hayne
Designer Krysta Furioso
Account Manager Johannis Breyten
Editor Dirk Brinkman
Contributing Writers John Betts, Kevin D. Bladon, Jeremy Boyd, Andrew Fedora, Garth Greskiw, Audrey Harvey, Richard Krygier, Ken Mayhew, Steve Mueller, Bill Murphy, Uldris Silins, Alex Woods

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Columns

Editorial

by Dirk Brinkman

Sustainability Breakthrough

In June 1968, three young graduates rolled into Mackenzie, BC's new boom town. The Bennett Dam was under construction and North America's largest reservoir was being cleared and flooded at the same time. Complete rookies got instant jobs in BC's most dangerous profession - falling - no training required or provided. Three months later, WCB shut the whole slashing enterprise down due to the frequency of deaths and gangrene. As a further introduction to boom times, we moved some Beaver Nations people to their 32-acre reserve beside a swamp gifted to them to replace their flooded 200 km long valley.

After 40 years of boom times and down cycles, most of the logs felled, limbed, and topped in the 1960s are still on the bottom of the Williston reservoir, having sunk inexplicably. Mackenzie's sawmills are both shut down and the pulp mill is in receivership despite a good wood supply in the Williston valley. Most of Mackenzie's suddenly unemployed residents have moved to the construction, mining, or oil and gas booms, and some of those who remain seem to be in shock. However, the mayor is full of fire and resolve, despite, and perhaps because, this is a very different kind of down cycle.

The Mackenzie scene is repeated in forest industry-based remote rural communities all across northern Canada. The farther the mills are from market, the greater the cost impact of energy on product transport. Silviculture contractors cannot pass on fuel, food, and other in-season cost increases to forest sector clients whose market situation is as bad or worse. Therefore ways to cut costs emerge and become status quo.

This is the worst forest market since the depression. Emerging will take a more dramatic transformation than we have seen in the past 40 years. North America's "peak oil"in the 1970s was accompanied by a threat of global nuclear war. BC's Mountain Pine Beetle blighted interior reminds everyone that this "peak oil" is accompanied by global climatic disruption. It is not just a threat, it is here and already causing serious and unexpected harm. A timpani of natural disasters and climatic extremes that have no historic precedent may be making the highest oil prices ever acceptable, because price as a mechanism for reducing the use of the atmosphere as a fossil fuel waste dump may help reduce the risk of runaway climatic disruption.

Attempts to grow alternative energy fuel stocks, according to a recent World Bank report, accounted for a 75% increase in global food prices. Continuing on the food crop bioenergy road to solve climate issues will clearly lead to massive starvation and regional conflicts. Northerners and the poorest of the poor are allied in focusing the hunt for bioenergy feedstock on forest waste. Adding bioenergy value to the bottom of the forest profile creates conflicts with existing pulp demand, but this will work itself out, because without a milled and pulp wood demand for the higher value trees, current bioenergy values do not support whole log harvesting and processing, even at today's energy price.

The US subprime housing market collapse dominoing through US and international banks has unpredictable consequences for the global financial world. While northerners can take hope in eventually replacing some of the US market demand in the emerging third world economies, some companies will not survive the time it will take to play out. Companies with cash reserves to ride it out may have more patience than their human resources, because in this strange forest sector down cycle, the mining, construction, and oil and gas sectors are desperate for talented labour. Since much of the old workforce may be missing when forest product demand revives, what gives remote northern forest community leaders hope?

Allen Alley is the advisor to the Governor of Oregon and he put the Western Climate Initiative together. In 1972, when the fledgling Japanese auto industry challenged the megalithic American auto industry with the new concept of quality, Alley recalls sitting around the table as a young engineer in Detroit with Ford executives, arriving at the strategic consensus that the sector could beat them on price, because quality costs too much. Alley is reminded vividly of this strategic error of North America's auto industry when he encounters government and industry resistance to the concepts of sustainability and the need to act now to prevent climatic disruption.

It was out of the utter destruction of the Second World War that Japan's and Germany's modern manufacturing created booming economies built on high quality. They took over the camera, automobile, home entertainment and any other market to which they applied their fierce survival focus. China, India and Brazil have now emerged to become the leading economies of the new century, having overcome a severe poverty challenge.

The Forest Products Association of Canada (FPAC) has been counseling the forest sector to survive because the combined population and per capita growth across the developing world is levitating all resource demand beyond where it has ever been before, and the limited supply of renewable forests will be no exception. The only way 9 billion people can share the well being of health, education, and freedom is to collectively nurture limited renewable resources like food, water, forests, and biodiversity. Canada already has the world's most sustainable forest management practices on which to build. FPAC has committed to the forest sector becoming carbon neutral.

The breakthrough in the forest sector will be sustainability creating the northerner's new economy. "Peak water" and "peak biodiversity" have also passed, and "peak food" prices are here with a vengeance. Can the forest sector break through "peak wood" by pricing in all forest products the climate, water, soil productivity, and biodiversity footprint? Can new forest tenures that integrate the management of carbon, water, biodiversity, and recreation values manage total life cycle forest product footprints? Is the Canadian silviculture industry's path to thriving through a sustainability breakthrough economy for Canada's northerners?

Only the shock of an extreme downcycle will force government, industry, and society into a truly competetive future.

Forest Health

by Alex Woods

Lodgepole Pine, the Folly of the Chosen One?

An intimately mixed young plantation of lodgepole pine and interior spruce, the latter attacked by the foliar disease Rhizosphaera kaukhoffii *(photo by Alex Woods)*

Lodgepole pine is one of the most extensively managed tree species in BC. Its management has been supported by much research, including trials designed to determine optimum planting stock type, spacing, and genetic gain, among many others. One of the most highly regarded provenance trials in the world, the Illingworth trial, has focused on the intensive management of lodgepole pine and the development of optimum deployment strategies for the species in BC. The reasons for this focus are well-founded. The species produces a valuable timber product over a relatively short rotation, in as close to a predictable agricultural model as any softwood tree species in BC. We may have been drawn to lodgepole pine because of this predictability and the desire to manage trees as an agricultural crop to better to fit our forest management models. Unfortunately, those days of predictability are over.

This loss of predictability is not simply due to the unprecedented mountain pine beetle (MPB) epidemic, which is no doubt beyond any entomologist's wildest dreams and woodlands manager's worst nightmares. Other forest health agents, including root collar weevils and fungal pathogens like hard pine rusts and foliar diseases, are also becoming more prevalent and damaging in our once predictably productive plantations of lodgepole pine. Lodgepole pine has co-evolved with a great variety of insect and disease pests and has coped well with them in the past, but the rules of the game are changing. From a pathological perspective, the current epidemic of Dothistroma needle blight in northwest BC epitomizes this apparent shift in the balance between host and pests. Both the host, lodgepole pine, and the pathogen, Dothistroma, have co-existed in the area for centuries, but our management practice of favouring lodgepole pine has helped set the stage for an epidemic. Over the past decade, environmental conditions have favoured the pathogen Dothistroma, leading to the loss of close to 10% of pine plantations in northwest BC, while a cloud of uncertainty hangs over the remaining 90%. Ten years ago, we would not have thought a native foliar disease would be capable of such a feat. Had management practices not focused to such an extent on lodgepole pine, Dothistroma would not have had the opportunity.

Although not as damaging as Dothistroma, other foliar diseases of lodgepole pine including *Lophodermella concolor*, *Elytroderma deformans*, *Phaeoseptoria contortae*, etc. are all becoming more prevalent in many areas of the province. These pathogens won't likely kill their hosts, but they will reduce growth rates, possibly predisposing lodgepole pine trees to other damaging agents. Foliar diseases are predicted to be some of the forest disease organisms most sensitive to the effects of climate change. The increased prevalence of these foliar diseases has coincided with a trend toward increased summer precipitation and increased overnight minimum temperatures in areas of north central BC. Both of these climatic trends are consistent with global climate change predictions, and both favour foliar pathogens.

Hard pine rusts, including comandra, stalactiform and western gall rust, may also be benefiting from the same changes in the weather. In assessments of the incidence of hard pine rust conducted in the 1980s near Burns Lake in central BC, comandra blister rust was uncommon. Today, in the same area, close to one third of lodgepole pine leading plantations have an incidence of comandra blister rust above 20%. Part of that apparent increase is possibly due to plantation management itself, with the creation of patches of trees across the landscape of an age susceptible to comandra blister rust. Some of the increase in incidence is also likely due to more favourable climatic conditions. Fungi in general are favoured by wetter conditions and rusts are no exception. A recently established trial in central BC, designed to test for genetic resistance to comandra blister rust among lodgepole pine families, has experienced incidence rates of close to 60% in two of three sites, four years post establishment. Over that same four-year period, weather stations in the area have experienced two of the wettest summers on record, 2005 and 2007. For example, at Fort St. James where daily weather records date back to 1895, the accumulation of 268.2 mm of rain over the summer of 2005 was over twice the long-term average and was the second wettest on record. The rain and the rusts may be purely coincidental, but an increase in rust incidence occurring in areas exposed to greater summer precipitation would be consistent with fungal biology.

On a recent overview flight west of Babine Lake in central BC, I saw something that has become rare in the province - a healthy, managed landscape dominated by lodgepole pine. There were vibrant green lodgepole pine plantations growing like they should. It was beautiful. I also saw a plantation intimately mixed with lodgepole pine and interior spruce where, instead of the usual situation of lodgepole pine failing due to one pest or another, it was the spruce that was suffering. The spruce trees were afflicted with one of those foliar diseases (*Rhizosphaera kaukhoffii*) that until quite recently was almost unheard of. The combination of those two observations perhaps holds the key. The arrogance in thinking that we pathologists, entomologists, ecologists, geneticists, and silviculturalists can determine the "chosen one" is folly. Management of a diversity of species, including everything currently suited to areas, such as lodgepole pine and some species that in the near future may be suitable, is our best bet given the uncertainty of climate change.

Alex Woods is a Forest Pathologist in the Northern Interior Forest Region, BC Ministry of Forest and Range, based out of Smithers BC. The professional views expressed in this article are those of the author and they are not expressed on behalf of other professionals or his employer.

Linking Silviculture to Watershed Management

by Kevin D. Bladon and Uldis Silins
photos by Uldis Silins

Public perception of the importance of both water quantity and quality originating from forested regions of Canada has steadily increased in the past decades. Water now likely ranks near the top of a list of non-fibre forest values considered important by most Canadians.

Since both natural and human-caused forest disturbances can produce significant effects on a range of water values including water quality, quantity, and timing of stream flows, integrated management of forest watersheds for a range of fibre and non-fibre outputs has also become a more challenging element of the sustainable forest management planning process than has been the case in previous decades.

However, despite the increasing complexity of the planning process, many of the key issues in integrated watershed management are more closely tied to the implementation and success of silvicultural systems than is often appreciated by many forest practitioners.

Watershed impacts

Forest disturbances (e.g. harvesting, wildfire, and pest outbreaks) generally affect hydrology and water quality by reducing evaporative losses from the forest canopy (interception and subsequent re-evaporation of precipitation, and reduction in water loss by canopy transpiration), and by disturbance of water flow paths through the forest floor and soils.

Though the combined effects of canopy and soil disturbance on hydrology of forests differ strongly among climatic regions, small to moderate increases in annual water production (yield) and changes to timing of stream flows (timing of snowmelt runoff, occurrence of peak and low flow events) are among some of the more general hydrologic effects. Soil disturbance is often associated with erosion and sedimentation in streams, and the combined changes to water cycling along with erosion can produce deterioration in water quality, changes in aquatic ecology, or other adverse downstream effects.

At the site scale, the magnitude of hydrologic impacts due to harvesting are influenced by several factors, including the amount of crown removal, forest floor disturbance, and density of linear disturbance features such as skid trails and in-block roads. Generally speaking, the greater the degree of crown removal, the greater the potential for hydrologic impacts. Thus even-aged silvicultural systems (clear cutting, low density shelterwood) produce greater impacts on hydrology due to more intense changes in water cycling compared to variable retention harvest, commercial thinning, or uneven-aged silviculture systems.

Likewise, the degree of forest floor disturbance during harvest operations or afterwards during site preparation is an important factor in potential hydrologic effects. Heavier ground-based logging equipment (feller bunchers, forwarders, and skidders) typically produce greater soil disturbance than their lighter weight (low ground pressure) counterparts. Similarly, wet season harvesting will typically produce more soil disturbance, such as rutting, than dry or winter season harvesting. Soil disturbance during post-harvest site preparation using heavy drag scarification, ripping/plowing, mulching, or even high density mounding can also dramatically increase the extent of soil disturbance. Thus, there can be potential short-term conflicts between silvicultural objectives for site preparation and those aimed at watershed protection.

Impacts at the larger watershed scale largely reflect the cumulative intensity or "footprint" of areas disturbed in the basin. While the percentage of watershed area disturbed is often used as a coarse scale indication of potential impacts on water production, timing, and water quality, numerous factors such as climate, physiography, and age of disturbances contribute to high variation in impacts observed among watersheds. In particular, the cumulative network of linear disturbances created by skid trails, in-block roads, and haul roads are capable of transporting sediment and other contaminants and thus, are important contributing factors governing landscape scale impacts.

However, while some silviculture practices used in site preparation for forest regeneration may appear to be in conflict with landscape goals for watershed protection in the short term, success of silvicultural strategies aimed at targets for regeneration, stocking, and juvenile growth are often closely in line with broader watershed management objectives in the longer term.

Watershed recovery

Watershed recovery with respect to linear features, such as roads, is generally

addressed in provincial forest regulations reflecting best management practices for erosion. Mitigative measures most often involve stabilization of ditches, cut and fill slopes, and erosion control measures (including cross drainage structures for permanent roads), and decommissioning and road reclamation in the case of temporary roads and trails.

... both the rate and degree of watershed recovery is very closely tied to the success of silvicultural practices and landscape objectives

However, the broader recovery of hydrologic processes after forest disturbance generally depends on re-establishing the evaporative processes and hydrologic flow paths that were present prior to the disturbance. Recovery of the natural functioning of many of these processes is largely regulated by re-establishing the forest canopy along with understory vegetation and forest floor litter. Thus, both the rate and degree of watershed recovery is very closely tied to the success of silvicultural practices and landscape objectives for stocking and juvenile performance of regenerating stands.

Not surprisingly, watershed recovery after harvesting is generally quite rapid in warm and moist eastern and western North American coastal regions, where rapid stand development and juvenile canopy closure occurs comparatively quickly. Significant watershed recovery within 5-10 years has been observed in many of these regions. In contrast, slow growth rates characteristic of harsher environmental conditions such as high elevation upper montane or sub-alpine forests can be associated with much slower watershed recovery after disturbance (50-80 years, or more in some cases).

Furthermore, long-term changes in the hydrology of forest landscapes have been observed where larger landscape scale changes in forest stand composition have occurred after harvesting. Conversion of tree species composition involving the relative mix of hardwoods and softwoods, or changes in tree species composition involving differential transpiration demands, have produced long-term changes in hydrology of some landscapes. These have been driven by watershed scale changes in evaporative water losses by the forest because of changes in canopy interception of precipitation and transpiration.

Because of the long time scales required to study changes in forest stand condition (stand canopy dynamics, forest species composition, etc.), much more is generally known about the magnitude and short-term effects of forest disturbance on hydrology than is known about how these long-term forest dynamics affect water values. However, this type of information is needed for integrated forest watershed management plans that typically involve very long time scales.

Integrated forest-watershed planning

Watershed management plans most often evaluate hydrologic impacts of forest disturbance using expert opinion and published scientific literature on watershed research conducted in broadly similar forest settings, or using hydrologic models capable of predicting

the hydrologic effects over long time scales characteristic of strategic planning horizons.

One of the challenges in such planning exercises is representing the time frame of hydrologic recovery over long time scales. Because the hydrologic effects of a unit area harvested diminish over time with canopy re-development, hydrologic models used for integrated forest watershed management must be able to predict the decreased hydrologic impact of disturbances as time progresses.

Of the more broadly used procedures for this purpose, the Water Resource Evaluation of Silviculture Sources (WRENSS) and Equivalent Clear-cut Area (ECA) procedures developed in the US several decades ago are particularly well suited to the spatial and temporal scales needed for strategic forest planning. These most often use hydrologically important forest stand attributes (basal area, stand height, periodic annual increment, or even canopy leaf area index) as proxies for hydrologic recovery of old disturbances.

... good forest management is a crucial foundation for good watershed management

These procedures allow forest managers to represent the partial or intermediate state of hydrologic recovery of existing disturbances in a watershed, and explore how a proposed harvesting plan might produce incremental hydrologic effects. Use of such procedures often involves evaluating how the magnitude and timing of new proposed disturbances in a watershed might be balanced against (or interact with) recovery of older existing disturbances in a watershed.

These types of analyses have been used routinely in BC for well over a decade (and more recently in Alberta) to balance both the harvest intensity and timing against recovery of older disturbances to limit watershed impacts from forest harvesting.

Such analyses most often show a clear connection between acceptable magnitude of proposed harvests with the state and growth rate of the growing stock in existing older disturbances. Indeed, forest management issues often viewed as solely silvicultural problems such as regeneration lags, establishment, stocking, and juvenile growth often have a demonstrable effect on allowable future harvest levels where watershed management procedures such as ECA or WRENSS analysis have been employed as regulatory constraints to harvest levels.

Unfortunately, hydrology and management of forest watersheds has often been viewed by forest practitioners as a distinctly separate forest management issue from the more traditional or “bread and butter” forestry issues of silviculture and forest growth and yield. However, the implementation and success of silvicultural practices and systems is more closely connected to forest watershed management objectives than is often appreciated.

This notion was captured by one of North America’s best known forest hydrologists, John D. Hewlett, in his classic book titled *Principles of Forest Hydrology*. In it, Dr. Hewlett states, “In a sense, land, watershed, and habitat are synonymous terms; you cannot manage one without simultaneously managing the others.”

Indeed, good forest management is a crucial foundation for good watershed management.

Kevin Bladon is an Ecohydrologist in the Department of Renewable Resources, University of Alberta. Uldis Silins is an Associate Professor of Forest Hydrology in the Department of Renewable Resources, University of Alberta.

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Western Climate Initiative Draft Recommendations for Cap-and-Trade Program

by WCI Staff

The Western Climate Initiative (WCI) began in February 2007 when the Governors of Arizona, California, New Mexico, Oregon, and Washington agreed to join The Climate Registry, develop a regional greenhouse gas (GHG) reduction goal consistent with their state goals, and design a multi-sector market-based mechanism by August 2008 to help meet the GHG reduction goal.

The five Governors invited other states, provinces, and tribes to join the WCI or to participate as observers. Since the initial signing, the Premiers of BC, Manitoba, Quebec, and Ontario, and the Governors of Montana and Utah have joined the Initiative. The states of Alaska, Colorado, Idaho, Kansas, Nevada, and Wyoming participate as observers, as do the provinces of Ontario and Saskatchewan along with the Mexican border states of Baja, Chihuahua, Coahuila, Nuevo Leon, Sonora, and Tamaulipas.

The WCI partners issued their regional GHG reduction goal on August 22, 2007 of 15% reduction from 2005 levels by 2020. This regional, economy-wide goal is consistent with the state and provincial goals of the WCI partners and does not replace the partners' existing goals. The WCI partners also re-committed to do their share to reduce regional GHG emissions sufficiently over the long term to significantly lower the risk of dangerous threats to the climate. Current science suggests that this will require worldwide reductions in carbon dioxide emissions of 50-85% below current levels by 2050.

On October 29, 2007, the WCI partners released their Work Plan of WCI activities through August 2008 for public review and comment. Comments on the Work Plan were requested and more than 100 organizations and individuals submitted comments. As directed by the Governors and Premiers, the Work Plan describes the process for developing design recommendations for a proposed cap-and-trade program as one element of the WCI's effort to identify, evaluate, and implement ways to reduce GHG emissions and achieve related co-benefits.

Five WCI subcommittees (each chaired by one of the partners) are working toward a cap-and-trade program design that all partners can embrace and implement.

WCI Draft Recommendations for Offsets

Offsets will include forestry sinks. The primary role of the offset program is to reduce the overall compliance costs for the cap-and-trade system, by enabling the offset market to deliver lower-cost emission reduction options than are available in the sectors/sources included in the cap-and-trade system. In addition, by lowering overall costs, an offset program can potentially offer greater environmental benefits. The offset program can also serve to encourage innovation, co-benefits, GHG emission reductions from sources not covered by the cap-and-trade system, and removals by sinks.

Offset project types and protocols

The WCI recommends that partners:

- develop an initial set of eligible project types and approved protocols prior to cap-and-trade program launch;
- develop a process to review and approve other project types and related protocols proposed by project developers;
- use protocols that are standardized to the extent possible; and
- make use of, and adapt if needed, existing protocols from other trading systems as appropriate.

Offset projects approved through the WCI offsets program

The WCI should consider a method that gives priority to offset projects located within WCI jurisdictions. The method should also consider other roles of the offset system, such as ensuring that co-benefits occur within the region.

In addition to those offset projects approved within its jurisdictions, the WCI should consider approving offset projects located throughout Canada, the US, and Mexico, where such projects would be subject to comparably rigorous oversight, validation, verification, and enforcement as those located within the WCI jurisdictions and would not undermine the ability for the WCI to link to other trading systems.

Tradable units from government-regulated GHG emission trading systems

For compliance purposes, the WCI should consider allowing individual regulated entities to use tradable units (offsets and allowances) from other government-regulated GHG emission trading systems that the WCI recognizes as meeting similarly rigorous criteria for environmental integrity.

The WCI should ensure accounting systems are in place to prevent using tradable units more than once for compliance.

Quantity limits

The WCI recommends limiting the use of offsets and non-WCI tradable units for compliance by individual regulated entities:

- to ensure that meaningful emission reductions take place within the sources covered by the cap-and-trade system; and
- in recognition that foregoing emission reductions at facilities covered by the cap-and- trade program in the WCI states has the potential to forego health benefits and other benefits near those facilities.

The WCI Offsets Subcommittee will consider making a specific draft recommendation to the WCI, based on further analysis and considering the level of the cap set for the cap-and-trade system.

Summary of Major Comments Received to Date on Offsets Recommendations

In each of the opportunities for stakeholder engagement in the design of a cap-and-trade system for the WCI, there has been strong support for including an offset program. Stakeholders have expressed a desire to see the offset program focus on ways to reduce the overall cost of meeting GHG emission reduction targets, whether through reduced compliance costs for emitters, reduced economic impact for consumers, or increased economic opportunities to encourage emission reductions. Stakeholders have also shown a strong and consistent concern for the environmental integrity of the offset program, realizing the direct connection between the integrity of the offsets and the integrity of the regional target.

Many stakeholders feel that offsets should be allowed to enter the WCI system from sources outside the WCI, by project approval through the WCI process or as approved trading units from other cap-and-trade systems. A number of stakeholders also believe there are compelling economic, environmental, and social reasons to give priority to offset projects from within the WCI or to phase in other regions over time as experience grows. Several stakeholders suggested ways to develop or design limits on the type of offsets, including basing limits on project location. The WCI Offsets Subcommittee recognizes that offset projects must reduce or remove GHG emissions and may have co-benefits regardless of where the project is located, and will continue to examine the balance of economic, environmental, and social benefits in the design of the program.

Given the encouragement to focus the offset program on reducing costs for the cap-and-trade system, some stakeholders find the concept of limiting the use of offsets to be counterproductive, reasoning that limiting the use of lower cost compliance alternatives simply means higher cost compliance. Other stakeholders argue that an oversupply of inexpensive offsets could reduce the impetus for capped emitters to make progress on direct emission reductions. The subcommittee invites further suggestions on the design of limits or alternative methods to balance the use of offsets with reductions under the cap.

Stakeholders generally supported the recommendation to establish a centralized administrative body to perform routine processing and management functions.

These draft recommendations are due to be finalized by September, at which time it can be approved by the government. For further details on the recommendations, visit www.westernclimateinitiative.org.

BC's Top 10 Forest-Related Economic Opportunities Created by Climate Action

1. Bioenergy
2. Energy conservation and efficiency
3. Renewable electricity
4. Geoexchange and community systems
5. Renewable diesel
6. Cellulosic ethanol
7. Wood in construction
8. Wood pellet exports
9. Forest carbon offsets
10. Green tourism and other services

by Graham Whitmarsh, Head, Climate Action Secretariat

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WESTERN

SILVICULTURAL CONTRACTORS' ASSOCIATION

by John Betts, Executive Director

BC Tree Planters Claim Six Billionth Tree Milestone

In early June the silviculture industry celebrated BC's six billionth seedling reforestation milestone in a series of community and media events covering all quarters of the province. Not since the then Deputy Minister of Forests Mike Apsey hosted the first billionth tree celebration in the early 80s have treeplanters actually been officially invited to participate in this symbolic exercise. So maybe it was time for the silviculture sector to claim the celebration, and in taking a little credit for the accomplishment, share it with the communities who depend on the forests now and into the future. At a time when the mood in forestry is largely funereal, it was a positive reminder that we are good at growing seedlings and planting them in this province.

In celebrating the six billionth tree milestone, we chose to recognize in particular the treeplanters themselves: both the stolid veterans and the 100,000 or so who have passed through the industry as part of growing up in Canada. Again the WSCA would like to thank those workers for their generousity of spirit and their hard work. We would also like to thank all of those who helped with this year's milestone festivities. May the next billionth tree celebration be soon.

There are lots of figures floating around today pertaining to the forests. Most of them are on an unimaginable scale. For instance, what does 12 million hectares of beetle-attacked wood look like? Even if there was a vantage point to appreciate this area, I am sure any normal human would fall short of fully comprehending what they were seeing. The six billionth tree milestone suffers from the same problem of perspective, not only in scale, but in comprehending the effort involved to plant that many seedlings. I personally balk at imagining a million, which is planting one tree a second for eleven and a half days. One billion is doing that for 32 years. So six billion is, well, way out there.

If we say six billion trees is planting 150 laps around the equator at one metre spacing, I'm not sure that helps either, being that few of us have actually walked around the equator to know what that involves. My old favourite of using the spinal leverage ergonomic equivalent to compare planting six billion trees to lifting the Great Pyramid up and down six times only makes sense to chiropractors. And people keep asking; if you've picked up the pyramid, why would you put it back down again? The comparison implied an element of futility, which is not what we want to convey in the context of treeplanting.

Time is a problem too. As I write, trees are being planted at more than 100 per second provincially, the pace needed to plant this year's estimated 250 million seedlings. To achieve six billion we have averaged 80 trees per second during the field season for the last four decades. But even this fairly straightforward metric is lost when you consider this in its panoramic perspective. These trees aren't being planted in one convenient spot, but are the outcome of diverse efforts across the whole province. The logistics, innovations, improvisations, planning, and supervision for this kind of dispersed campaign are lost in the measurement of so many trees per second.

So, is comprehending planting six billion trees one of life's deeper mysteries? Such a human accomplishment seems to suffer from seemingly inhuman measurement. By human I mean that treeplanting is one of those increasingly rare manual occupations where people actually work for a living. In the modern industrial world, robots and machines do most of this kind of production.

Perhaps it is worth reflecting that treeplanting in BC is still something that directly requires the human hand. And perhaps this is the level at which it can be best understood; that by one tree at a time, an increment defined literally by hand, we can accomplish remarkable things.

ONTARIO

FOREST RENEWAL CO-OPERATIVE INC.

by Bill Murphy, Executive Director

Who is Running the Forests of Ontario?

In the past year and a half there have been some changes in the way our Crown forests have been managed. In the early 80s, we had the Forest Management Agreements (FMAs), then in 1994, the Crown Timber Act was replaced with the Crown Forest Sustainability Act. This put the entire management of the individual Crown licences in the hands of forest and forest management companies, which at that time presented the perfect opportunity for Ontario Ministry of Natural Resources (OMNR) to divest themselves of a lot of major field responsibilities. In 2005, the OMNR was pushing for the formation of more Co-op Sustainable Forest Licences to try to reduce internal management costs, but at the same time improve sustainability by amalgamating various licences. The two licences that did not pass to co-ops (Cochrane and Temagami) were the last of the Crown forests that had not succumbed to the FMA process or subsequent first round of co-ops, and still had not found a suitable co-op structure. MNR still carries management responsibility for them, although the work may be farmed out.

Since 2005, rumours have been floating that the OMNR wanted to take back the management planning aspect of all the licences. Can this rumour be tied to the following questions?

1. Were the funds allocated by the provincial government to try to get the companies out of financial difficulty just enough to keep them in trouble?

2. Why were the dollars allocated only to certain companies that used 50 megawatts or more of electricity?

3. Was it co-op or OMNR management when two forests were handed back after being selected for co-op SFL status and one was given back due to external frustrations, and then third party arrangements were quickly assigned to a consultant group to manage that forest?

Several major sawmills and pulp mills have been shut down, and in some cases are being mothballed, due to lack of product sales. This has led to some licences not achieving their allowable cut.

The allowable cut is our control for the management of the forests. The work and concessions that the OMNR made with forest companies in the 70s and 80s helped alleviate the over-mature wood syndrome. Was this in vain, as wood not cut each year could possibly go into an older age class? Will there be a splurge of cutting within the operating plan to alleviate this scenario? I think not. What is happening to the renewal and maintenance of these licences if dollars are not being assigned by way of harvesting to the renewal trust and the Forestry Futures Trust? Some companies do not have their trust funds up to date. Some have had the OMNR top them off so that regeneration efforts can be continued, and others owe the government significant dollars in back dues. Are the Crown lands in jeopardy?

The Crown, while taking back the initiative of management, will have to spend dollars to do just that. If the companies are not able to harvest and pay stumpage and renewal fees, at what point will the coffers be taxed? Will the Crown relinquish its responsibility to manage, and to whom would that responsibility be given?

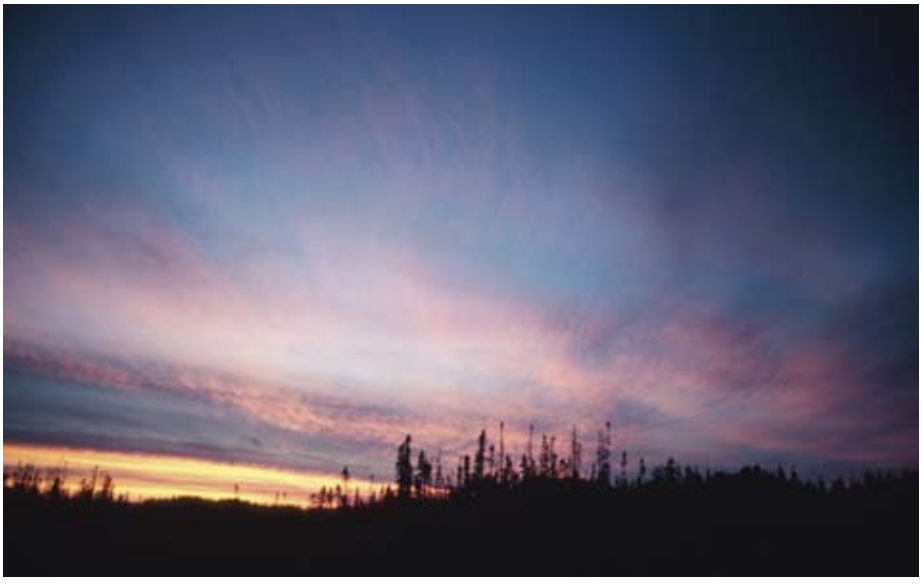
It looks like man has had more than one chance at managing our forests, and maybe it is going to be taken over by a woman - MOTHER NATURE!

QUEBEC

ASSOCIATION DES ENTREPRENEURS DE TRAVAUX SYLVICOLES

par Audrey Harvey, Responsable des communications, AETSQ

Les entrepreneurs sylvicoles s'inquiètent de l'avenir de la forêt et des régions



La crise forestière qui sévit au Québec ne touche pas que les scieries. Depuis quelques années, on remarque aussi ses effets sur la sylviculture. La situation précaire du secteur forestier ne permet pas la réalisation de tous les travaux sylvicoles prévus annuellement si bien qu'au lieu des 177 millions de dollars de travaux nécessaires au maintien du rendement de nos forêts, il pourrait bien ne s'en réaliser que 120 millions de dollars. Si cela devait se concrétiser, il s'agirait d'un creux historique dans la réalisation des travaux sylvicoles au Québec et nous craignons pour l'avenir de nombreuses entreprises et de leurs travailleurs dans nos régions.

La raison principale à ce ralentissement est bien sûr la crise forestière. Rappelons que 90% des travaux sylvicoles dans les forêts du domaine de l'État sont payés à même les redevances que l'État perçoit des coupes forestières. Le 10% restant doit être assumé par les industriels qui coupent le bois. Or depuis quelques années, les coupes sont en déclin, ce qui a inévitablement un impact sur la réalisation des travaux sylvicoles. Cette année, la situation est encore pire puisque les industriels, après plusieurs années de crise, n'ont simplement plus de marge de manœuvre. Il leur est donc difficile d'assumer leur part des travaux, sous peine de devoir jeter leurs travailleurs à la rue. Résultat: les travaux sylvicoles sont à la baisse et la crise, loin de se résorber, touche maintenant tous les secteurs de la foresterie. Des discussions ont toujours lieu avec le ministère des Ressources naturelles et de la Faune (MRNF) afin de trouver une issue satisfaisante pour toutes les parties avant qu'il ne soit trop tard.

Conséquence de la hausse du prix de l'essence

Tout le Canada est touché depuis plusieurs mois par la hausse du prix du carburant. Au printemps dernier, au moment de réagir à l'arrêté ministériel sur la valeur des traitements sylvicoles, l'AETSQ avait proposé de développer un taux ascenseur pour suivre adéquatement la fluctuation du prix de l'essence. De plus, nous avions également suggéré à ce moment d'utiliser un indice des prix à la consommation (IPC) avec une composition plus importante d'énergie, comme le fait déjà Hydro-Québec. Cette démarche permettrait d'ajuster rapidement et de façon juste les taux alloués à chacun des traitements sylvicoles en fonction des variations du prix de l'essence. De plus, l'Office national de l'énergie ne prévoit pas de baisse du coût du baril de pétrole au cours de l'été. Nous pouvons donc prétendre qu'au mieux, le prix à la pompe se maintiendra entre 1,35$ et 1,40$ au Québec. Contrairement aux années précédentes, le prix du diesel a également subi une hausse importante de plus de 70% par rapport à l'année dernière pour atteindre entre 1,45$ et 1,50$ par endroits.

Les conséquences varient d'une entreprise à l'autre. Plus les opérations sont mécanisées, plus le manque à gagner est important. Pour une machine utilisant du carburant diesel, la charge monétaire sera presque doublée, le diesel ayant fait un bond de plus de 70% depuis un an. Aucun mécanisme n'est actuellement prévu pour pallier à ce manque à gagner. Les entreprises doivent combler l'écart à même leurs marges bénéficiaires déjà presque inexistantes, ce qui a inévitablement des conséquences sur les travailleurs puisqu'il y a moins d'argent disponible.

Un mot sur le nouveau régime forestier

Depuis quelques semaines, le ministre des Ressources naturelles et de la Faune, M. Claude Béchard, a dû s'absenter pour des raisons de santé. C'est donc Mme Julie Boulet, déjà ministre des Transports, qui assure l'intérim. C'est elle qui a déposé le 18 juin dernier le document de travail sur l'occupation du territoire forestier québécois et la constitution des sociétés d'aménagement des forêts. Parmi les développements à noter, soulignons la volonté du gouvernement de créer des sociétés d'aménagement des forêts afin de dicter les grandes lignes des interventions sylvicoles dans les différentes régions du Québec. Les industriels auront un droit de premier preneur sur 75% de leur volume garanti, soit leur CAAF actuel. Le 25% restant serait soumis au marché, par l'intermédiaire d'un bureau de mise en marché des bois. Des consultations publiques auront lieu à l'automne. Les groupes concernés auront à nouveau l'occasion de se faire entendre par le Ministère qui souhaite déposer et faire adopter un projet de loi avant la fin de l'année.

QUEBEC

ASSOCIATION OF SILVICULTURE CONTRACTORS

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

Quebec's Forestry Crisis Raises Concern

The forestry crisis affecting Quebec is not limited to sawmills. For several years its impact on silviculture has also been noted. The precarious situation of the forestry sector is an obstacle to annually planned silvicultural efforts, to such an extent that instead of the $177 million needed to maintain the yield of our forests, only 120 million may be available. If this proves to be the case, it would constitute a historic interruption in silvicultural activities in Quebec, which makes us fear for the future of numerous enterprises and their employees in our regions.

The principal cause of the slowdown in silviculture is clearly the forestry crisis. It should be remembered that 90% of silvicultural work in publicly owned forests is paid for out of government levies on forest cuts. The remaining 10% is assumed by the industries making the cuts. For the past few years, cutting has been declining, which inevitably affects the carrying out of silvicultural activities. This year the situation is even worse because the industry participants, after several crisis years, simply have no room to manoeuvre. It is thus difficult for them to assume their share of the work, at the risk of having to lay off their employees. As a result, silvicultural activities are at a low ebb and the crisis, far from being resolved, now affects all forestry sectors. Discussions are still underway with the Ministry of Natural Resources and Wildlife to find a solution acceptable to all parties before it is too late.

Impact of the increase in gasoline prices

All Canadians have been affected for several months by the increase in fuel costs. Last spring, responding to the ministerial decree on the value of silvicultural projects, the AETSQ had proposed a rising rate tied to the fluctuations in gasoline prices. Furthermore, we had suggested at that time the adoption of a commodity price index (CPI) weighted for energy, as is currently used by Hydro-Québec. This move would allow rapid and equitable adjustment of the rates paid for silvicultural work in the light of variations in the price of gasoline. Furthermore, the National Energy Office doesn't foresee any reduction in the cost per barrel of oil during the summer. It can therefore be expected that, at best, the pump price will remain at $1.35 to $1.40 in Quebec. Unlike previous years, the price of diesel fuel has also undergone a major increase of more than 70% over the previous year, reaching between $1.45 and $1.55 in some areas.

The consequences vary from one company to another. Those whose operations are mechanized suffer the greatest loss in revenue. Operation of a machine fueled by diesel will almost double in cost. There is no current technique to compensate for this loss of revenue. Companies must cover the shortfall from their profit margins, which are almost nonexistent, and this inevitably has an impact on the workers because there is less money available.

A Word about the New Forestry Regime

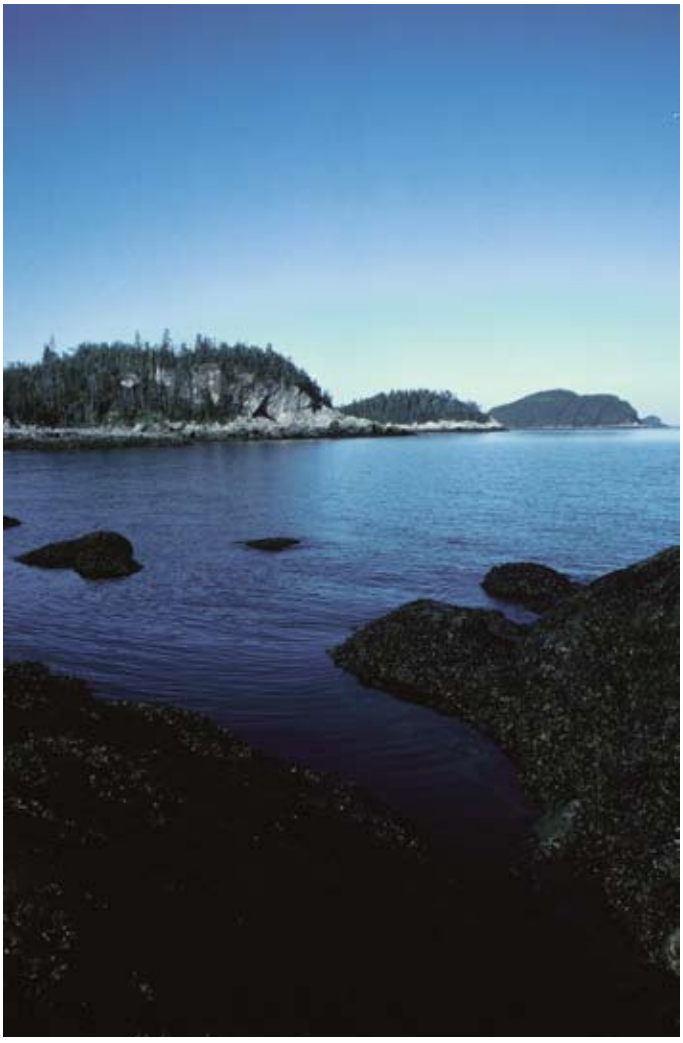
The Minister of Natural Resources and Wildlife, Mr. Claude Béchard, has taken a leave for health reasons, and Madam Julie Boulet, already Minister of Transport, has had to fill in. She tabled the working document on the occupancy of Quebec's forestry territory and the constitution of forestry management societies on June 18. Among the developments worthy of note, the government's wish to create forestry management societies in order to direct major silvicultural activities in the various regions of Quebec should be stressed. Industry leaders will have first claim on 75% of their guaranteed volume (i.e., their current CAAF). The remaining 25% will be put on the market by means of a wood-marketing office. Public consultations will take place in the fall. The groups concerned will have a further opportunity to be heard by the Minister, who wants to submit and adopt a new draft bill before the end of the year.

PEI

FOREST, FISH AND WILDLIFE DIVISION

by Ken Mayhew, Information Officer

Ecosystem-based Forest Management Manual



One of the primary recommendations arising from PEI's recent forest policy hearings was the desire to see government pay more attention to ecological goods and services when managing public lands or assisting private land owners. This spring, the province responded to that wish by releasing PEI's first *Ecosystem-based Forest Management Manual*. This guidebook will shape management activities on all public forest lands and guide publicly funded management programs for private land owners.

The manual builds on the principles and concepts of earlier forest management programs but, whereas earlier manuals tended to focus on forests as economic development tools, the new manual places priority on ecological principles and values. Other values such as income, employment, and economic development will continue to play important but lesser roles. The intent is to demonstrate that private and public forests, managed with public funding and support, result in public benefits for all Islanders.

The new manual contains several sections designed to address typical forest management issues and concerns. These sections include Infrastructure, Tree Establishment, Stand Improvement, and Special Enhancement Techniques.

Infrastructure deals with the creation and maintenance of roads, trails, bridges, and culverts. Roads and trails are an integral part of any forest management effort, but they should be designed to suit local terrain and soil conditions. The manual recognizes that because bridges and culverts pass through or over ecologically sensitive areas such as riparian zones, seasonal wetlands, and streams, extra care must be taken to minimize disturbances and ensure the free passage of water and aquatic creatures.

The section titled "Tree Establishment" addresses the creation of a new forest stand by natural seeding and/or tree planting with Acadian Forest species. For sites that require some form of planting, the manual supports three planting systems including full planting, where an entire site is planted, partial planting, where only some areas of the site require planting, and enrichment planting, where selected species are planted in small numbers across the site.

The "Stand Improvement" section concentrates on reducing the impacts of several centuries of poor harvest and land use practices by removing low value trees and focussing attention on those with the highest potential values. Pre-commercial thinning and commercial thinning remove a percentage of the trees in order to improve the overall quality of the stand as well as provide more sunlight and root space for higher quality trees. Shelterwood systems remove mature trees in a series of two or more cuttings, allowing long-living, shade tolerant species to become established in the forest shade. Release treatments focus on the removal of trees which overtop, and thus shade out, more desirable tree species growing underneath. By removing the overstory, more sunlight and nutrients reach the shaded seedlings.

The final section is "Special Enhancement Techniques," and it covers the non-timber attributes and benefits of forest lands. In many cases, these are things which, while intangible, still mean a great deal to people and to the health and productivity of our forest lands. These techniques may be related to wildlife habitat, forest aesthetics, non-timber forest products, and recreational values.

The *Ecosystem-based Forest Management Manual* should be seen as a living document because as new information and strategies become available, the manual will be revised and updated to reflect the new knowledge and interests of society. Core concepts are being written into new management plans for public forests. They have also been incorporated into the newly revised Forest Enhancement Program (www.gov.pe.ca/go/fep) for private woodlot owners. You can access the summarized version at www.gov.pe.ca/go/Eco-summary or the complete technical manual at www.gov.pe.ca/go/eco-Manual.

NOVA SCOTIA

FEDERATION OF NOVA SCOTIA WOODLAND OWNERS

by Andrew Fedora, Executive Director

An Even Perspective on Nova Scotia's Uneven-aged Management Program

Nova Scotia's uneven-aged silviculture outreach and funding program has made some progress since our previous update. The province introduced this Category 7 program last fall to encourage a wider variety of silviculture practices in Nova Scotia, focusing more on quality improvement than volume and growth rates.

The Association for Sustainable Forestry (ASF) is responsible for administering the overall program. Picea Forestry Consulting & Woodlot Services (Picea) has been contracted by the ASF to handle the outreach component.

According to ASF Coordinator Rebecca Aggas, "There are a wide variety of sites being funded under this program; from sites comprised entirely of tolerant species in the case of selection management, to sites with a smaller component of tolerant species that will also receive a fill planting treatment of tolerant softwoods. This program," adds Rebecca, "really is a great option for woodland owners in the province who want to manage their woodland in an uneven-aged manner (when it is appropriate)."

The Category 7 program has provided strong evidence that many landowners and contractors in Nova Scotia have a desire to practice uneven-aged silviculture. With the uncertainties surrounding the traditional softwood industry and the hard-to-predict impacts of climate change on our Acadian forest type, there is an increasing awareness that we should not be putting all our eggs in one spruce/fir basket.

Based on attendance and participation in the education and outreach component, Patricia Amero with Picea described "The interest and demand to conduct silviculture activities that promote high quality forest products while maintaining (or aiming to achieve) multiple ages, species, and structures (uneven-aged mgmt) is truly immense."

The province has allocated approximately $500,000 to assist contractors and landowners in performing Category 7 program silviculture treatments. All of the funding has been applied for and, pending site inspections, is expected to be spent on the ground.

In a climate of rising production costs and poor markets, it is no surprise that any sort of assistance provided would be well received by contractors and landowners. However, there is still no clear indication whether assistance levels are sufficient to make Category 7 treatments economically feasible. Many contractors and landowners feel the cost is still too great to bear, and there hasn't been any significant increase in the per-hectare silviculture rates over the last ten years.

There is a less-than-popular argument that no assistance is needed at all to carry out uneven-aged management in Nova Scotia. By using a properly mechanized setup and running double shifts, it is possible to increase productivity by 20% - negating the need to offset the loss in revenue from extracting lower volumes. In some cases, this may be true, but it does not hold a lot of weight with the average landowner using a tractor and chainsaw. Site conditions are another factor when considering production increases.

Interest in the Category 7 program and the funding uptake seemingly indicates that assistance levels are sufficient and the amount of uneven-aged management in the province is increasing. Though there may (or may not) be an increase in uneven-aged management in Nova Scotia, it is unclear how accurately the Category 7 program reflects what is presently happening on the ground. Under the program guidelines, previously treated sites can receive funding. Areas treated up to 10 years ago are eligible for assistance. When asked how much funding the ASF is allocating to new activity versus old jobs, they were unable to provide an answer.

In addition to previously treated sites, the ASF is funding work on sugar bush operations (maple syrup production sites). Technically speaking, funding work in sugar bush operations follows the main objective of the program "to increase the amount of uneven-aged forest management for quality forest products on small private woodlands across Nova Scotia." Maple syrup is certainly a quality forest product in Nova Scotia. However, since most quality sugar bush operations require frequent thinning of stands and removal of competition (which is generally considered a cost of doing business), it is questionable how much new uneven-aged management is taking place in these areas.

We are hopeful that a program post-mortem will address ambiguities regarding how much new uneven-aged management is occurring in Nova Scotia, and whether assistance levels are sufficient. Ambiguities aside, the Category 7 program has been successful in increasing awareness of uneven-aged management in the province and has put a few dollars in the pockets of rural Nova Scotians.

For more information on this subject or any other forestry related topic in Nova Scotia, please contact FNSWO at (902)-639-2041or info@fnswo.ca.

Not My Grandmother's Willow

The Emerging Use of Willow for Phytoremediation and Biomass Production

words and photos by Richard Krygier

Willow has played a role in society and the environment over the ages. Its almost global distribution as a species and its growth and wood characteristics have resulted in willow being put to a multitude of uses.

Willows belong to the same plant family as poplars. There are about 450 species of willow worldwide, of which 106 are growing in North America, with a multitude of growth forms ranging from prostrate dwarf species to trees over 40 metres tall. They are mainly found in the northern hemisphere in the temperate and arctic zones, but subtropical and tropical varieties also exist. Willows inhabit a wide range of ecological niches varying from wetland to upland (drier) sites.

Willow is a perennial species with separate male and female plants that hybridize naturally and can reproduce sexually from seed and asexually from woody shoots. The woody shoots sprout roots and leaves easily when planted in a favourable environment. The wide geographical distribution of willow, the range of sites on which it grows ,and the variety of its growth attributes provide opportunities for selecting species, and clones within species, for specific uses and for inclusion in conventional breeding programs.

Willow has been used by man since before the Stone Age. It was used for the construction of shelter and fencing (wattle/daub construction), for basket production, for arrow shafts, and for fish traps. Willow bark infusions were used as analgesics, the salicin used as a precursor to synthetic aspirin.

In my grandmother's time, willow was used primarily for basket weaving. Until the middle of the last century, no other single use generated a similar level of production and interchange of species and hybrids between America, Europe, Asia, and the Far East. Weavers were always seeking new species and clones that would provide them with the best wood and rod characteristics to make baskets for ornamental to shipping purposes.

Recently, willow is being used more for environmental purposes and to mitigate the effects of human activity on the environment. Willows are planted along stream banks to consolidate the soil - the thick, enmeshing root matt binding the soil together and preventing the undercutting of the bank. A buffer of willow planted along a stream bank provides an effective barrier to movement of nutrients into the water from agricultural or industrial activities.

Planting, June 2006

Living fences of willow rods are used in urban settings for sound and wind barriers, and willows are planted in shelterbelts around farm fields across Canada, thanks mainly to the work of the Prairie Farm Rehabilitation Administration (PRFA). The PFRA continues

Early shoot growth, two weeks after planting

One-year growth after coppice on two year-old roots

to work with willow, albeit for broader uses than shelterbelts.

Willow is used for the ecological restoration of wetlands and for wildlife conservation. It has high wildlife value, providing a rich and diverse source of food and habitat for a variety of mammal, bird, and insect species.

Willows are used to stabilize damaged soils and re-establish a biologically active soil surface. The variability of the sites on which willows can grow and their ability to bud, root, and resprout from woody material makes them ideal for establishment on damaged soils or degraded sites.

The use of willow in phytoremediation - the use of plants to clean substrates through chemical and metabolic processes - is being intensely investigated around the world. The removal of heavy metals from contaminated soils, the degradation of pollutants in soils through root activity, and the filtration of nutrients from wastewater are only some examples of this use.

Most recently, willow is also being used as a woody biomass feedstock in the new bio-economy. The development and use of biomass for energy and as a source of chemical feedstocks has become a high priority around the world. This is driven by concerns about the environmental impacts of fossil fuels, the security of energy supply, and the sustainability of natural resources.

Biomass can come from a number of sources - as residues from agriculture, forestry, or industrial activities, from municipal waste collection, or from the production of dedicated woody or herbaceous crops. In Canada, the recent rapid increase in the amount of corn and wheat planted for the production of bioethanol, and canola for the production of biodiesel, are examples of dedicated herbaceous crop production.

Compared to the establishment of dedicated herbaceous biomass crops in agriculture, the establishment of dedicated willow biomass crops in Canada has been limited. However, the concept is not new, and there are numerous environmental and social benefits. During the energy crises of the 1970s, Canada, along with several other nations, began research and development work with willow as a dedicated woody biomass crop. Breeding and establishment work was undertaken at the University of Toronto as part of a national strategy to seek alternate energy sources and for energy independence. However, with the subsequent decline in the price of oil, Canadian research focus shifted to other areas.

In the 1970s, a similar scenario played out in Sweden; however, work continued to the present. They have approximately 15,000 ha of dedicated willow biomass plantations for community and local heating systems, and their breeding programs have generated many new willow varieties for continued expansion of the planting program. More recently, as part of the UK's strategy to reduce greenhouse gas emissions, thousands of hectares of willow have been established for co-firing with coal or for use in small scale heating systems. Several other countries are establishing willow for biomass (Argentina - 46,000 ha, China - 21,000 ha, Romania - 24,000 ha), and an extensive research program is underway in New York State.

Dedicated woody biomass plantations are established on well prepared agricultural land. Good control of perennial and annual weeds using cultivation and herbicides, and deep tillage is essential to ensure good establishment and early growth of the crop. In the case of willow, greenwood cuttings (20 cm long dormant sections of last year's shoots) of superior clones are planted at high densities (10-20,000 stems/ha) in typically a two row bed arrangement using planting machines capable of planting 15,000 cuttings per hour. However, other planting arrangements can also be used (single row and three row beds). The rows in the two row beds are typically 75 cm apart with cuttings approximately 60 cm apart within the row. There is approximately 150 cm between the beds.

Willow is a perennial crop harvested on a three-year rotation using modified agricultural equipment that cuts and chips the willow in one operation. Depending on the location and the clones used, yields of 15-45 oven-dry metric tonnes of woody biomass per hectare at harvest

With the advent of climate change initiatives and the increase in world oil prices, work on the development of woody biomass feedstocks has started anew in Canada.

have been achieved. The willow plants re-sprout vigorously after each harvest. The root systems are viable for seven to eight harvests. After establishment, the use of herbicides is generally not required because the large, well established root systems and fast growing sprouts gain control of the site very quickly, outcompeting other plants for moisture, nutrients, and light. Fertilizer, mainly nitrogen, is required after each harvest. Organic or inorganic fertilizers can be used, the rates and types being determined specifically for each site.

At least five different species/clones of willow are planted on each site with either one clone in a complete bed or all five clones randomly mixed within the bed. These mixtures enhance structural and functional diversity and reduce the impact of insects and disease. As a fixed volume of willow biomass is required each year, the planting of a site is often staggered over three years so that there is always an area ready for harvest after the current growing season. This creates a diverse habitat as there are always three structural stages of shrub development on the landscape.

With the advent of climate change initiatives and the increase in world oil prices, work on the development of woody biomass feedstocks has started anew in Canada. Under the Canadian Biomass Innovation Network (CBIN), a federal government initiative, demonstration plantings of dedicated willow and poplar biomass plantations have been established across the country to demonstrate the methods (establishment, management, harvesting) and the potential of producing dedicated woody feedstocks as well as determine the value of the feedstock to existing and new biomass conversion processes.

As part of this program and with the support of the town of Whitecourt, Alberta, Alberta Environment, and Geoflow Inc. (an irrigation company), a demonstration/research site was established. The purpose of the project is to investigate the production of willow biomass and its potential for municipal sewage wastewater cleanup.

Sewage wastewater disposal is becoming a challenge for many municipalities across Canada, especially rural communities reliant on storage lagoon systems to treat their wastewater. The opportunity to utilize these wastes as a fertilizer/irrigation water source is an environmental and economic win-win for these communities. They can produce woody biomass and safely utilize their nutrient waste streams in the production of the crop, thus offsetting the need for chemical fertilizers.

Municipal sewage wastewater is being used to a limited degree for irrigation of willow in Europe and the United Kingdom. It is viewed as a means of addressing two environmental problems - water pollution and climate change. The benefits of using wastewater for irrigation include high treatment efficiency, increased biomass yields, resource efficiency, and cost savings.

Whitecourt planting site

Example of cuttings planted at Whitecourt

Willow has several characteristics that make it ideal for combined biomass production and wastewater cleanup:

- willow can utilize large volumes of water and nutrients;
- it's easy to vegetatively propagate;
- willow has the ability to re-sprout after multiple harvests;
- it's a perennial crop that can remain on site for up to 30 years;
- it yields up to 20 oven dry metric tonnes per hectare per year of biomass with irrigation;
- willow has fibre suitable for either energy production or biorefining; and
- it can absorb and retain heavy metals, especially cadmium and zinc.

The 2 ha research site in Whitecourt is located on agricultural land adjacent to the municipal sewage treatment plant, which utilizes an activated sludge treatment system. Some of the treated wastewater, which would otherwise be discharged into the Athabasca River, is used for irrigation. Although the plant does not use a lagoon treatment system, the site was selected because of the close proximity of available land to the treatment plant, easy access to electricity, and the ease of access for demonstration purposes.

The year before planting, the field was subsoiled, disced, and harrowed using conventional agricultural implements. No herbicides were applied because the farmer who leased the land prior to this project was using cropping systems that effectively controlled the perennial weeds. The field was divided into four parts, two replications each of the irrigation and control treatments. A subsurface drip irrigation system was installed in the fall of 2005. Subsurface drip irrigation was selected because of the site's proximity to the town's sports fields and a residential subdivision, and Alberta Environment's concern about the potential for human contact with the wastewater. Irrigation is controlled by a computer and soil water sensors, irrigation water only being applied when the soils are dry.

Three, two-row beds of five willow clones and two hybrid poplar clones were hand planted in early June 2006 at a density of 18,000 stems/ha. Annual weeds were controlled using mechanical cultivation until the willows were above knee height.

At the end of each growing season, the numbers of shoots per cutting, shoot diameter, and shoot height are measured by clone and treatment. Volume of woody biomass is determined by destructive sampling. Insects, diseases, wood, and soil chemistry are monitored. The crop will be harvested this coming winter, at the end of its third growing season.

The effects of irrigation vary by clone and by species. Not all the willow clones responded positively to irrigation, as would be expected. One of the willow clones produced 22% more wood when irrigated while another clone produced 10% less. The poplar clones cannot be evaluated to date due to poor establishment and the need to fill plant at the start of the second growing season. There have been no negative impacts on the soil or the plants from the application of the wastewater.

The study has been a success in that it has demonstrated the potential to incorporate wastewater cleanup into the production of willow biomass. It has stimulated interest in the concept and in establishing new sites to test the use of wastewater from sewage lagoons, and planning is in progress to investigate the use of municipal sewage biosolids in willow production. The study has also revealed the need for finding or breeding more frost-tolerant, fast-growing willow clones. The five clones planted at Whitecourt have experienced varied levels of winter kill over the past two years.

With ever-increasing energy prices and concerns about climate change, the need and opportunities for alternate energy sources have never been greater. Willow biomass is potentially one of these alternate energy sources with the ability to provide other benefits in the process. Willow may once again become an important resource to society, as it was before and during my grandmother's time.

Richard Krygier is Intensive Fibre Management Specialist with Natural Resources Canada, Canadian Forest Service, Canadian Wood Fibre Centre,Edmonton.

Focus on Safety

by Steve Mueller

BC Silviculture Drives for a Safety Milestone

Six billion seedlings planted - that's the 40-year milestone passed in BC this June, and it sets the stage for another silviculture accomplishment that the industry and its workers are driving for.

Silviculture is reinventing itself, and in the process it's making fly-by-night treeplanting operators a fast-shrinking minority. Times have changed a lot since the 1980s when I put my first seedling into the ground. The industry is more business-like, as proven by the industry's concerted move to safer work practices that will reduce costs due to injuries. It's a commitment to helping the bottom line that also meets employees' needs.

Treeplanters want good equipment, good camps, and a work environment that lets them go home in one piece at the end of the day, and the end of the season. In a tight labour market, a good safety record is a competitive advantage and results in better worker recruitment and retention. The company also benefits from reduced costs like lower sector-wide assessments this year by WorkSafeBC.

A crucial safety tool for silviculture is the SAFE Companies program. Most of BC's silviculture industry is certified now, including all the major players. Despite small gaps, the prevailing notion is that treeplanters' health and safety is the priority, which is a major shift in less than five years.

I'm not saying everything is perfect. In May, a 25 year-old silviculture worker died after being thrown from a crewcab in a rollover on a forest service road. She was the only one of five truck occupants not wearing a seat belt; the others suffered only minor injuries. This northern BC tragedy was our first treeplanter fatality since 2004, and it stunned the industry.

When hiring young workers, most silviculture contractors acknowledge and accept responsibility for other people's daughters and sons. The industry now works hard to keep treeplanters safe - to make any serious incident an exception to the rule that nothing trumps safety.

This goes beyond the obvious good business sense. The silviculture industry knows that taking a leadership role in health and safety is the right thing to do.

After 22 years in the silviculture industry, Steve Mueller is now director of worker development for the BC Forest Safety Council. For more on its SAFE Companies program for silviculture and other forestry employers, go to www.bcforestsafe.org.

Safe Practices Add up to Corporate Staying Power

by Steve Mueller

A good advocate of silviculture's drive for safety is Zanzibar Holdings Ltd. Zanzibar has emphasized worker safety since it was formed 25 years ago by Tony Harrison and Gord Saunders. They formalized their priority on safety in 2007, when Zanzibar became one of the first companies to earn SAFE certification from the BC Forest Safety Council. "It's always been one of our values to have people work safely," explains Harrison. "Essentially, any company going down this path has a competitive advantage. It's more or less the rule now throughout the industry."

Harrison sees certification as a way of incorporating safety meaningfully into daily business activity. "A lot of programs can be smoke and mirrors, just lists and tick boxes," he says. However, SAFE Companies recognizes that some documentation is important and helps find the best way to get information to workers and back from the work site.

Harrison describes, "The program took us to another level. We became a better company, not only because of more safety, but because dialogue expanded among employees and supervisors. This had carry-over benefits in our day-to-day production as well. We educate planters that safety's important and that they'll make more money because we've managed their safety."

For instance, workers developing early symptoms of repetitive strain are paid to stop planting and take time off before a reportable injury occurs. This early intervention usually puts them back on the job after a couple of days with minimal effect on productivity. Harrison calls this "giving piece-rate workers incentive to slow down" before injuries put them completely out of commission. He credits Saunders as one of the first in BC to introduce three'n-one scheduling. "It's the most ergonomic for planting trees", because working three days on and one day off reduces accumulated strain by allowing the planters more frequent recovery time.

Approaches like that are key to Zanzibar's staying power. "You can get through in the short term without safe work practices, but you can't stay in business for the long term," notes Harrison. "A healthy workforce is more productive; that's why it all works in the end."

Aboriginal Silviculture

by Garth Greskiw PhD, and Jeremy Boyd MSc, RPF

First Nations have become increasingly more influential in land and forest management in the past decade. Federal and provincial governments as well as resource extraction industries have sought ways to sustain development in "the hinterlands". The Supreme Court of Canada confirmed Aboriginal rights and title to traditional territories, so now in order to secure access to natural resources, there is much incentive to work with Aboriginal communities - or so it would seem. While there is much invested in collaboration between Aboriginal communities and the forest industry, and although many are hopeful, we need to be cautious about what will constitute indicators of success.

Five ways First Nations can become involved

Preliminary research in classifying different types of collaboration suggests that "harmonizing processes" work in the following five ways:

First, through agreements and treaties with government there is potentially a new role emerging for Aboriginal people in decision making. For some communities, better processes for shared decision making are on the horizon. Discussing prospects for collaborative decision making can enhance respect between parties, that in turn improves the process. However the process studied in mitigating forestry conflict in the high-profile Clayoquot Sound case indicated that decision making power is not truly shared among participants if the province maintains the final authority over the decision. The Clayoquot Sound studies also indicated that the equitability of the decision making process was questionable due to the limited capacity of First Nations to participate on terms set by the province.

Second, through recent access to forest tenure, communities have increasing responsibility and potential rights to forest resources. From the point of view of managing costs and benefits associated with moving timber volumes, forest tenure in a weak forest economy provides more costs than benefits. For example, in BC the recent Mountain Pine Beetle non-replaceable forest tenures apportioned to First Nations are especially risky, as they have high up-front administration costs associated with a depreciating timber supply. Most First Nations that logged their licenses last year probably paid more for the stumpage than their return on investment. Nevertheless, forest tenure is seen as a way into the forest sector by most First Nations (but not by all). Forest tenure allocation is a way that communities that have been systematically excluded from the forest industry may now choose to be included through Forest & Range Opportunities (forest revenue and forest tenure), Direct Award agreements (forest tenure only), or both. Despite the current forest economy and high rates of stumpage paid to the Crown, First Nations communities are hopeful that even if good profits are not realized in their forestry and silviculture businesses, then at least skills and employment levels can increase. Trying to find the balance of employment gained and profitability earned within a First Nations forestry business is a difficult task. Trade-offs lead to either more employment gained with less profits or less employment gained with more profits. In the end, the First Nations community has the authority to decide the balance between employment and profitability for their logging businesses.

Third, through economic arrangements and partnerships, communities are experiencing

Back row: Keith Atkinson, RPF. Second row: Left to right - Leonard Joe, RPF; Matt Wealick, RPF; Jeremy Boyd, RPF; Terry Teegee, FIT; Pamela Perreault, PhD candidate (Forest Management); Georgina Thomas, Andrea Lyall, RPF. Front row: Left to right - David Walkem, RPF; Spencer Siwallace, RPF

an increased role in silviculture and planning. In some cases, forestry opportunities for Aboriginal peoples are available as a negotiated partnership with a major licensee working with the community. In past decades of the Federal Resource Development Agreement (FRDA) and Forest Renewal BC, the government sponsored employment projects provided a monetary incentive for companies to develop partnerships with First Nations in developing their silviculture companies. More recently, and more as a conflict avoidance tactic rather than a money making venture, licensees have been approaching First Nations communities in their operating area as partners in silviculture or logging. Partnerships and joint ventures between licensees and First Nations can result in a good silvicultural or logging workforce, but this requires the type of long-term commitment that seems to be in short supply with most licensees, due to consolidation occurring in the forest sector. The common questions of the forest industry - "how to access the aboriginal workforce", and "how to create employment and develop economic self sufficiency" - are already answered by the licensees who have worked with their First Nations neighbours over several decades. There are First Nations communities that would like to work at the strategic level with the forest licensees, but this proves too difficult for most in the forest sector. First Nations would like to have continual involvement in planning with the major licensees from the beginning to the end of a forestry activity. The status quo of just being a First Nations contractor for forest licensees is being challenged around the province by First Nations who want control over the resources in their territories.

Fourth, through their own forestry companies and logging businesses, Aboriginal communities have become involved in the industry. There are First Nations logging and silviculture contractors that have developed forestry and logging businesses without tenure and without specific industry or government partnerships. In many cases these contractors have had to become like their non-Aboriginal competitors and in order to stay in business there was a requirement to stay "on the road". A strong sense of place and knowledge of traditional territories may not be as noticeable among loggers, contractors, or silviculture workers that make it in the non-Aboriginal world. In their territories First Nations tell non-Aboriginal participants in the forest sector, "We are not going anywhere because this will always be our home."

Fifth, by being consulted in forestry and planning, the communities are also increasing their influence. Although this is often a weak method of involvement, consultation has different levels of influence in decision making. The type of consultation afforded First Nations in Clayoquot Sound - though it was called "co-management" - was

still not considered equitable. Consultation that enlightens more than confuses is considered acceptable in most Band offices; but it is still rare. Referral systems that allow various agencies' independent submissions, with poor standards for mapping or on-site consultation, do not do justice to a reasonable definition of "consultation". First Nations wonder how harmonization can be possible with such poor standards set by the Crown for business communication between industry, government, and First Nations.

Where do we go from here?

In BC whole values are still routinely lost in acceptable forest practices. Ecological forestry practice that began with landscape level plans in the late 1990s had the potential to respect Traditional Ecological Knowledge (TEK). However, the silviculture practices that were supposed to correspond with the landscape-level biodiversity strategies and targets of land use plans were not coordinated across management scales. By 2008, despite the urging of both TEK and ecological science in BC, we have seen efforts to sustain whole landscape values becoming more fragmented along with the forest landscape. As long as biodiversity plans are not respected, then forest types and forest-based communities will have an uncertain future with fewer options.

Foresters and other forest professionals within the Shuswap Nation (south central BC) are concerned that silviculture interpretations in biogeoclimatic subzones and associations are focused only on achieving free-growing status of commercial tree species, instead of making a long-term commitment to whole landscape values. Since the Forest and Range Practices Act of BC releases licensees from any long-term silviculture obligations after trees have achieved a free-growing state, there is much pressure to plant fast growing trees. The question whether non-commercial species today may be commercial in the future is not considered when blanket silviculture interpretations are enforceable by law. The other obvious question is whether a currently commercial species today - lodgepole pine - is a sensible choice for future forests, given the epidemic of mountain pine beetle in a dying overstory of lodgepole pine. Foresters and forest professionals in the Shuswap Nation are suggesting that silviculture interpretations and standards might best be learned and formulated at the watershed level, not at the timber supply area level.

Working for a diversity of species and ages for forests and forest inhabitants is essential in maintaining future options for social, ecological, and economic sustainability. The top-down landscape level planning that ensures that connectivity for wildlife movements and seral stage distribution must harmonize with the bottom-up site level of planning. From the watershed level up, long-term forest stewardship should ensure that well-stocked stands of acceptable species are regenerating on denuded sites. However, the definition of what constitutes a future acceptable well-stocked stand should be given careful consideration. For management decision making in forest practice, this implies a long-term plan for changing stocking standards according to different and changing watershed level site requirements. Historically in Canada we have witnessed economic and social pressures that have discouraged ecological planning for connectivity between forest types.

The same economic forces that fragment forests (short-term thinking, and centralization of power and carelessness are among them) also fragment wildlife populations and forest based communities. These economic pressures are systemically related to the pressures that restrict and limit the participation of Elders in land stewardship processes. Aboriginal silviculture commits to a forest that lives beyond the free-growing stage. For this reason it is problematic for mainstream industrial forest practices in BC. In traditional territories, Aboriginal silviculture is interested in examining apparent relationships between species and sites and also between user groups. In the BC context, this is difficult since communications are fragmented between government ministries, across land jurisdictions, between forest licensees, and various user groups. As potential connections, mutual interests, and whole values between these groups are left unrealized, then the effects of fragmented communication between forest users continue to manifest on the regional landscape.

Sustainable silviculture will ensure that a healthy forest continues to grow beyond the free-growing stage. The purpose of the healthy forest may be for timber resources. But equally, if not more importantly, the future forest must provide correct attributes for diverse habitat in key locations. It must provide shelter for wildlife species and a protective overstory for foods and medicinal plants. The future forest will need to extend and connect to traditional and new travel routes from the river valleys up to mountain meadows. Planning for these future forests that connect forest types across ecological landscapes will provide many intangible benefits. The additional benefit of connecting the many fragmented groups that have resource use concerns as productive learning organizations might also be realized. Increasingly, First Nations are finding themselves instrumental in facilitating a process of balancing industrial and Aboriginal interests in lands and forests. Arguably, the process of the reconciliation of interests might essentially be a "coming to terms" with the true costs and benefits of ecological forest practices.

Garth Greskiw, PhD is Aboriginal Initiatives Manager in the University of BC's Faculty of Forestry. Jeremy Boyd MSc, RPF is Director of Forestry for the Shuswap NationTribal Council and is of Tsilhqot'in ancestry.

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