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Growing Wood Fibre for Energy

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Contents

CANADIAN SILVICULTURE

Cover Story

Cover and inset photos courtesy of the Colorado State Forest Service

Wood biomass is a feedstock for energy and fuel. The chips shown on the cover are used to create pellets.

Features

Columns

Publisher Joyce Hayne
Designer Krysta Furioso
Account Manager Johannis Breyten
Editor Dirk Brinkman
Contributing Writers MaryAnn Arcand, John Betts, Michael Carlson, Michelle Cleary, Gaston Damecour, Audrey Harvey, Mike Hutchinson, Ken Mayhew, Debbie Minke, Steve Mueller, Bill Murphy, Sten Nilsson, Don Roberts, Derek Sidders, Andy White

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Forest Health

Resistance Breeding and Screening Against Blister Rust: Return of the White Pine!

White pine blister rust (WPBR) is a disease which has decimated five-needle pines throughout their natural range in North America. The fungus was introduced to western North America in the early 1900s from Europe on a shipment of seedlings, and the disease had previously travelled to Europe from Asia. Following its introduction, WPBR spread rapidly through its western North American hosts, including western white pine. Over the next several decades the volume of white pine, was depleted to the point where it was no longer considered viable as a commercial species.

The rust fungus requires an alternate host, *Ribes* species (currants and gooseberries), to complete its life cycle. The disease is particularly damaging in young trees with most infections occurring within a few metres from the ground where environmental conditions are usually favourable for the rust. Very few trees escape infection when young. The disease is easily recognizable when aecial pustules erupt through the bark or cankers on the branches and stems in the late spring/early summer, releasing masses of orange aeciospores. Infections on the main stem will usually girdle the tree. The length of time to kill the tree usually depends on the number of infections, tree size, and the length of the growing season.

Early blister rust control efforts aimed at *Ribes* eradication were quite costly and generally unsuccessful. For several decades now, the selection and breeding of white pines resistant to WPBR has remained a high priority for pathologists, geneticists, and forest practitioners because the species commands high ecological and commercial values to forestry in BC. However, there has been reluctance from foresters to include western white pine in reforestation plans, despite rust-resistant stock being available. This may be due to more large-scale planting of other conifers like Douglas-fir and lodgepole pine, in large part because of these species' ability to rapidly achieve the minimum height requirement for free-growing. These conifers also succumb to other forest health problems, which are often not fully expressed until several years post free-growing. However, results from provenance and operational field trials throughout the Southern Interior of BC show consistently lower infection rates, high survival, and impressive growth yields in genetically improved western white pine. This warrants us to now rethink our desire to manage this species.

photo by Forrest Joy, Pacific Ecological Services

photo by Forrest Joy, Pacific Ecological Services

The USDA Forest Service started its breeding program for western white pine in the mid-1950s. By the early 1980s, scientists had selected and tested trees for blister rust tolerance/resistance and grafted successful candidates into a seed orchard near Moscow, Idaho. Seedlots from this orchard were thought to confer resistance to the deadly rust fungus, and material from this orchard enabled the BC Ministry of Forests and Range (MFR) to advance in efforts to produce genetically superior rust resistant stock as part of the tree improvement program for interior western

by Michelle Cleary and Michael Carlson

photo by Michelle Cleary

white pine. In the mid-1990s, the Bailey seed orchard was established by the MFR near Vernon, using 50 parent trees from the US Forest Service family-structured progeny test in Idaho combined with a selected number of parents from the MFR and Canadian Forest Service rust resistance breeding program. From this orchard, parental seedlots were selected along with seedlots from wild, selected/untested BC, and the genetically improved Moscow, Idaho arboretum to establish long-term realized genetic gain field trials in the Southern Interior.

After 10 years, the selected/Moscow seedlots had infection rates of 21-31% compared with 69% infected for the bulked wild control seedlots. One of the main resistance mechanisms responsible for the lower infection rates is known as slow canker growth. At present, the genetic worth of stock produced from the Bailey seed orchard is rated at 65%, which is interpreted to mean that we expect approximately 65% of the planted white pine seedlings from seed orchard seedlots to reach rotation age, less mortality caused by factors other than WPBR.

Superior performance of genetically improved white pine has also been demonstrated in other operational field trials in BC. In a comparative performance trial with Douglas-fir, Idaho resistant white pine, and a local (wild) white pine seedlot, percent cumulative mortality after 20 years of the Idaho and wild seedlots caused by WPBR was 30% and 97%, respectively. Estimated site index for Idaho white pine was the highest at this site.

The increased planting of genetically improved western white pine and management of these stands to promote high survival and growth will help restore white pine back into its innate ecosystem, make a significant contribution to rotation age stand structure, and increase long-term timber supply of this beautiful furniture wood.

Michelle Cleary (Michelle.Cleary@gov.bc.ca) is a Forest Pathologist for the Southern Interior Forest Region with the BC Ministry of Forests and Range in Kamloops. Michael Carlson (Michael.Carlson@gov.bc.ca) is a Research Geneticist with the BC Ministry of Forests and Range, Research Branch, based at Kalamalka Forestry Centre in Vernon.

Forests & Biofuel Production

by Don Roberts, Andy White, and Sten Nilsson

Photo courtesy of the Colorado State Forest Service

Photo courtesy of the Colorado State Forest Service

Despite concerns about the rapid expansion of the biofuels sector, it seems certain that this growth will continue given the underlying forces that drive this expansion. These forces can be summarized in terms of security:

- Environmental security (amelioration of climate change)
- Economic security (protection against the rising real price of oil)
- National security (decreasing dependence on the Middle Eastern/ Russian fossil fuels)
- Political security (economic growth in rural areas)

Although the importance of each force will vary between jurisdictions, they stimulate the perception of a need to grow more feedstock for biofuel production and that perception is resulting in action in many countries, including some of the largest economies. By the end of the 11th Five-Year Plan (2006-2010), China is expected to have put into place a total of 5,500 MW of biomass-fired power generating capacity. The objective is 30,000 MW of generating capacity, fuelled by biomass, by 2020. The Chinese government, being conscious of the need not to let biofuel production displace food production, is supporting cellulosic ethanol production with a 10-year, $5 billion commitment. For Brazil, some analysts forecast that annual ethanol output, from sugar cane, will grow from roughly 18 billion litres in 2006 to over 40 billion litres by 2015. In Indonesia, the palm oil industry already has 6.5 million ha of plantations across Sumatra and Kalimantan. Some observers project this area will reach 16.5 million ha by 2020. And finally, following rapid expansion stimulated by a combination of subsidies and minimum renewable fuel content targets, the US is now the world's largest producer of biofuel, principally from maize.

Convergence of Food, Fibre and Fuel

Since food and fibre are now converted into fuel on such a large scale, one way to understand what the "biofuel boom" means is to consider the convergence of markets for these three commodity groups. These three markets will converge in the sense that their primary feedstocks will tend to trade on the basis of their "energy equivalency". Thus, as substitutes for biofuel production, the price of maize will be responsive to the price of woodpellets, and for the forest sector there is now another meaningful user of wood, particularly lower quality wood. This increase in demand will put upward pressure on wood prices until, as expected, they reach a price floor that reflects the wood's energy equivalency. In most parts of North America, the price of sawdust/shavings approximately doubled between 2005 and early 2007.

Three other key variables drive the economics of biofuels:

- the price of oil (the main substitute);
- regulations, which stimulate demand; and
- the conversion technology.

At present, all of these variables are in a state of flux, notably the price of oil. As a rough guide, when crude oil prices fall below $60/barrel, interest in building biofuel plants falters in most countries (except for Brazil), and it is sparked when oil hits $70/barrel and above. But government targets and subsidies for biofuel production are now commonplace in both developing and developed countries. Recent reconsideration in Europe about biofuel targets in the light of their effect on food prices has shown that regulations are also prone to variability.

The use of wood has the disadvantage of more expensive processing costs than feedstocks such as sugar and maize. However, those costs are coming down. Wood has other advantages that include longer and cheaper storage, lower transportation costs, less intensive use of inputs, and established collection systems. Although the capital costs are still higher for processing wood, the variable costs may be lower making wood a competitive feedstock.

What does this mean for forests?

Price increases in wood feedstocks should stimulate increased production, and it is estimated that an additional 20-25 million ha of land will be required for intensive industrial plantations to meet global demand in 2020. However, due to possible decreases in the supply of land for forestry, the effects will be felt most in the southern hemisphere where lower land costs combine with higher crop yields and lower labour costs. This is a potential opportunity for nations that have a natural biological advantage that has not been realized in traditional agriculture due to trade restrictions.

There is already ample evidence for this shift. In the last several years, the pressure to develop biofuels and non-food oils has resulted in an explosion of foreign-owned plantations in developing countries. A Chinese company, for example, has committed to investing US $1 billion to establish a 3 million ha biofuel plantation in the Democratic Republic of Congo. In Tanzania and Mozambique, Swedish companies Atlas Copco and Sekab have announced plans to develop over 400,000 ha of land for bioenergy production. A similar project is underway in Ethiopia as German company Flora EcoPower begins investing US $77 million in the Oromia regional state as part of a purchase of over 13,000 ha of land for biofuel production. In Lao PDR, Stora Enso, the international paper and packaging company, recently commissioned a feasibility study for establishing 35,000 ha of Acacia and Eucalyptus plantations in Savannakhet and Salavane provinces. Such large investments indicate that these corners of the world are now valuable places for foreign companies, despite distance and the potential political risks. As a result, rural and forest land prices in many parts of the developing world are increasing dramatically. But this expansion will not necessarily be dominated by large scale forestry investors. Small and medium-sized forest enterprises (SMFE) already generate more employment and production than larger enterprises in many parts of the world including Brazil, US, and India.

However, a number of risks associated with "carbon forestry" have been identified, including: renewed and even increased state and "expert" control over forests; support for anti-people and exclusionary models of forest conservation; violations of customary land and territorial rights; unequal and abusive community contracts; and land speculation and land grabbing. As land becomes an increasingly scarce commodity, it is questionable whether natural forest management will be competitive against the fuel and food sectors.

These problems may be exacerbated as biofuel feedstock production (wood-based or otherwise) is likely to be at the "extensive margin" of forested areas as harvesting and planting is extended into more remote regions in response to higher absolute wood prices. This may not be such good news for forest-dependent peoples, who are often amongst the poorest, particularly those with weakly defined property rights. Shifts to biofuel production will leave them vulnerable to displacement.

If steps are taken to ensure these people participate in the growing and processing of biofuels, if their land rights are respected, and they have the authority and capacity to negotiate fair contracts, threats may be turned into opportunities, particularly through development of SMFEs. In general, a biofuel industry that is focused more on the local market is more likely to benefit the rural community. It is also less vulnerable to external exploitation and market fluctuations. But of course, if appropriate forestry practices are not followed, non-market goods and services in these areas may be jeopardized. What is clear is that integrated land use is crucial for future sustainable global development.

Don Roberts is a Managing Director with CIBC World Markets Inc., where he leads CIBC's Paper & Forest Products Research Team, and is also responsible for the bio-fuels sector. Andy White is the Coordinator of the Rights and Resources Initiative, an international coalition working to encourage greater global action on forest policy and market reforms to increase household and community ownership, control, and benefits from forests and trees. Sten Nilsson is Acting Director of the International Institute for Applied Systems (IIASA), an expert on international forests and global forest sector analysis, and Fellow with the Rights and Resources Initiative.

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Growing Wood Fibre for Energy

by Derek Sidders

Woody biomass produced from forest plantations or resulting from purpose grown short-rotation woody crops on agriculture lands are options for a developing bioeconomy. A national network of purpose grown afforestation and concentrated woody biomass plantation sites has been established in Canada and is being monitored by the Canadian Wood Fibre Centre (CWFC) staff in Edmonton. The network of sites tracks growing regime options, growth, site, species, and clone suitability, best practices and associated technologies, costs, and conversion opportunities. At the present, this team works in cooperation with universities, provincial agencies, private companies, and landowners with the objective of promoting sound management regimes and demonstrating practical applications on various candidate sites. Biomass recovery from juvenile natural forest stands has not been evaluated adequately in any of the forest regions of Canada, but has potential to be a key source for future energy and bioproduct conversion.

This article will present some new opportunities for natural forest and review the present state of development of purpose-grown plantations to optimize access to biomass as a feedstock for energy, fuel and other bioproducts.

Above: 3 Year-Old Hybrid Poplar Afforestation (Saskatchewan). Opposite: 7 Year-Old Natural Aspen and Planted White Spruce (Alberta)

Reforestation of natural forests following harvest or natural disturbance is accomplished through the use of natural regeneration, if suitable for the desired species, or through artificial systems using desirable and ecologically suitable species, seed sources, and seedling type, or through combinations of both.

Planting of non-forested lands, herein referred to as afforestation, review the land management practices for area-based planting of tree seedlings, cuttings, or rooted cuttings links to biogeoclimatic indices, crop preference relative to commercial land use, and/or desired end product.

Purpose Grown Woody Biomass

Two short-rotation woody biomass régimes for energy and new bioproducts management are being employed in Canada at the present time, deployed in both cases in local areas.

Afforestation is the area-based planting of fast-growing high-yield tree species (usually hybrid poplar) in a stand-oriented design for a single rotation of 12-20 years.

In most cases, afforestation uses short-rotation high-yield management approaches to maximize fibre production, increase biomass availability in close proximity to the processing facility, increase diversity, and reduce investment risk.

Concentrated woody biomass plantations are managed for repeat harvests at 3-4 year intervals yielding a total of five to seven crops over the lifespan of a root system. Shrub and tree willow and hybrid poplar are used in these Plantations. Non-forested agriculture lands are target lands for both management regimes.

Afforestation

Afforestation management regimes use short-rotation woody crop systems that plant 1100-1600 stems/ha in

Site Preparation and Mechanical Marking (Ontario)

Hybrid Poplar 1st Growing Season (Manitoba)

area-based, row orientations managed under moderate to high intensity. These systems are designed to replace or create an alternate fibre/biomass source and make it available in time frames of 12-20 years. Site suitability systems have been developed to determine the woody fibre and/or biomass yield potential of sites across Canada. Afforestation, at this stage of development, is a management practice limited to moderate to high quality agricultural lands with good travel access and level to gently rolling topography. Suitable lands also have soils with few stones, a texture that is neither too fine nor too coarse (sandy loams to clay loams), is moderate to well drained, has a pH of 5.0-8.0, and relatively low salinity levels.

Pattern, Species and Genetics

High-yield afforestation uses a systematic orchard-style pattern that maximizes the operational and resource effectiveness of a site (even distribution, even growth potential, consistent genetics for consistent growth). Although monocultures are the preference for afforestation, mixes of softwood and hardwood are an option. In conventional monoculture designs, hybrid poplar is often the species of choice; however, in recent years selected clonal aspen varieties have also been used in biomass afforestation systems. Hybrid poplar clones are controlled crosses of 2 species of poplar (cottonwood, balsam poplar) that have been selected for their superior growth performance, hardiness, shape, and resistance to biotic pathogens. As the term "clone" suggests, each one is genetically identical, possessing the same physiological and growth properties. Although individual clones are preferably managed in a distinct block because they simplify vegetation management activities and maximize the consistency of the harvested fibre, it is recommended and common practice to have several clones planted in individual blocks on a particular site. Clonal diversification minimizes the risk that clone-specific weather, pests, or pathogens damage an entire plantation.

Site and Clone Matching

Different clones have different tolerances to site and climate, grow in varying shapes and sizes, and have varying life spans. These differences are considered in matching sites and clones in plantation establishment. Clones and species that have good growth characteristics but short lifespan or high vulnerability to extreme weather events can be used in concentrated woody biomass plantations. Others with longer life spans and nice bole shape and hardiness are suitable for mixed species afforestation. Site suitability classification maps have been developed for Canada that use biogeoclimatic indices to forecast land productivity potential. Management of these plantations is recommended to be fairly rigorous, starting with site selection, based primarily on soil class, growing season moisture, hardiness zone, heat degree days, and location in proximity to transport infrastructure and production plant or facility.

Afforestation designs presently in use include planting densities of 1100-1600 stems/ha with higher densities being established in the Prairies and northern BC than those in eastern Canada and southern BC. Plantation density is determined by tree growth habits, climate (influencing survival), desired end product (high density for biomass and paper products, lower for dimensional/structure wood product processing) and management implications. Trees are spaced to maximize establishment, maintenance, harvest operation efficiency, and crown spread. Crown closure by year 3-5 is considered optimum to eliminate most of the competing vegetation on site and maximize height growth and lower bole natural stem pruning. At present, the CWFC tracks about 1900 ha per year being established in Canada on agricultural fields.

The CWFC recommends that plantations not be established within 20 m of an existing natural stand and that buffers of 5-8 m be maintained around all plantations for establishment, maintenance, and harvest operations to use as turnarounds and service supply corridors.

Site Preparation

Site preparation on candidate sites includes various mechanical and chemical treatments to produce consistent, well aerated, vegetation-free conditions. In most cases, the soils to be planted are low in organic material, are without a defined litter layer due to the previous annual agriculture land management practices, and are fairly compact below the regular disturbance level of approximately 15 cm. A deep mechanical discing in both directions (coarse soil mix), followed by green-up and a glyphosate broadcast spray operation and a shallow discing or cultivation for the finish pass, can create an excellent rooting environment for hybrid poplar or aspen. In the Prairie provinces and Ontario it is recommended that a microsite environment of 30 cm in depth be created for afforestation plantations, followed by a bare-soil vegetation management regime to achieve full woody biomass yield potential. Given that most of tree rooting is located in the upper 15 cm of soil, soil heating to stimulate root spread, along with access to moisture and nutrients, are maximized with a bare-soil strategy.

Planting

Mechanical marking is completed on a site just prior to planting, marking the symmetric planting point of the trees. Hybrid poplars are propagated using dormant vegetative stem cuttings. Trees are planted on the marked sites using either long cuttings (20-30 cm Ontario-Prairies, 50-60 cm in southern BC) planted vertically (buds up) with only the top bud exposed, or rooted cuttings, planted vertically with 2-3 cm of soil above the root collar or plug.

Container or barerooted cuttings are acceptable, the latter being the most hardy and robust. Cuttings are conditioned using a water soaking treatment for 12-24 hours prior to planting to hydrate and take them out of dormancy. In contrast, rooted cuttings are just thawed and moistened. Trees are planted when the rooting environment is above 12°C in the case of cuttings and 8°C for rooted cuttings. Care is taken to ensure that an individual clone is planted in a block and that the clone name is mapped for long-term tracking.

This tracking is critical to validate clone suitability and maximize management efficiency as well as diversifying risk. In the case of clonal or hybrid aspen plantings, 2-year dormant rooted stock is recommended.

Mechanical planting is an option for afforestation, but manual planting is more common and recommended to achieve a consistent spacing and more accurate plant placement (depth, compaction, and stem angle). Cuttings or rooted cuttings are carried in a planting bag similar to those used in natural forest tree planting, and planted using a long narrow shovel (cuttings require a 20-27 cm hole) or a medium length and width shovel for container and bareroot. A wider hole and complete L-slit method is recommended for bareroot that benefit from a spreading root placement. The deep site preparation and a fine mix finish treatment, performed prior to planting, are critical to establishing planting consistency, plant root response efficiency, and production.

Vegetation Management

Trees should flush within 1 to 2 weeks after planting. Ideally, the first vegetation management treatment for which a straddle mechanical treatment using spring tooth cultivator follows. This method has the tractor or prime mover driving over the trees (centre of tractor over the tree row) with the centre portion of the cultivator having its teeth removed. This allows for vegetation control very close to the establishing tree and establishes a physical pattern on the site for between row cultivation and repeat straddle applications. Early control of the site vegetation is essential in the establishment of a successful and consistent plantation. Hybrid poplar and aspen are intolerant species and require full sunlight. They also spread their roots very wide to capture available moisture and nutrients, and benefit from high soil heating which stimulates root elongation and biomass production (heat is energy). Straddle applications are replaced with only between row passes once the trees are approximately 0.75 m tall. Although not viewed as essential for establishing a successful plantation, chemicals such as glyphosate are available to aid in vegetation control. Shrouded applications of glyphosate are successful and cost effective for plantations that are almost fully crown-closed. They are also useful for between-row applications rather than using mechanical cultivation. Vegetation control should carry on until the crop is fully crown closed, which is usually achieved 3-5 years post planting.

Care must be taken to avoid damaging the lower branches or stems when performing vegetation management treatments. Consequently, smaller tools and prime movers are required as the crop grows. The CWFC recommends that cultivation should never be deeper than 4-5 cm as the root systems will be damaged by a deep disturbance. Dying lateral branches and suckering between the rows are indicators of root damage. Cultivation can be completed using depth controlled discs, s-tines, fixed, spring loaded, and power rotary harrows, or depth controlled horizontal drum or fixed-blade rotorvators. Mowing is only recommended if vegetation was not adequately controlled and the site has deeply established vegetation. A mowing followed by a shrouded glyphosate application during the active growing season can rectify this issue. Five to eight metre bare soil buffers around the plantation should be maintained on an annual basis to eliminate rodent habitat and fire risk.

Vegetation adjacent to the tree bole in the first 2-3 years can be controlled by selective hand weeding, a power cultivator, a granular pre-emergent herbicide, or a shrouded sprayer. All are expensive treatments that are moderate to high risk to the tree if the proper precautions are not taken to prevent damage to the stems or root systems.

Shrouded Spraying on Afforestation Plantation (Manitoba)

Fill-planting

CWFC recommends that fill planting only be employed in the same year of initial establishment to allow the late trees an opportunity to establish their roots in the same season as the rest of the plantation. A larger, more robust tree medium should be used for fill planting and it should be completed by August 1.

Pruning

For biomass afforestation plantations, CWFC recommends no branch pruning, except in the case of selective multiple tops that could impede vertical structure development and/ or survival in an intolerant environment, as branches are also woody fibre.

Ongoing Management

After crown closure (greater than 80% leaf area for most clones) minor selective vegetation management is required. Monitoring of the site numerous times a year during the growing season is necessary to assess the crop performance and discover the presence of any pests or pathogens that may be impacting crop health and vigour. Browsing of stems, branches, and twigs is common where deer and rabbits inhabit the area. Browsing activities usually only adversely affect new growth within plantations. Furthermore, plantations of 15 plus ha can usually absorb the impacts of local wildlife while maintaining high annual biomass yields. Moose and other large mammals can damage the whole tree when it is in its juvenile state (2-4 metres), pulling the tree down to access palatable stems in the winter. When established in an agricultural setting, livestock can also cause serious damage to a plantation. Accordingly, cows and other livestock should not be grazed in afforestation plantations.

Harvesting and Production

Harvesting, transportation, storage, and processing of mature stems (usually 22-35 cm in diameter at breast height [DBH] and 18-24 m tall) are accomplished using conventional large stem mechanical full-tree logging systems. Biomass plantations may produce primary forest products from the main stem, while energy and other bioproducts are produced from the tops, branches, and twigs. The amount of biomass available for the latter is significant. Branches and twigs can amount to 25-40% of the stem volume, and 18-26 % of the total grown volume.

At the present time CWFC monitors short-rotation, high-yield afforestation plantations established on agriculture lands in Quebec, Ontario, and the Prairie Provinces. Operational scale activities are underway in Alberta and southern B.C, with an expanding program in Manitoba under a new provincial government program.

Production from short-rotation, high-yield afforestation plantations

Examples from 2 sites:

	Age in Years	Stem Volume	Tonnes CO_2e/ha/yr	Stem Vol. Increment m^3/ha/yr	Diameter/ Height
Potential	12-20+	280-400 m^3	11-17	13.5-20	35 cm/22 m
S. of Edmonton Alberta	7	78 m^3	10.4	11.1	9.5cm/10.2m
Guelph Ontario	4	38 m^3	8.95	9.5	7.5cm/7.8m

The cost to get an afforestation plantation to year five with crown closure is estimated to be $2,200-$2,800/ha, excluding land rental. At 8.5 ODT/ha per year, a 20 year-old plantation would yield 173 ODTs, equating to an establishment cost of $14.45-$20.23 per ODT.. Land rental, if applicable, harvesting and processing, and transportation costs to the final user (processing facility) must be added to accurately determine total supply costs.

Concentrated Woody Biomass Plantations

Concentrated woody biomass plantations (CWBP) are area-based plantations of selected clone shrub and tree willow or hybrid poplar with characteristics that produce high biomass accumulations in very short time frames. They have root systems that can support coppice management practices and maintain root vitality (if managed properly) for over 20 years (subject to ecozone, climatic, and physiological variation). These plantations are established using various designs, all with densities of 14,500-20,000 stems/ha. Plantations are established primarily in beds consisting of one, two, or three row patterns. The number of rows in a bed is usually dictated by the technologies and preferred practices used to establish and manage the plantations. All designs use a parallel hedge-like pattern, preferably running in a north-south direction to take advantage of the sun and avoid adjacency influences. The single row design spaces the trees 30 cm apart within a row and 1.65-1.8 m between rows (18,500-20,200/ha). The two-row bed design uses tree spacings of 61 cm within a row, 73 cm between rows and 1.52 m between beds (14,570/ha), while the three-row bed design spaces the trees 60 cm apart within rows and between rows, and 2.0 m apart between beds (15,625/ha). Concentrated woody biomass plantations require a consistent site that has level to slightly rolling topography, no stones, loam to clay-loam soils, moderate to well drained soils, a pH of 5.0-8.0, and low salinity.

Site suitability classification has been completed nationally that uses biogeoclimatic indices to rate productivity potential for these practices on agricultural lands. Sites from PEI to BC have suitable characteristics for deployment of this management practice.

6 Week-Old Willow Concentrated Woody Biomass Plantation (Ontario)

Site Preparation

Site preparation of CWBP candidate sites includes a deep–tilled, weed-free microsite with a fine finish mix. This is accomplished using a disc, deep cultivator, or powered rotorvator, or a combination of the three followed by a green-up stage and broadcast application of glyphosate or another acceptable herbicide, and finally a finish mix of the top 15-20 cm just before planting. A systematic and parallel marking of the centre point of the beds or rows is completed followed by mechanical planting using a multi-row transplanter or manual planting once the rooting environment is warmer than 12°C and moist. Mechanical planters plant several parallel rows simultaneously, with 20-25 cm cuttings being the preferred plant medium. Manual planting can also be done, but alignment (parallel rows) is essential within the rows to allow for effective vegetation management. All species and clones used in CWBP are propagated from 1-2 year-old stem cuttings, soaked in water prior to planting for 12-18 hours, and then planted vertically (buds up) with 2-3 cm above the soil surface. Compaction of the cuttings is completed by the packing wheels located behind the planting mechanisms of the transplanter.

3-Row Concentrated Biomass Mechanical Planter (Alberta)

Vegetation Management

Once planted, usually cuttings will flush within 10 days. CWFC recommends vegetation management commence within 2 weeks following planting (unless there is no vegetation growing on the site) using a multiple split-row tiller or cultivator that straddles the rows and mulches the establishing competitors within 8-10 cm of the stems. Split row machines can operate on sites with parallel rows and are powered or pulled by a small to medium tractor (18-45 horsepower). Between beds, disc, s-tine, or powered rotovators can be used to eliminate the competing vegetation. Management tools should not compact the site or damage the crop tree stems or roots. Operations should be shallow, impacting only 2-4 cm of the soil surface. Mechanical vegetation management treatments should be repeated two or three times in the first season, based on weather conditions and vegetation vigour. Acceptable chemical applications can be used as an alternative to the mechanical treatments, but are not necessary if mechanical systems are employed in a timely and operationally effective manner. A selective hand weeding of the vegetation adjacent to the tree stem can be completed in the first season to maximize crop tree establishment effectiveness.

Pruning

At the end of the first growing season and once the plants are dormant, cutting of stems is completed at 8-12 cm above the ground using a sicklebar mower or brushsaw. This stimulates multiple stem, coppice origin growth (from the stem) that maximizes leaf area spread. Split-row cultivation between the tree rows is completed until the plants occupy the full bed or the height impedes the operations (split-row cultivators are shrouded with front deflectors diverting the crop trees outside of the cultivation action). Between bed cultivation continues until the crop trees fill the canopy of the site to a degree that eliminates the majority of the competing vegetation. Willows and hybrid poplar stems will be approx. 0.8-1.5 m tall after year one, 1.5-3 m at the end of year two and 4-6 m at year three, dependent on the clone, management intensity, and site quality.

2 Year-Old Willow Concentrated Biomass Plantation

Harvesting and Production

Concentrated wood biomass plantations are managed to year three post-coppice (four years post-planting), and are then harvested using continuous mechanical systems that effectively clean-cut the stems horizontally at approximately 15 cm in height and gathers, bundles, bales, chips, or mulches the stems for conversion to energy or other bioproducts. Manual brush or chainsaw cutting and hand removal has been performed on developmental plantations to determine production volumes and assess species and clone second generation response. New harvest technologies are being developed, introduced, and tested in Canada to address harvest methods on both small and large scales. Each species and clone has unique physical characteristics that influence harvest methods, recovery levels, and final handling methods. Harvest of the stems should occur every three years and there is potential for five to seven harvests on each plantation. Given that concentrated biomass systems are relatively new in Canada, the number of effective harvest generations or cycles is not fully known at this time.

Fertilization using a medium that delivers 100 kg per ha of nitrogen is recommended in the season after each harvest cycle.

Yields from CWBPs range from 6 to 12 ODTs per ha per year, depending on the site, species, and clone, management intensity and effectiveness, and level of protection from biotic and abiotic damage agents. Work is currently being performed by various research agencies across Canada to identify and mitigate animal browse, insect, diseases, weather, and other damaging agents. Costs for the establishment and management of these plantations ranges from $8,500 to $13,500 per ha excluding harvesting, handling and transport of the biomass recovered after each cycle.

... regeneration strategies that would recover competing tree and shrub biomass while releasing the desired crop trees would definitely increase biomass volumes on natural forest sites.

At the present time there are research and CWBPs in Quebec, Ontario, Manitoba, Saskatchewan, and Alberta. In Quebec, Saskatchewan, and Alberta, biowaste from the livestock industry and municipalities is being incorporated into the woody crop management regimes to increase yield (acting as fertilizer and irrigation) and address the issue of disposing of these materials.

Natural Regeneration

Natural forests are regenerated using natural seed sources, root suckering, stem coppicing or planting of seedlings (usually conifer) onto sites following harvesting or natural disturbance, mechanical site preparation or scarification (a site preparation technique that stimulates natural seeding or root sucker oriented regeneration). In Canada, there are approximately 500,000 ha left for natural regeneration, 150,000 ha scarified for natural seeding and hardwood suckering, and 300,000 ha planted annually.

Biomass produced by natural forest regeneration systems can create 0.6 to 5.8 oven dried tonnes/ha (ODTs) per year of woody biomass from stems, branches, and twigs over their lifespan, with higher values realized in mixed wood stands than pure hardwood or pure softwood. This is based on conventional forest management with large stem product preferences, not strictly biomass production. Although there are options for more biomass-intensive local management practices, our natural forests grow at rates significantly lower than purpose grown afforestation scenarios, which employ fast-growing hybrid hardwoods and intensive management regimes on productive agriculture lands.

For instance, regeneration strategies that would recover competing tree and shrub biomass while releasing the desired crop trees would definitely increase biomass volumes on natural forest sites. High density regeneration of trembling aspen (in the Boreal Plains) originating from root suckers after clearcut harvesting, and tolerant hardwood/softwood regeneration in the Acadian forests are two examples of opportunities for high volume woody biomass recovery in short timeframes under natural forest conditions. Although the fibre characteristics are those of juvenile trees, the potential sources of biomass for energy in 5-12 years post disturbance cycles could produce multiple short-term crops, dependent on species, stand complex and site. Fire origin nature lodgepole and jack pine stands are also potential sources of high volume biomass and pre-commercial thinning at 15-20 years could recover biomass volumes equal to those of purpose grown plantations on some sites.

Possible Approaches for Natural Forest Biomass

The following two hypothetical case scenarios also illustrate the potential for a more intensive approach to natural forests management for both biomass and higher value products:

Approach 1: Hardwood/softwood mix with a preference for softwood crop long-term: Hardwoods are regenerated naturally (aspen/poplar suckering) with softwood (white spruce) planted as the preferred crop. The hardwood component is maintained until the softwood is established (year 6-12), at which time the hardwood is harvested for woody biomass recovery and as a release treatment for the softwood. The softwood is managed for higher value products over the long-term, with selective entries for biomass recovery of non-commercial stems and species (tree and shrub). Final harvest sorts the valuable logs and roundwood, while the tops and branches are recovered as biomass.

Approach 2: Pure natural or planted softwood designed for multiple entry harvest scenarios: High density spruce, fir, or pine are managed to achieve short-term crown closure (year 15-20), followed by several entries to recover biomass and pulp. Final harvest sorts the valuable logs and roundwood within each approach, while the tops and branches recovered as biomass.

While the discussion of these scenarios is not new, to the author's knowledge they are not a present practice.

Harvest recovery, handling, processing, transportation, and other production chain components have not been adequately

Mulching Natural Juvenile Hardwood Stand (Quebec)

Mulching Dense Fire Origin Lodgepole Pine (Alberta)

developed or adapted from small scale logging systems and short-rotation, small woody stem harvest, and processing technologies used in other industries. These technologies include: combining (agriculture harvesting), chopping or mulch and gathering, cut and bundle baling, or progressive chipping. Ecological sustainability and operational entry options and timing of these practices will require additional research and innovative development to fully realize these illustrated cases. However, emerging demand for bioenergy will drive these opportunities, and as there are very few major technological leaps to bridge, appropriate policy incentives can accelerate this development.

Natural forests are definite candidates for short-rotation afforestation-like systems, but at present more holistic land management is pursued on these lands. Selected native aspen, balsam poplar, and cottonwoods under very intensive management regimes could be established on forest sites to reduce rotation age and recover high yields of a specific fibre type or woody biomass.

New and exciting opportunities for the silviculture industry in woody biomass production could prove to sustain us through the economic downturn and energy cost increases we are experiencing.

Softwood Thinning (Nova Scotia)

Derek Sidders is a Regional Coordinator for the Canadian Wood Fibre Centre and the leader of the Silviculture and Afforestation Innovation Group centred in Edmonton. The Canadian Wood Fibre Centre is a virtual centre of the Canadian Forest Service, one of four member organizations of FPInnovations.

WESTERN

SILVICULTURAL CONTRACTORS' ASSOCIATION

by John Betts, Executive Director

Results-based Forestry: More Quid Than Quo?

Early in the first BC Liberal parliament, government acted to move away from the prescriptive requirements of the Forest Practices Code. The regulatory burden of the Code was seen as an unproductive intrusion of government into the more efficient functioning of business. Forestry would now be conducted in a "results-based" environment. The WSCA supported this regulatory shift believing it would not only reduce administrative and planning costs, but lead to better forestry as well. In fact we saw a clear quid pro quo implied in the transition. In exchange for government reducing forestry red tape, forest companies would practice more efficient, effective, and innovative forestry. Now, quite a few years later, with so many of the key silviculture indicators in decline, it looks more quid than quo. In exchange for less regulation we seem to be getting less forestry.

Recently, the new BC Minister of Forests and Range has emphasized the need to practice silviculture more aggressively if we are to offset the looming falldown in timber supply. Minister Bell has indicated he is prepared to look at changing the tenure system in particular, to ensure that we have forests tended for their full rotation. He sees that managing to free growing is not only a simplistic standard, but one that falls short of the demanding ecological and economic imperatives we face today. Minister Bell recognizes the importance of intensive silviculture and sees it as a direct instrument to increase forest productivity. Implicit in the minister's thinking are exotic possibilities such as stewardship tenures and carbon credit funding streams. But he also recognizes that for these kinds of investments to be made there has to be some kind of incentive for the investors. In other words, a far more defined quid pro quo: if you invest you get the return on your forestry efforts.

This kind of thinking is necessary and welcome, particularly from the Minister of Forests. This province knows how to grow forests. What is needed then is some sort of host environment that can foster the efficiencies, effectiveness, and innovations we are capable of. The Minister is on the right track and seems to be prepared to challenge the conventions that have brought us to the present crisis. In that, the Minister has the full support of the silviculture sector and probably many of the operational foresters who want to practice the kind of forestry they are trained to do and that the province needs.

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

La marche vers le nouveau régime forestier continue

Lors de la dernière parution de *Canadian Silviculture*, nous avons donné un aperçu de l'état des discussions dans notre route vers un nouveau régime forestier. Voici un bref rappel: en février dernier, le ministre des Ressources naturelles et de la Faune déposait un livre vert sur la forêt dans le but avoué de tenir des consultations à l'automne et finalement présenter un projet de loi avant l'ajournement de la Chambre en décembre prochain. Toutefois les choses ne se sont pas passées ainsi et le gouvernement est plutôt revenu à la charge en juin avec un document de travail et l'annonce d'une commission parlementaire à l'automne.

Ce document de travail a suscité l'insatisfaction de tous les groupes impliqués en foresterie. Dans un communiqué publié conjointement par l'Association des entrepreneurs en travaux sylvicoles du Québec (AETSQ), le Conseil de l'industrie du Québec (CIFQ), la Fédération québécoise des coopératives forestières (FQCF) et le Regroupement des sociétés d'aménagement forestier du Québec (RESAM), on pouvait lire que ce document constituait « un recul par rapport aux consensus du Sommet sur l'avenir du secteur forestier québécois. » Les partenaires ont ajouté : « C'est aussi un recul évident par rapport au Livre vert. Enfin, c'est un recul encore plus flagrant sur certains éléments en regard desquels le gouvernement s'était pourtant engagé publiquement. » Lors des consultations sur le Livre vert, les partenaires ont demandé des éclaircissements au gouvernement mais se sont retrouvé avec davantage de questions que de réponses suite au dépôt du document de consultation.

S'unir pour mieux avancer

Devant cette déception, des partenaires de différents horizons ont décidé de s'unir et de travailler sur une proposition qui pourrait rallier l'ensemble du secteur forestier. Ils ont pris comme point de départ les 12 consensus du Sommet ainsi que les 5 objectifs généraux du Livre vert. Ils ont également pris en compte les nouvelles réalités énoncées par le document de travail du gouvernement en regard du travail des sylviculteurs. Bien qu'il s'agisse d'un projet aussi audacieux que périlleux, les partenaires souhaitent avant tout mettre de l'avant des pistes de solution durables autant pour assurer un approvisionnement stable de matière ligneuse que pour améliorer le sort de l'industrie sylvicole. Le groupe s'est même permis de visiter une diversification des modes de tenure au Québec. Par exemple, nous pourrions instaurer le concept de forêt de proximité, développer la forêt habitée ou concéder davantage de conventions d'aménagement forestier (CvAF) et d'aménagement faunique où les entreprises sylvicoles deviendraient des productrices de ressources.

Un des éléments les plus nébuleux du Livre vert était sans doute l'instauration d'une instance régionale pour articuler toute la nouvelle stratégie forestière. Dans le document de travail, le MRNF a donné un nom à ces nouvelles structures : les Sociétés d'aménagement des forêts. Le groupe de travail s'est également penché sur la question et a élaboré le modèle qu'il juge le plus adéquat pour répondre aux besoins des divers intervenants forestiers. Mais le plus important pour les partenaires est d'éviter de créer une nouvelle structure. Il faut plutôt utiliser ce qui existe déjà et l'adapter à nos besoins. À notre avis, le mandat de cette instance régionale doit être bien défini et devrait surtout consister à élaborer les orientations, les objectifs et les stratégies à adopter pour tendre vers une gestion intégrée des ressources du territoire forestier. Afin d'assurer la représentativité de cet organisme, il est proposé que les principaux acteurs et utilisateurs de la forêt participent aux discussions. Ce faisant, l'organisme régional serait en même temps près de son milieu mais aussi indépendant et à l'abri de toute influence, chacune des parties pouvant faire contrepoids à une décision qui irait dans le sens d'un seul des groupes en cause. Également, le groupe de travail souhaite que le MRNF demeure un joueur important mais son rôle exact n'est pas encore précisé.

Un élément crucial pour les sylviculteurs est sans aucun doute la création d'un fonds d'investissements sylvicoles dédié à l'intensification de l'aménagement forestier. Il est maintenant connu de tous que depuis plusieurs années, le gouvernement parle d'une telle intensification au Québec mais malheureusement, les moyens sont absents. Avec un tel fonds, les entreprises d'aménagement disposeraient des sommes nécessaires afin de non seulement rattraper le retard mais surtout le combler, dans le but d'atteindre notre objectif ultime: Doubler la valeur des produits issus de la forêt.

Avant de crier victoire…

Au moment d'écrire ces lignes, le document du groupe de travail est toujours en évolution constante. S'il est accepté par les instances officielles de chacun des partenaires, le document devra ensuite être soumis à la ministre par intérim des Ressources naturelles et de la Faune, madame Julie Boulet. Il y a donc loin de la coupe aux lèvres. Avant que le document ne devienne la référence, il reste encore beaucoup de chemin à parcourir et on ne sait jamais de quoi la route sera faite. Une chose est certaine, il témoigne de la volonté ferme du milieu de prendre son destin en main et de trouver des solutions durables qui permettront non seulement de redresser l'industrie forestière mais de permettre une meilleure cohabitation entre les usagers.

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

Moving towards a New Forestry Régime in Quebec

In the last issue of *Canadian Silviculture*, we outlined the state of discussions on our way to a new forestry régime. Here is a brief recapitulation: last February the Minister of Natural Resources and Wildlife tabled a Green Paper on forests, with the stated intention of holding consultations in the fall and finally presenting a draft bill before the National Assembly adjourned next December. Things didn't happen like that, however, and the government returned instead to the question in June with a working paper and the announcement of a parliamentary commission for the fall.

The working paper aroused a negative reaction in all forestry-related groups. In a communiqué published jointly by the Quebec Association of Silvicultural Contractors (AETSQ), the Quebec Council of the Forestry Industry (CIFQ), the Quebec Federation of Forestry Co-operatives (FQCF), and the Grouping of Forestry Management Companies of Quebec (RESAM), one could read that this document was "a backward step with respect to the consensus reached by the Summit on the Future of the Forestry Sector in Quebec." The partners added, "It is also a retreat from the Green Paper. Finally, it is a still more flagrant retreat from certain elements with respect to which the government had nevertheless publicly committed itself." At the time of the Green Paper consultations, the partners had demanded clarifications from the government, but found themselves with more questions than answers following the tabling of the consultation paper.

Unite to make better progress

In the face of this disappointment, the partners from different segments decided to join forces and work on a proposal that might unite the whole forestry sector. As their starting point, they took the twelve points of agreement of the Summit as well as the five general objectives of the Green Paper. They also took into account the new realities presented in the government's working paper with regard to silvicultural work. Although their project is both bold and risky, the partners wanted to put forward sustainable solutions, both to assure a stable supply of timber and to improve the lot of the silvicultural industry. The group even undertook to consider a diversification of leasing practices in Quebec. For example, we might launch the concept of adjacent forests, develop an inhabited forest, or grant more forestry management agreements (CvAF) and wildlife management contracts, in which silvicultural companies would become resource producers.

One of the vaguest items in the Green Paper was probably the creation of a regional agency to layout the entire new forestry strategy. In the working paper, the Ministry gave a name to these new structures: Forest Management Societies. The working group also studied this question and developed a model that it considered most suitable to respond to the needs of the various forestry participants. But the most important concern for the partners was to avoid creating a new structure. What is needed is to make use of what already exists and to adapt it to our needs. In our view, the mandate of this regional agency must be carefully defined and should consist above all in detailing the directions, objectives, and strategies to be adopted in order to move towards an integrated administration of the forest's resources. To assure that this organism will be representative, it is proposed that the principal workers and users of the forest take part in the discussions. By this means, the regional agency would be at the same time close to its area but independent and free of outside influence, with each of the parties being able to act as a counterbalance to a decision that favoured only one of the groups concerned. Similarly, the working group wants the Ministry to remain an important player, but its role has not yet been defined.

A crucial element for the silvicultural contractors is undoubtedly the establishment of a silvicultural investment fund dedicated to the intensification of forestry management. It is now general knowledge that for several years the Quebec government has been talking about such an intensification, but unfortunately the means are lacking. With such a fund, management companies would have the necessary resources, not only to catch up with the backlog, but to exceed it with a view to attaining our ultimate objective - doubling the value of products from the forests.

Before we claim victory…

As these lines are being written, the working group's paper is still constantly evolving. If it is accepted by the officials of each of the partners, the document will then have to be submitted to the acting Minister of Natural Resources and Wildlife, Madame Julie Boulet. There's many a slip betwixt the cup and the lip. Before the document becomes an official guide, there is a long road to travel and one never knows what that road may contain. One thing is certain: it bears witness to the strong determination of the milieu to take charge of its own destiny and to find durable solutions that will allow us not only to restore the forestry industry, but to make a better relationship between its users possible.

PEI

FOREST, FISH AND WILDLIFE DIVISION

by Ken Mayhew, Information Officer

Province Announces New Forest Management Program & Standards

PEI's Minister of Environment, Energy, and Forestry George Webster announced new standards for Island forests managed with public funds and technical advice. Beginning in 2008, all services and assistance for private landowners will be offered through the Forest Enhancement Program (FEP), and must meet standards set out in the new *Ecosystem-Based Forest Management Manual*. Ecosystem-based forest management looks at the forest as a whole, rather than the more traditional focus of looking only at the trees. It supports the range of goods and services forests provide, including timber and non-timber products, wildlife and habitat, clean air and water, carbon storage and more.

During the 2005 forest policy consultations, Government heard loud and clear that Islanders want programs that support a range of forest management options and values - not just economic values. PEI's new forest policy reflects this, as does the new FEP and associated standards.

Over the past few years, the province has offered two primary programs to Island woodlot owners. The Forest Renewal Program (FRP) focused on replanting clear-cuts and managing plantations,

and these programs accounted for 90% of available funds. The remaining 10% of funds were allocated to the FEP, for advice and services such as patch-cutting, strip-cutting, and enrichment planting. The new program supports a broader range of work and is intended to create a better balance between plantations and alternative types of forest management.

The revised FEP brings in a number of changes including:

• A requirement for pre-harvest management plans before a landowner may access public funds. A management plan matches the capabilities of the forest with the landowner's objectives and resources. The new program cost-shares the development of the plan.

• Minimum standards for cover patches and cavity trees for wildlife as well as for legacy trees and the amount of coarse woody material to be left on site. Standing and fallen trees are critical to forest health and productivity.

• A requirement that clear-cuts larger than two hectares include a minimum 15-metre vegetation corridor between blocks. On these sites, cover patches and corridors must comprise at least 15% of the harvest area.

• A restriction on creating plantations or using herbicides in certain types of forest, such as upland hardwoods.

• The addition of a number of special enhancement techniques designed to enhance wildlife habitat, forest aesthetics, non-timber products, and recreational values.

Landowners are still responsible for deciding what is best for them and their forests, so the new program does not restrict what they can do with their land. However, the province believes that management plans help landowners to fully understand their options before they harvest. While landowners are the final decision-makers for their lands, ultimately if they want to use public funds for this work they must meet certain standards and follow the recommendations of their plan.

The new FEP offers varying degrees of financial assistance, with funding cost-shared among the province, forest industry, and landowners. More information is available at www.gov.pe.ca/go/fep or by calling (902) 368-4700.

Ken Mayhew, Information Officer, Forests, Fish and Wildlife Division can be reached at khmayhew@gov.pe.ca or (902) 368 6450.

NOVA SCOTIA

FEDERATION OF NOVA SCOTIA WOODLAND OWNERS

by Mike Hutchinson

Bioenergy Options

Demo International 2008 rolled into Nova Scotia this September for the first time ever. In connection to the Demo field tours, there was a two-day conference focusing on the new industry buzz about bioenergy. The conference was called “Bioenergy: Developing Trends and New Opportunities for a Changing Industry”, and was hosted by the Canadian Woodlands Forum and CanBio at the Westin Nova Scotian Halifax Hotel. Over the course of two days, there were 17 speakers, followed by a field tour that included a Barrett Lumber harvesting site, Taylor Lumber co-generation plant, Enligna’s pellet mill, and Verboom Grinders Ltd. mobile biomass grinding operation.

The first three presentations covered the evolution, potential and development of biomass from the forest for energy production, followed by a series of four speakers who gave scientific and insightful looks at the ecological pros and cons of biomass harvesting in the Maritimes. After lunch, the theme turned towards the economics, innovations, and efficiencies of biomass harvesting with presentations from forest engineers and contractors. Thursday morning was a mixed bag of presentations including bioenergy development and policy frameworks, bioenergy’s niche in the carbon trading market, and three presentations discussing national and international pellet markets.

The Wednesday morning presentations were of great interest to all the forest managers in the crowd. The speakers went into considerable detail about many of the hot topics associated with taking more from the forest (whole tree logging being the most prevalent). Available biomass volumes, soil nutrition, nutrient depletion, acid accumulation, ecological productivity and diversity, site suitability for whole tree harvesting, and silvicultural improvements to unproductive stands were the topics that received the most discussion.

There were variable estimates and forecasts on each of these subjects pertaining to whole tree harvesting in the Maritime provinces (particularly NB and NS). Acid rain has pushed much of Nova Scotia’s woodland soils into acid exceedance and therefore whole tree harvesting in these areas would be detrimental, according to Michael Maine, NS Agricultural College. Site-by-site assessments must be conducted prior to harvesting to determine site suitability for whole tree harvesting. Ecological sustainability must be incorporated into industry development from the outset, not after the fact, suggested Evelyn Thiffault, CFS. Integration with existing harvesting operations is integral to economic success of biomass harvesting says Mark Ryans of FERIC). Forest machinery entrepreneurs are important in the development of fuel stock supplies and need to be supported by government and industry, according to Dominik Röser of the Finnish Forest Research Institute. Jim Verboom suggested that the burning of biomass is carbon neutral, and whole tree harvesting of stagnant stands and a follow-up regeneration plan would help improve the silvics of these unproductive sites while reducing greenhouse gases and creating more local jobs.

This conference brought clarity to the fact that biomass harvesting is the way of the future here in the Maritimes. There are clearly many decisions that need to be made quickly by government policy makers. The industry, and ultimately the forest, will be in dire need of some regulations before this time next year as contractors, sawmills, green energy projects, and pellet producers ramp up demand for low-quality forest products.

New Brunswick and Nova Scotia (collectively) currently consume about 5.1 million green metric tonnes (GMT) of biomass annually. This figure is estimated to rise by another 1.3 million GMT within the next 12-18 months to satisfy demands from new co-generation plants and pellet mills throughout the two provinces, stated Dave Palmer, of theYork-Sunbury-Charlotte Marketing Board. Without some forethought and careful constitution of biomass harvesting guidelines on a provincial level, demands for more forest fibre could easily lead to irreversible damage to our forests. Conversely, if the provincial leaders of Natural Resources cooperate with industry, entrepreneurs, and research scientists to set a framework for the ecological and economical success of this new opportunity, I remain convinced that the forest can supply us with an invaluable resource. Bioenergy just may be part of the answer we have been looking for - steering away from high levels of fossil fuel consumption, and easing the forest industry out of its current recession.

Mike Hutchinson is a Forest Technologist and is on the Projects Committee at the Federation of Nova Scotia Woodland Owners.

AGFOR REPORT

by Gaston Damecour

Public Support of Silviculture

The forest sector is experiencing what some commentators are calling the perfect storm. What is less well known is how the various forest sector players are weathering it.

Harvesting

With more than half the pulp and paper sector closed and most sawmills closed temporarily or permanently, Don Roberts of CIBC World Markets Inc. and Peter Woodbridge, Woodbridge Associates Inc., say that wood purchases from private woodlots are down by more than 50% since 2004. In their recent report, *Future Opportunities for the Forest Products Industry in New Brunswick*, Roberts also suggests that the logging contractor fleet may have fallen below its critical mass.

Silviculture

In its March 2008 budget, the Government of New Brunswick announced an unexpected 50% cut to its private lands silviculture program - from an annual budget of $8 million to $4 million. To add to the shock of the cut, a change in the funding formula now requires the landowner to cover 50% of the costs, up from 20%. This alone is having a serious dampening effect.

These were stunning decisions by a government whose leader has consistently said - beginning with his 2003 electoral platform - that he is committed to the implementation of a "dedicated 10-year silviculture fund for private woodlot owners in order to foster stability and long-term planning." As recently as 2007, in a meeting with woodlot owners, Premier Shawn Graham advocated a "10-year sustainable silviculture program". The immediate reaction was one of shock, when the announcement came on the eve of the 2008 silviculture season. Contractors scaled back their silviculture activity immediately, leaving many silvicultural workers scrambling for other employment.

There is no evidence of recovery from the decimation of the budget and subsequent downsizing. "The silvicultural critical mass has taken a hard hit," states Ken Hardie, Executive Director of the New Brunswick Federation of Woodlot Owners.

Rural New Brunswick did not take this lying down and there were numerous meetings and heated demonstrations, which included one on April 14, 2008 at the Premier's constituency office in Rexton.

The New Brunswick Department of Natural Resources and the New Brunswick Federation of Woodlot Owners held several productive meetings during this heated period that resulted in a workable solution: a $6 million program with an expectation that landowners would contribute 30%.

Furthermore, the province agreed to fund one forest technician for one year at each of the forest products marketing boards. The additional funding came from New Brunswick's $30 million share of the $1 billion national aid package announced by the Government of Canada earlier this year for single-industry towns impacted by the prolonged downturn in the forest sector.

Since then, the Government of New Brunswick, the Federation of Woodlot Owners, and the seven forest products marketing boards have formed a working group to outline how landowner contributions will be made and how they will be monitored. (See the August 2007 issue of *Canadian Silviculture* for information on monitoring publicly funded silviculture.)

With all that has happened, recovery of the silviculture program on private land has been slow, with uptake at 60% below target as of early September.

The forests that cover 85% of the provincial land base, including private woodlots, are still there.

Focus on Safety

by MaryAnn Arcand and Steve Mueller

So Much Can Impair Safe Decision-making

When it comes to improving worker safety, the silviculture industry has made great progress, but we can still get off track. That's what happened in northern BC last May.

The industry was rocked by its first treeplanter fatality since 2004. A 25 year-old female passenger was killed after being thrown from a crew cab during a rollover on a haul road. She was the only one of five occupants not wearing a seat belt. For everyone else, the incident meant only minor injuries.

The obvious moral of this story seems to be that seat belts save lives, but we think it goes much deeper. We wonder why this worker chose not to buckle up and the driver let her get away with it. For them, the seat belt was hardware that depended on the critical software of decision-making.

If we believe that driving is the most hazardous activity our workers face, then we need to pay more attention to what influences, or impairs, the choices made by workers and the people responsible for them. Broader health and wellness factors - such as fatigue, driver distractions, substance abuse, fitness and nutrition, even questionable attitudes about life and work - can all affect road safety. Factors like these can compromise judgment all too easily and can amount to impairment. Consider these examples:

„ Most treeplanters are young with blind faith in their invincibility, while older veterans can grow complacent and cut corners. Those attitudes impair decision-making, and safety, in both groups.

„ Drivers can be too easily distracted by busy haul roads, radios, cell phones, coffee cups, road maps, or even conversations with their passengers.

„ Working 15-hour days, typical for many silviculture supervisors and foremen, can leave them operating as if their blood alcohol were at 0.05. This isn't far from the level where drinking drivers are criminally impaired. Even the normal work hours of treeplanting crews combined with the often challenging sleep conditions of crowded tent cities can leave workers functionally impaired as the season wears on.

„ Fitness, or the lack of it, is also key. How many drivers make unsafe decisions because they're distracted by muscle fatigue or by cramps from poor hydration?

„ It's accepted "wisdom" that smoking pot and drinking alcohol are, for many, essential ingredients of the treeplanting experience. When it comes to both workplace and transportation safety, substance use and abuse are very real impairment factors that need to be addressed with proactive company drug and alcohol policies.

It's imperative that the definition of worker, and driver, impairment is expanded to include all the issues described above, and to deal with them. The BC Forest Safety Council is working hard at that by collaborating with industry associations, employers, workers, public health officials, and other industries whose employees share resource roads with ours. The goal is to prevent injuries and fatalities like that one that stunned us in the spring, and continue building on the safety improvements that the silviculture industry has made.

MaryAnne Arcand directs the Forestry TruckSafe program of the BC Forest Safety Council and leads its health and wellness initiatives. Steve Mueller directs the Council's forest worker development program and for 22 years was a treeplanter and silviculture contractor. For more information, go to www.bcforestsafe.org.

Seeing Red
MPB Targets America

by Debbie Minke
photos by Katherine Timm, Colorado State Forest Service

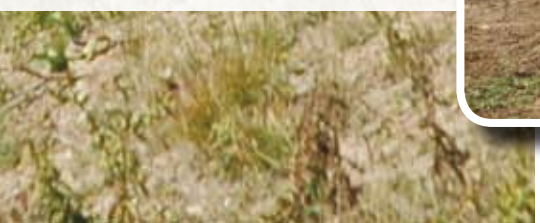
That infamous Canadian celebrity responsible for so much destruction and grief in the western parts of our fair land has also done its damage to our southern neighbour, the US. The mountain pine beetle (MPB) is native to both countries, and the current outbreak has reached epidemic and catastrophic proportions with its effects felt across North America.

There are approximately 750 million acres of forested land in the US, about one-third of the total land area (including Alaska and Hawaii). Nationwide, these forests provide numerous economic, social, and environmental benefits to residents. Unfortunately, in 2006 approximately 5.3 million acres of tree mortality was reported due to insects and diseases.

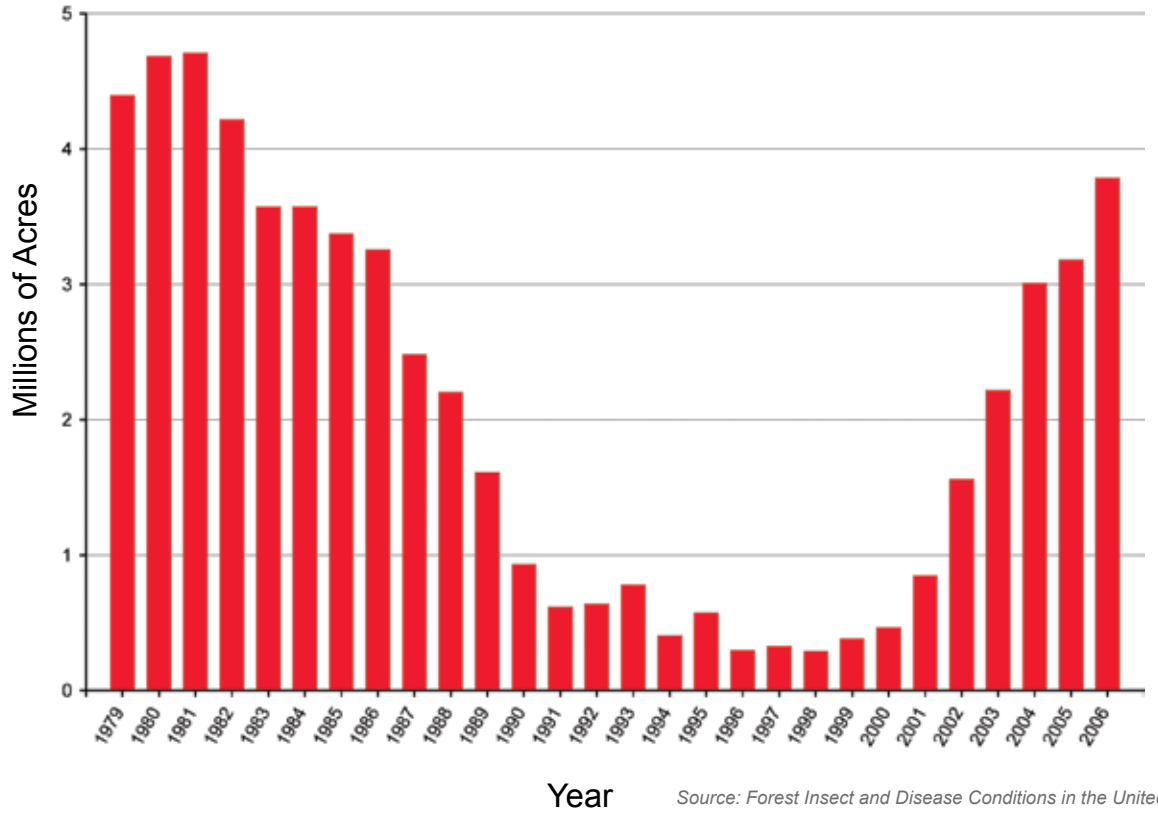
"MPB has reached epidemic levels in some states," according to Robert Mangold, Director of Forest Health Protection of the US Forest Service. "Four million acres have shown some level of mortality in 2007 due to MPB." Colorado is considered "ground zero", with California, Wyoming, Montana, Oregon, Washington, and Idaho also reporting heavy damage due to MPB infestation in the last six years. "The biggest economic generator in Colorado is recreation," according to Susan Gray, Group Leader of Forest Health Management in the Rocky Mountain Region. "MPB is affecting not only higher elevation forests, but also campsites, roads, and trails in a devastating way."

The Black Hills region in South Dakota started to report infestation in its ponderosa pine forests about three years ago, presenting significant economic impacts on the timber industry as well as recreation. "Ponderosa pine is a prolific, resilient species, so MPB infestation is a huge concern in an area where timber production is so significant to America," says Gray.

Western forests have become highly vulnerable to bark beetle infestation. "It's a smorgasbord for bugs out there," suggests Mangold. Rather than having a mosaic of uneven aged trees, the western states have huge stands of mature, densely growing trees that have been weakened by fierce competition, and are generally deteriorating due to their age of approximately 80 years. These trees are stressed and vulnerable, and are extremely susceptible to disease, infestations, and fire. Much of the western forested landscape now lacks the stand structure, species composition, and age diversity needed to resist and slow bark beetle attack. Add to these factors the prolonged drought-like conditions North America has been experiencing and rising temperatures that ensure their survival, and it's a beetle's heyday.



Mountain Pine Beetle Outbreaks in the US, 1979 - 2006



Source: Forest Insect and Disease Conditions in the United States 2006

"MPB is just one of several bark beetles that affect our forests," says Mangold. "It's a native pest that has always been around." Indeed, figures from the USDA's report *Forest Insect and Disease Conditions in the United States 2006* indicate that levels of MPB outbreaks were higher in 1981, when they peaked at more than 4.5 million acres. By 1996 infestations had dropped to less than 400,000 acres. The cyclical nature of these pest and disease outbreaks is one reason some experts aren't as worried as others.

In Canada all eyes have been on the voracious progress of MPB as it has infested Alberta and is making headway into boreal forests, having successfully colonized lodgepole and jack pine hybrids. Due to rising temperatures, MPB in the US have spread upward to whitebark pine trees, which are found at higher elevations than their favourite hosts, lodgepole and ponderosa pine. Whitebark pine has also been attacked by white pine blister rust, so the weakened trees have less resistance to MPB infestation. The beetle has invaded lower ponderosa pine forests, which have greater economic value and are important wildlife habitats.

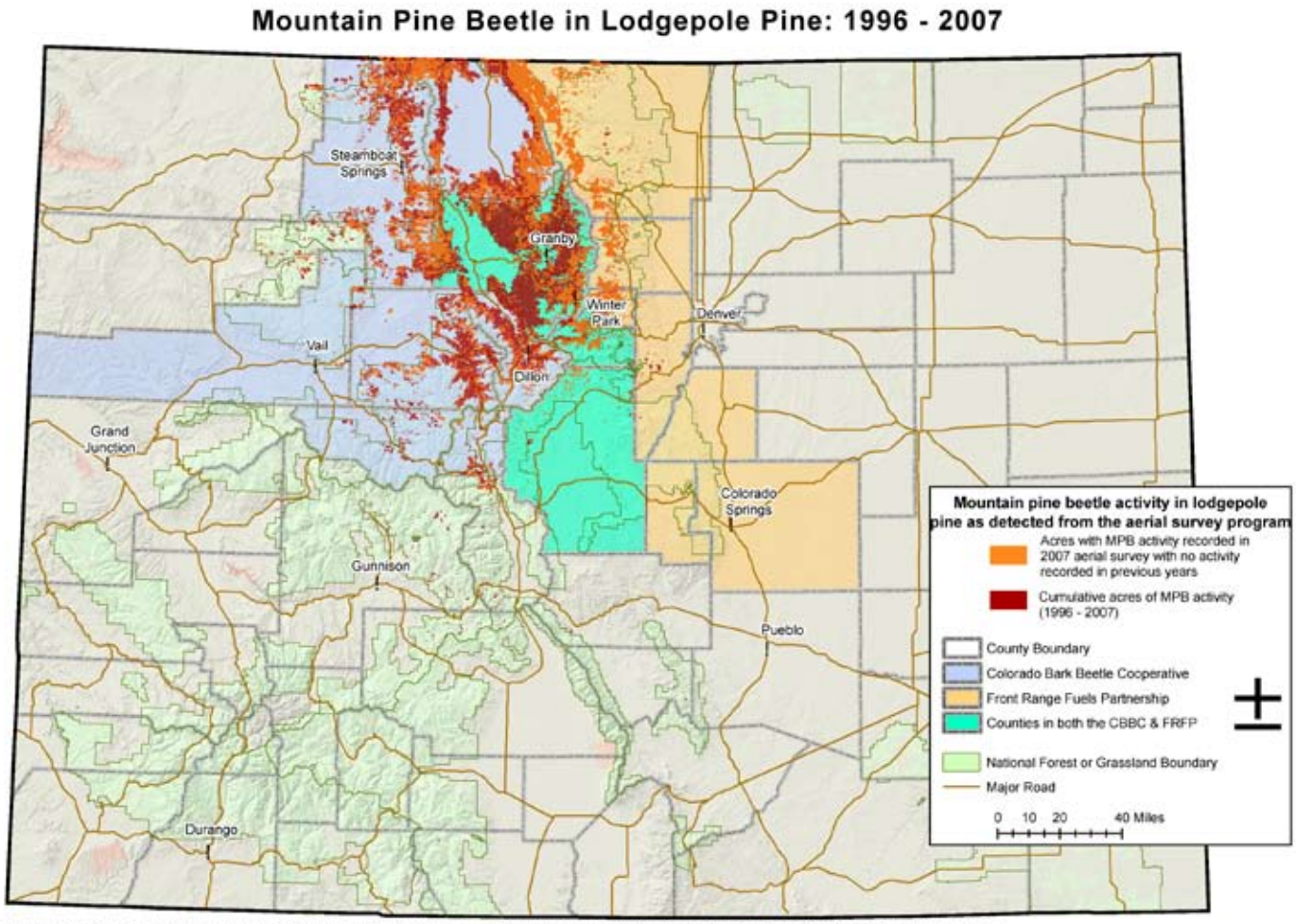
In response to the large scale outbreaks of bark beetles in recent years, the US Forest Service Health Protection department began the Western Bark Beetle Initiative in 2004. Completed by 2006, the Initiative focused on ten priority topic areas:

1. management options in critical ecosystems
2. meaning of trap catches
3. trap-out strategy effectiveness
4. interaction with fuel mitigation work
5. effectiveness of anti-aggregation pheromones
6. optimal semiochemical mixtures
7. new pheromone release devices
8. effectiveness of silvicultural strategies
9. improvement of single tree protection
10. IPM strategies for critical habitats

In all, the Initiative consisted of twenty-seven projects that examined short- and long-term treatments and promoted the development of research tools to mitigate bark beetle-caused impacts. Advancements were made on several management tools used to control western bark beetles.

Four projects were initiated or completed related to the effectiveness of traditional silvicultural strategies. Thinning treatments designed for improving forest health conditions and increasing stand resistance to bark beetle attacks were examined in ponderosa pine stands. Principal findings showed thinning with and without prescribed burning had long-term effects on ponderosa pine water stress, growth, phloem thickness, resin flow, and bark beetle abundance. Pheromone-baited trap catches of MPB were higher in unmanaged than managed stands.

Trapping technology was developed to improve monitoring, suppression, or prevention of bark beetles. Pheromone baiting lures beetles into trees that have been treated with a synthetic hormone that mimics the scent of a female beetle. Beetles can then be



Due to the nature of aerial surveys, the data on this map will only provide rough estimates of location, intensity and the resulting trend information for agents detectable from the air. Many of the most destructive diseases are not represented on this map because these agents are not detectable from aerial surveys. The data presented on this map should only be used as a partial indicator of insect and disease activity, and should be validated on the ground for actual location and casual agent. Shaded areas show locations where tree mortality or defoliation were apparent from the air. Intensity of damage is variable and not all trees in shaded areas are dead or defoliated.

Source: US Forest Service, Rocky Mountain Region

contained in a single area, where they can more easily be destroyed. Insecticides (semiochemicals) were also tested and evaluated for their effectiveness.

Silvicultural treatments were examined, such as sanitation harvesting. Single infested trees were removed to control the spread of beetle populations to other areas. Other forest management techniques such as mechanical thinning, prescribed burning, and thinning can manipulate the forest to slow down the infestation. More attention needs to be given to these silvicultural and integrated management techniques to achieve long-term results.

Since the Western Bark Beetle Initiative, there haven't been any large-scale national efforts to address beetle infestations. Federal funding has been directed to the regions, which in turn conduct specific studies to explore the effects and management of MPB. "We're not finding any treatments to be truly effective at this epidemic level of infestation," states Gray. "In fact, all the scientific research and literature about lodgepole pine and MPB is being turned upside down. We're rewriting the books."

In general, the US has not done extensive salvaging of affected trees. Rather, they are focusing on reducing fuel loads by thinning in select areas. "We're not going to solve this problem," suggests Mangold. "It will run its course like any other natural disturbance. What complicates the situation and how we handle its effects is the wildland urban interface. Unlike Canada, we have many people living in the forests." Concerns for public safety and human values are paramount.

Unfortunately, the US doesn't have a good market for affected trees. They are not readily merchantable, especially in developed recreational sites where they are not easily accessible. Lots of time, energy, and money is being spent getting the dead trees cleaned out in order to protect those who live in and enjoy the forest.

In the Rocky Mountain region, Susan Gray and her team of entomologists, pathologists, and technicians located in four different Forest Health Management offices spend more than 80% of their time on MPB-related issues. Minimizing the impacts of ongoing and future unstoppable outbreaks on the highest priority acres in the West is crucial.

Healthy forests provide many benefits - clean air and water, wildlife habitat, and recreational opportunities - while serving as renewable sources of forest products. All North Americans depend on these public benefits derived from healthy forests for their economic, social, and ecological wellbeing. High levels of tree mortality due to the MPB epidemic will be felt for generations to come. We must be committed to long-term forest stewardship in order to regain a vigorous, healthy forest resilient to pests, diseases, and drought.

Editorial

by Dirk Brinkman

Celebrating Canada's 20 Billionth Tree

It is time for Canada to celebrate the planting of its 20 billionth tree. Whether Canada's decimal moment is a milestone, a milepost, or a miletree depends on the context the reforestation industry creates at the time.

As a milestone, it may lie like a tripping stone underfoot that is best avoided by governments, especially if it only brings unwanted attention to unresolved problems in the forest. As a milepost at the forest sector's low watermark, it can bring sympathy for the pain of paying for planting in the context of the sector's crippling costs. But the big challenge is making this a living miletree, making it an occasion for the reforestation industry to bring critical attention to the opportunity of reforestation, and using the event to bring the industry back to life to do what it does best, growing.

Times have definitely changed since we celebrated 16 billion trees planted in the previous century in the Fall 2001 issue of *Canadian Silviculture*. Canada's high minded ecosystem-based National Forest Strategy (2003-2008) ended in May 2008. The Canadian Council of Forest Ministers launched a new National Forest Strategy focused on two challenges, the devastated forest sector and the devastations of climate change.

With a forest sector starved for capital, the great unraveling of the international financial markets may make some conditions worse, but it may also bring investment survivors, looking for real assets, like forests, trees, or forest products. As a forest industry milepost, Canada's 20 billionth tree may be a flag pole to attract these investors. Reforestation is a climate change action. Planting 20 billion trees that will reach free growing at least 20 years earlier than waiting for natural regeneration will result in billion of tonnes of additional carbon being taken out of the atmosphere by 2050. If the reforestation industry works with government and the forest sector, it can mark this miletree and take this 16 kilometer wide band of trees planted across Canada as a road to greater investment in reforestation.

Events surrounding BC's 6 billionth tree provide a cautionary tale for Canada's 20 billionth. On April 17, 2008 Premier Campbell invited select "community and industry leaders" to a forest sector conference side-event. The news only reached the silviculture industry after the fact, even though some reforestation leaders were at the conference. This precipitated a reforestation counter-celebration. On June 5th, all of BC's 6,000 treeplanters planted the 6 billionth tree in a unified, egalitarian revolt. The government may have been surprised at how effectively the industry's righteous indignation orchestrated simultaneous local and provincial media coverage. Treeplanters effectively highlighted both the 2009 seedling downturn and the lack of reforestation in the vast MPB devastation in BC.

Perhaps the BC government saw a 6 billionth tree celebration as a tricky milestone in the face of a 40% reduction in the number of trees to be planted in 2009. Those of us who plant know that the public thinks BC's climate greased MPB explosion is creating a 13 million hectare reforestation bonanza. Calling attention to a 40% reduction in reforestation in 2009 may have seemed unnecessary.

Perhaps this influenced Premier Campbell, who shuffled his Forest Minister some months later, to select a silviculture keener, Pat Bell, MLA from Prince George. BC's new Minister of Forest and Range has expressed a commitment to create carbon, biomass, and even reforestation or forest restoration tenures to harness the opportunities of climate change, take advantage of demand for new energy, and deal with the market challenges facing the sector.

There is a way to reforest Canada's pest, fire, and other catastrophic forest losses, and restore degraded forests without taxing the beleaguered forest industry. It is the reforestation industry's challenge to find that option.

Canadian Silviculture invites the reforestation sector to pull this Excalibur of Celebration from Canada's 20 billionth tree milestone. Let's hammer it into a tool for replanting the future of the silviculture sector when we plant Canada's 20 billionth miletree.

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