



CANADIAN

SILVICULTURE

SPRING 2003



PRE-COMMERCIAL
THINNING

SWEDISH LESSONS

PREVENTING
TREE PLANTING INJURIES



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CANADIAN SILVICULTURE



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Thinning birch trees with a clearing saw.



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by Dirk Brinkman

"Plans are worthless. Planning is essential"

Dwight D. Eisenhower, general and president (1890-1961)

In the past six months, I participated in the development of the fifth National Forest Strategy (NFS) for the period 2003-2008. This was my fourth such experience since 1985. Does a NFS make any difference?

This year also marks 25 years of planning, visioning, lobbying for change and then publishing the emerging key information and vision. The 1978 Pacific Reforestation Workers Association (PRWA) Newsletter became the Western Silviculture Contractors Association (WSCA) Newsletter in 1982 that became the Canadian Silviculture Magazine (CSM) in 1993 and Canadian Silviculture in 2001. Does a silviculture publication make any difference?

25 YEARS AGO The committee would like to take action against the BCFS for having used pesticides and chemicals that are harmful to the planter. We request that planters who have been harmfully affected from exposure to chemically treated seedlings present their case to the committee. With this information, we will approach the WCB to request an investigation into this practice and its health hazards. The committee strongly urges all contractors and planters to register their refusal to handle these trees without warning to the BCFS nurseries. The committee will request a complete record of all the treatments of each seedlot for the contractor-planter info. (PRWA Newsletter; Legal Committee Report, Dirk Brinkman)

10 YEARS AGO Canadian Silviculture Magazine reported: The CSA (Canadian Silviculture Association) and WSCA have always promoted positions of No Net Loss Forest Management where the 'consumer pays'. Lobbies within this context have included:
1986-7 (WSCA) all Crown land harvested

reforested as a first cost of the harvest. (Adopted by BC in 1987, Alberta in 1991)
1987-8 (WSCA) eliminate BC's backlog by the year 2000. (Adopted by BC in 1988)
1989-90 (WSCA/OSCA) afforest an area equal to any permanent forest land depletion as a cost of all development—e.g.; highway or Hydro line. (Adopted by Ontario Hydro in 1989, but unfortunately turned into a double accounted program by fiscally bankrupt OMNR. Hydro is now reforesting areas that should have been reforested by OMNR.)

1990-91 (WSCA/CSA) implement an intensive silviculture strategy to enhance the volume in the intensive age classes to off-set the fall-down effect of the shirking commercial forest land base.

1992 (CSA/Joyce Murray) initiate a national Carbon Sink Silviculture program of 15 billion trees over twelve years to absorb 50% of Canada's CO₂ emissions.

1993 (WSCA) all private lands reforested to Crown land standards as a first cost of the harvest.

1993 (CSA) all harvested Crown land in Ontario to be reforested as a first cost to the harvest. (Adopted by Ontario in March 1993, now being negotiated. The key issue today: Stocking Standards that allow Ontario to do nothing.)

TODAY Silviculture selections from the 2003-2008 NFS (draft) Objective 1 from the Ecosystem-based management theme: Manage Canada's forest on an ecosystem-based approach that maintains a forest's natural health, structure, functions, composition and biodiversity, and includes, but is not limited to:

- A net increase of natural forested ecosystems.
- Under the Kyoto Protocol, maintenance of carbon reservoirs and management of the forest to be a net carbon sink, on a

long-term basis.

Actions: Incorporate the effects of climate change and the Kyoto Protocol commitments on the forest ecosystem into forest policy and forest management planning.

- Reforest areas that are cut for temporary use and establish forests with similar values for areas that are cut for permanent use.
- Redirect harvesting into forests affected by forest fire, pests and disease damage to mitigate the net forest loss.
- Evaluate the full range of advantages and disadvantages of Intensive Forest Management in Canada.
- Gradually eliminate the use of synthetic, chemical pesticides in forest management.

Some change in forest use takes a generation. The national strategies and Silviculture publications record the process and definite progress towards sustainable forest management. Excluded or emerging sectors dependant on forest practice or policy do gradually get included in the resolution of issues.

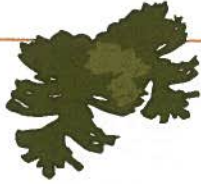
The National Forest Sector Strategy 1987-1992 was a traditional industrial forest sector national planning process. The NFS (1992-1998) Sustainable Forests included the first tentative representatives of environment and First Nations. 'Forest Sector' was changed to 'Forest'.

The Chair of the Vision, Issues Committee for the NFS 2003-2008 is now the President of Wildlife Habitat Canada. Environment and First Nations' representatives are fully engaged. However full participation of the tourism, recreation, secondary products and special forest products stakeholders is still emerging.

Working on the process change and recording progress is a privilege. Those privileged to participate in the process enjoy more value than those who read the publications. In Eisenhower's radical words, "Plans are worthless. Planning is essential."

MAKING SENSE of PCT

by Ted Needham and Neville Peasley



A diorama at the Harvard Forest Museum in Petersham, Massachusetts shows woodlot owners in the 1920's pre-commercially thinning a young forest stand as it reverts from abandoned agricultural land to become part of New England's second growth forest. Using axes and working at a relatively small scale, farmers removed unfavorable species to promote red oak, sugar maple, yellow birch, and beech.

A lot has changed since then. We mostly use spacing saws; we hire people (at about \$600/ha), and PCT is no longer done on a small scale. Approximately 152,000 hectares of crown land were treated across Canada in 2000 (Graph 1).

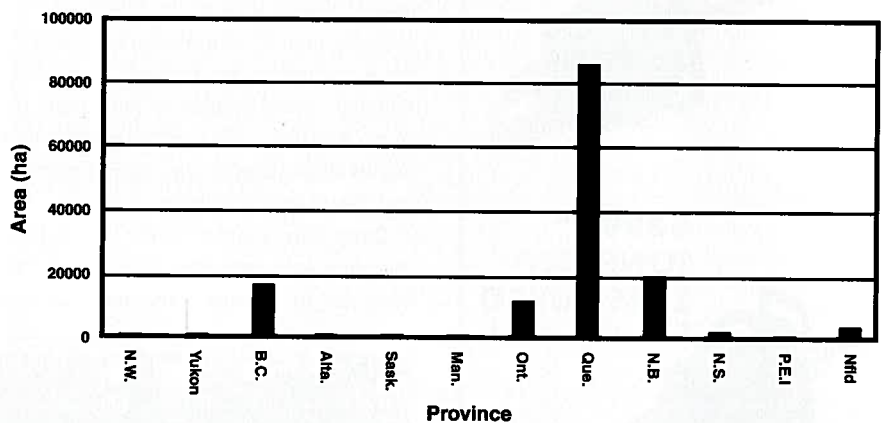
Farmers may have realized that like thinning the carrots in their garden, by thinning young trees, they could increase

the growth and yield of their stands to produce more wood of higher value in a shorter period of time. Given today's economic situation, do these advantages truly outweigh the costs? Are the growth and yield expectations reasonable? Does

pre-commercial thinning still make dollars and sense?

GROWTH AND YIELD PERSPECTIVE
Research to measure tree and stand response to tree spacing and density

GRAPH #1 Area PCT'd on Crown Land (2000)



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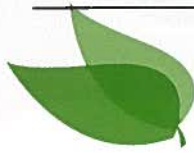


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control began in the 1950's, 60's, and 70's, although some trials were started as early as the late 30's and 40's. As a result of this work, foresters have come to expect the following growth and yield trends.

Average diameter increases

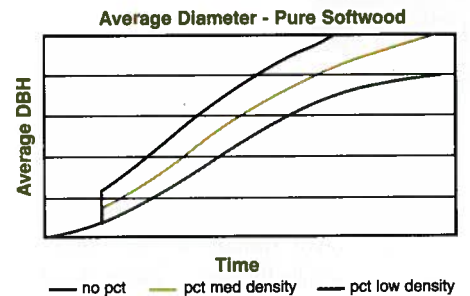
- It can be immediate if tree selection removes more small trees than big ones and diameter differences are thought to diverge over time depending on residual density levels (Graph 2).

Merchantable volume increases

- Initially, the rate of merchantable volume growth is higher. Ten to twenty years after thinning, merchantable volume can be more than twice as high as non-thinned stands depending on site quality, species and merchantability limits.

- Over the longer term we expect merchantable volume differences to continue to diverge until the carrying

GRAPH #2



capacity of the site is reached.

Height growth is unaffected except in special cases

- Such as when density is too high and species like lodge pole pine stagnate, or
- When faster growing competitors over-top crop trees.

VALUE OF PCT

PCT is an investment in the future.



in mixed species stands, there can be a huge

opportunity to favor more valuable trees

As a financial investment, the goal is to produce more value than it costs. As a wood supply investment, the goal is to meet a wood demand either in terms of when wood is available, the amount available, the species available or the type of product available.

The cost to pre-commercially thin a stand varies depending on the labour market and pre-thin density. In NB we expect to pay about \$600/ha. Graph 3 illustrates the yield and stumpage levels required from a 40 year-old balsam fir stand if PCT is done at age 15. The expected PCT yield is 170 m³/ha twenty-five years after treatment compared to 90 m³/ha for an unthinned stand. When harvested at age 40, stumpage needs to be \$21/m³ or more for the net value of the thinned stand to equal that of an unthinned stand. Current stumpage rates range between \$13/m³ and \$20/m³ for balsam fir depending on whether the wood is pulpwood or studwood quality. Clearly, the stumpage value of wood needs to increase some before PCT is deemed a good investment.

This example illustrates the tradeoffs between yield and stumpage rates needed to pay for PCT. It should be obvious that as the length of time PCT costs are carried increase, the yield and or stumpage rate required to break even also needs to increase.

Stumpage rates increase when product value increases or harvesting costs decrease. Increasing average diameter has a positive effect on both these. Product value also increases when species composition can be shifted from less valuable species to more valuable ones. In pure stands, there is no opportunity to shift species composition, however, in mixed species stands, there can be a huge opportunity to favor more valuable trees, such as favoring yellow birch over ironwood, paper birch over gray birch, or sugar maple over beech.

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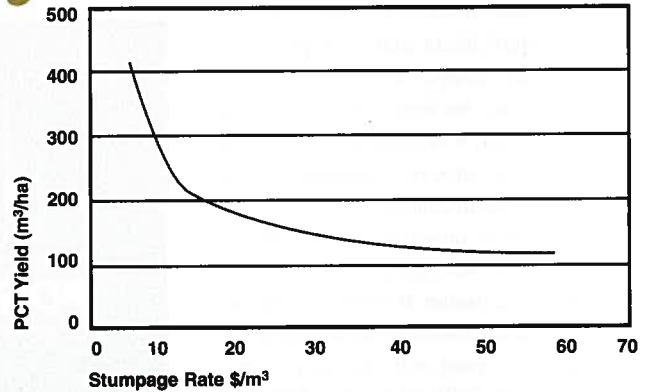
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GRAPH #3
 Breakdown PCT Analysis



Shifting species composition can also reduce the susceptibility of a stand to damaging agents that suppress survival and growth. An important species composition shift targeted in Eastern Canada is to reduce the amount of balsam fir in softwood stands while increasing the relative proportion of red or black spruce. Balsam fir is susceptible to spruce budworm and seems more likely to develop heart rot than spruce. It is shorter lived than the spruces and because the wood has a higher moisture content, it is more expensive to transport and dry. Spruce is a more valuable species and shifting species composition makes sense. Yield and stumpage differences need to be substantial or the pay-off time needs to be short for



High Density natural regeneration before thinning (50,000 trees/hectare)

merchantable volume

differences between thinned and non-thinned stands may actually converge much sooner than what was anticipated



sooner (have a sufficiently large average diameter and sufficiently high volume) than non-thinned stands, an \$800,000 annual investment in PCT could result in a 100,000 m³ annual allowable cut effect, raising the sustainable harvest level by 15% from 575,000 m³ to 675,000 m³ annually. At \$13/m³, the intervention would generate \$1.3 million annually without compromising the long-term sustainability of the forest. This is more than enough to pay for the PCT cost. After 50 years the treatment would also contribute to increasing a long-term AAC level of 800,000 m³/yr. Since each forest is unique in terms of its structure, the utility and cost effectiveness of PCT will vary from situation to situation.

CONCLUSION

So does PCT make sense and cents? In terms of species composition shifts, it may make sense. And based on our initial growth and yield expectations, it could also make cents. Fortunately or unfortunately, initial growth and yield expectations are being questioned. As experimental stands age and the

long-term dynamics of pre-commercial thinning become more apparent, it seems that the merchantable volume increases seen early on are not sustainable. In fact, merchantable volume differences between thinned and non-thinned stands may actually converge much sooner than what was anticipated. Whether this is due to better growth in unthinned stands than expected or slower growth in thinned stands than hoped for, or a combination of the 2 is not clear. However, convergence occurs because merchantable volume accretion is faster in unthinned stands as increasingly more trees become merchantable than in thinned stands, and it stabilizes in thinned stands once crowns close and the growing space is fully occupied. The timing and nature of this convergence probably depends on species, site, residual PCT density, and the merchantable volume product specifications. Depending on the timing and nature of this convergence, the financial benefit of PCT will vary.

As long as forest level wood supply analysis show the ACE and AAC benefit of pre-commercial thinning is equal to or

the treatment to be financially justified.

The use of PCT is often explained in terms of wood supply from an entire forest. Depending on the forest structure, the definition of sustainability, and initial assumptions about budget allocations available for silviculture, an allowable cut effect (ACE) can be realized as a result of PCT. That is, the annual harvest can be higher than what would otherwise be acceptable if PCT were not done. An example of how this can occur was given by Thom Erdle (1987) for a 200,000 ha forest in NB. He showed that since thinned stands become operable



Thinned down to 2000 trees per hectare; the trees are now "free to grow".

the future depends on reducing the

uncertainty in growth and yield predictions

less than the implementation cost, PCT will continue to be an attractive treatment. However, AAC and ACE determinations are also based on growth and yield predictions and if these are not accurate, the utility and cost of PCT could be wasted or wood supply analysis compromised. The sense and cents of PCT in the future depends on reducing the uncertainty in growth and yield predictions for the range of species and stand structures that exist in our forests.

Neville Peasley and Ted Needham are professors in the Faculty of Forestry and Environmental Management at the University of New Brunswick.



Dean Pennell of Corner Brook Pulp and Paper working in high density balsam fir in Western Newfoundland.

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SWEDISH *Lessons* FOR THE BC FOREST INDUSTRY

by Clay Anderson P.Eng.

The BC forest industry is approaching an economic "tipping point" with appropriate means for the liquidation of our old-growth forests driving solutions. Current policy changes address the problems through lower levels of regulation. Before details are filled in, we should review our condition in light of our largest and most successful competitor, Sweden. The relevance is important because Sweden, with the same forestland, has usurped many of our offshore and Value-added markets in the US. This has been done with plantation forests grown on less productive sites without the premier attributes of BC forests. They produce nearly double the BC forest product value and are gaining market share in the value-added world market. This article lays out the fundamentals that fostered this change in Swedish forests.

The most apparent advantage of the Swedish forestry industry over BC is its ability to grow timber profitably and sequester wealth on private forestland. This is achieved through value enhancement strategies and long rotation, multiple thinning tactics not practiced in BC. The output from Sweden's forest provides the fibre for a market-driven, broad-based, balanced industry that produces over 25% of the Swedish GDP. Their forest "Keep Home" income equals that of their Automotive, Engineered Products and High Tech. The forest industry swallowed the knowledge based "IT" revolution whole.

This came about as a result of three cataclysmic events that have seared the solutions they developed into the Swedish mind. These events have relevance for BC.

EVENT ONE

A land-restructuring event The "Lagaskifte"

At the beginning of 1800, Sweden's charcoal-based steel industry had effectively been displaced by the British Bessemer furnace. For 500 years Swedish forestry survived on a one-commodity industry - charcoal. There were no other forest enterprises except a nascent solid wood industry. There evolved a survivalist mix of forestry and agriculture - rich one day, surviving on what you could grow the next.

Swedish family structure and increased population partitioned the land into smaller, marginally economic units. The loss of the charcoal market created a dire situation - people starved to death. The land could not be adapted to other forest products, compete in agriculture or provide the necessities of life. This brought about a land reform process that lasted into the 1860's.

Land owners, communities, Kommuns, States and the Federal government went through a mutual process of rationalizing land base for the profitable use of this resource. This event was seared into the Swedish mind and created a culture of land use that is difficult to emulate in other countries. This new land structure, founded (perhaps unintentionally) on "Best Use", created an agricultural industry that provided strong family incomes for the next 90 years and provided the foundation for a world competitive forest industry. This spurred the Swedish government to allocate large forest tenures, similar to our Tree Farm Licenses, to moribund steel companies to promote investment in industrialized pulp and paper production. These

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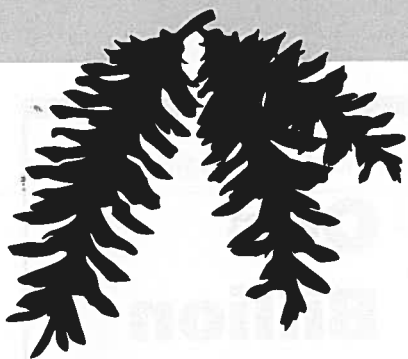
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Swedish high stocking and value management regimes are now an integral part of the restructured landbase.

tenures evolved into private ownerships. The result is a dichotomy of very large and small landowners dominated by the medium private operator. Although this evolution is partly serendipitous, it has resulted in a good balance of competing interests that co-operate in efforts to launch new world marketing efforts.

EVENT TWO

An industrial restructuring event Post WWII

After WWII, the pulp and paper industry was in crisis - too many obsolete plants and a declining fibre supply. Small landowners saw the government and the companies as collaborating in the control of log markets. Without profit, the

small operations withheld timber from the market. Market forces eventually forced a change. The number of pulp mills was reduced from 108 to 48 large, efficient plants. The market crisis pushed innovation, improved fibre recovery and increased pulpwood pricing. This brought the small landowner back into the market. Increased fibre output, initially from thinning, supported the expansion of pulping and paper-making capacity. Today, paper plants convert 90 percent of the pulp stock into exportable finished product. Fresh, small diameter, high quality pulp timber from successive thinning has high conversion potential and will produce high quality pulp at low cost, which translates into increased pulp

timber pricing. This energizes early, late and extended thinning programs, which are a distinct feature of Swedish value management of timber resources. These programs extend culmination age, which created larger culmination sizes and values ideally suited to an expansion of the solid wood product industries. The numbers of small "Niche Market" sawmills increased and large operations have become a smaller, cost conscious group. This industrial evolution is based on silvicultural regimes targeting maximum values rather than volume.

EVENT THREE

A market-restructuring event

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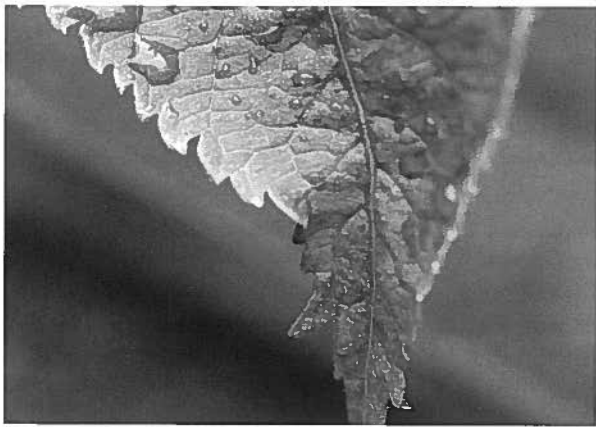
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Sweden, seventy percent of the fibre was sold as standing timber. There were no truly open or unfettered markets because of the large corporate and public land holdings. Vertically integrated companies perceived my logs from my land as the feed to my mill – log classification systems for the exchange of fibre were not trusted or accepted. Southern Sweden was organized in a different manner. There was a high percent of smaller land holdings, a truly unfettered log market, a much smaller percent of standing timber sales and wide acceptance of log classification systems. The south's free unregulated market structure provided pricing that always out-competed those in the north. This was the result of strong landowner associations "and in particular the founding of Södra Skogsägarna and the independent Swedish scaling bureau more than 50 years ago. The founding of Södra had a great impact because it shifted the emphasis from pure industry- manufacturing profit to optimizing landowner income. Initially Södra marketed the member's timber and advised on forest management aiming for optimum marketable net value/ha. It then acquired some industrial capacity (building new and purchasing existing). Södra's members thus got a much better understanding of end user demands and the importance of aggressive Marketing. This experience has proven that quality and efficiency is more important than quantity and that an independent scaling organisation with proper grading rules is a must for a properly functioning log market." (Source: Lennart Sandstrom and Bo Hecter)

Observing the greater efficiency of southern Sweden's diverse ownership gave the north the confidence to price logs in truly unfettered markets. As the market evolved, the government sold land holdings and large landowners consolidated the land base. In a short time, the percent of private land holdings increased from 40% to over 54%. (Large corporate and public land holdings decreased from 33% and 20% to 24% and 12%). The effectiveness of the open log market, the log classification system and the diverse ownership resulted in a drop in standing timber sales



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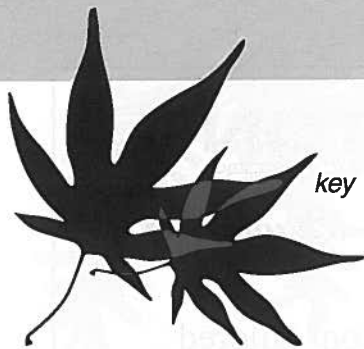
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key to improvement was an

evolving

open and unfettered timber market

that linked the three interdependent competitive parts of the forest industry...

to less than 10%. Swedish high stocking and value management regimes are now an integral part of the restructured land base and rationalized markets – but not without fits and starts. Thirty years ago, there was a trend toward low stocking, fast growth and pruning as the timber resource regime. The manufacturers and low potential values ended that trend.

Synergies resulted from integrating advanced silvicultural regimes, unencumbered log markets and restructured pulp/paper/sawmill industries. This brought about the latest evolution in Swedish industry – the high level of energy production from forest biomass. This has had a significant impact on industrial and landowner economics. Currently the market places a value on biomass that is competitive to low-grade

pulp fibre. This diversion of low-grade fibre to energy production upgrades the pulp/sawmill fibre supply, converts fibre from negative to positive values and has increased the landowners net returns by more than 15%.

We should note that Swedish forest industrial evolution has been driven by the markets capability to direct the various elements of the timber profile to the best economic use without regulation. This has been fostered by three innovative strategies:

1. Economic silvicultural technologies that supply 60% of the pulp mill fibre in high conversion, green, small diameter round wood. This has increased conversion efficiency by >40%, increased small log values, made first thinning profitable, markedly improved the quality

and reduced the cost of pulp. No BC pulp mill has these levels of recovery, but they could.

2. Silvicultural regimes that target a high portion of the yield as tight-knotted evenly grained fibre, used in value-added and engineered products. This high-density stand characteristic produces higher returns than the clear wood potential of pruned stands. Tests have proven that there is great potential for this high quality fibre in thinned coastal BC Douglas fir stands.

3. Profitable energy production from the low value component of the fibre supply. Full “co-gen” units can now produce energy at \$.038/KWH, supply district heating at gas equivalent prices of \$3.50/therm and pay competitive prices for biomass. This stabilizes plant

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and community energy costs over the long-term. This profitably utilizes sub-marginal logs, dry logs, slabs, trim ends and waste, which removes the high cost, low recovery components from the solid fibre/pulp mill flow.

Today's reformed Swedish market system encompasses six landowner associations, representing 50 percent of the forestland ownership, counter balanced by a mix of independent owners and the large integrated companies. The key to improvement was an evolving open and unfettered timber market that linked the three interdependent competitive parts of the forest industry, set prices, log values and generated financial returns. The impetus has been the increasing wealth and profitability of the medium and small landowner proving that owning and growing timber is profitable.

PARALLELS FOR A NEW BC MODEL

The structural success of the Swedish experience can be translated into BC with two parallel steps:

1. Change silvicultural regimes from volume-based to value-based systems.
2. Create unfettered log/timber exchanges for the full use and distribution of BC's wide range of timber attributes.

A new silvicultural strategy based on long rotations, highly stocking and repeatedly thinned stands will support higher value flowing through open market exchanges. This will allow the three independent industrial sectors (growing, logging, milling) to focus on their core activities. The new BC business model would be based on growing timber for value and profit, targeting customer-driven products starting at the standing tree and profitably converting small and low-grade logs.

A decision to change our silvicultural strategy to value/yield enhancement rather than volume-based will trigger a completely different future for BC's industry. The instant this silvicultural action/decision is taken, the forecasted "fall-down affect" will virtually disappear. This combined with the independent log/timber exchange's increased utilization will revitalize BC's whole sector. Sweden would be here to learn our lessons.

Clay Anderson has been CEO of C.H. Anderson & Associates LTD. since 1960 and has played a vital role in the development of harvesting systems, mechanization of thinning and whole systems designed to optimize forest value from silviculture through to manufacturing. He has worked in research, product design and joint venture project management in Austria, Germany, Sweden, the USA and across Canada.

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WESTERN SILVICULTURAL CONTRACTORS' ASSOCIATION

by Chris Akehurst



The BC Liberal Government finally unveiled its long-awaited legislation to restructure the Provincial Forest Industry last week. For anyone interested, details can be found at for.gov.bc.ca/mof/plan. The Government has embarked on a very bold path which will shake up the status quo. The Government is to be congratulated on trying to tackle the major structural problems that have bedevilled the industry for the last 15 years. All other recent Governments have shied away from dealing with these issues. The WSCA applauds the awarding of more tenure to the First Nations, Communities and Woodlot owners. Perhaps it is a sign of the poor state of the industry in BC that there is very little criticism of these reforms from the major licensees who are going to lose 20% of their tenures. However, it is fair to say that there is a lot of apprehension about how the Forest Revitalization Act will work out. The Government's plan is only laid out in broad form at the moment, but "the Devil is the detail", and there is a whole bunch of work to be done before we really see the real impact of the Act.

What do these reforms mean to the silviculture industry? On the surface not too much, as the wood will still be logged

and basic silviculture requirements are still in place. It might mean that there will be a lot more smaller silviculture contracts offered than at present. The elimination of cut control could make for a more cyclical market, as tenure holders will only log when prices are up. There is also potential for contractors to form strategic alliances or partnerships with First Nations Bands and communities.

However, it was what was not in the Government's proposals that concern our industry. There is nothing in these proposals that enables the Government to fulfill its "New ERA" promise: "To increase the AAC through scientific forest management, proper planning and incentives to promote enhanced silviculture."

The question of Silviculture Funding remains a critical issue. To truly address the forestry funding problem, we need to include remedies that are part of these wider reforms. These remedies should not be mere addenda to the emerging new order, otherwise it sounds like we will only continue the current failed methods (>30 extinct Forest Funds in 30 years). These ideas need to come forward now to take proper root in the legislative packages being proposed.

The WSCA has developed a set of principles, "Silviculture Principles for Sustainable Forest Management" that

attempt to deal with this funding problem. We have presented this paper to Government and circulated it amongst some industry people. For anyone interested, it is available on our website www.wsca.ca. The WSCA proposes that we set up a working committee comprised of interested parties from the MOF, Industry and the WSCA to look at this problem using the WSCA's principles as a starting point. We are going to be recommending this to the Minister.

Other important WSCA news is that at our annual conference in January, the silviculture industry voted to join the Forest Industry Safety Association (FISA, previously the BCHLSA -see the CSA Magazine Fall 2002 Edition for background). The Silviculture industry is a subset of that organization with our own budget. The aim of the safety association is to act collectively and pro-actively to reduce injury rates in our industry. Currently we are undergoing a Needs Assessment of the silviculture industry and appraising the courses that are available. John Betts has been hired part-time as the Silviculture Coordinator for FISA. We plan to be fully operational by the fall of this year at which time the Needs Assessment will be done and we will be able to prioritize our activities.

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LUSTR CO-OPERATIVE



Factors Affecting the Summer Planting of Jack Pine Seedlings

by William Murphy, RPF, GM of LUSTR Co-operative

Traditionally, the planting season for containerized jack pine and black spruce seedlings has been restricted to spring and fall. Extending the planting season to include July and August would allow nurseries and forest companies greater flexibility in scheduling. Also, tree-planting contractors would be able to provide longer-term employment to their planters.

With the goal of extending the tree-planting season in mind, a series of research trials were initiated by Bowater Thunder Bay, Forest Products Division. The first of these trials evaluates the influence of mycorrhizae, site preparation and planting date on the summer planting of jack pine current crop seedlings.

The trial was executed as a Split Plot design, with two splits (site preparation and mycorrhizal inoculation). The treatments were site preparation (prepared and not prepared), mycorrhizal inoculation (non-inoculated and inoculated), and planting date (July 10, July 17, July 24, July 31, August 7 and August 14).

Hill's Greenhouses grew jack pine seedlings for the trial in soft-walled plugs. The seedlings were sown to target two general planting windows: July-August

2001 and May 2002. Current crop seedlings were exposed to a blackout treatment from June 11 to June 20 to induce bud-set and increase stress resistance in preparation for planting. Seedlings targeted for the May plant were sown from the same seed lot in April 2001, placed in cold storage for the winter of 2001, and planted in May 2002.

Site preparation did not affect survival, condition, height, root collar diameter or annual growth increment after one season in the field. Site preparation has been identified as a method of controlling competition and providing seedlings with mineral soil microsites for regeneration.

In contrast, leaving land unprepared may retain moisture in the soil to avoid drought stress in newly planted seedlings. Given the various benefits of both regeneration approaches, assessment following the winter may reveal differences between seedlings planted in site prepared versus unprepared land.

Mycorrhizal inoculation significantly increased root collar diameter on all dates and increased height on some dates. At the beginning of the trial, mycorrhizal and non-mycorrhizal seedlings had similar RCDs, indicating that mycorrhizal* seedlings grew

proportionately more in the field.

Mycorrhizal plant-fungal associations can result in an increased root area for the host plant, improving its nutrient and moisture absorbing abilities. This is especially true in drought conditions. The larger root collar diameters (on all dates) and heights (on some dates) of the mycorrhizal seedlings may indicate that mycorrhizal inoculation improved their root systems. At this preliminary stage, it appears that mycorrhizal inoculation may play a role in the planting season extension of current crop jack pine seedlings.

In general, after one season in the field, survival was good, ranging from 75% to 97% (see graph). The good survival observed may indicate that summer planting of jack pine current crops is a viable regeneration strategy. However, survival rates following the first winter season may differ and this will be an important measure of establishment success.

Survival significantly differed among planting dates. Seedlings planted later in the season (August 7 and August 14) had the best survival, followed by July 24, then July 31 and July 10. Seedlings planted on July 17 had the worst survival. Differences in survival may be related


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Survival and

growth

following the first winter could change and will be important measures of establishment success

to weather conditions at the time of planting.

Air temperatures during the week following July 10, July 17 and July 31 were high and rose to 43, 40 and 45C respectively. Temperatures were maintained above 36C for three to eight hours, which may have raised soil temperatures to levels that were lethal to newly planted seedlings. Conversely, during the week following July 24, August 7 and August 14 daily highs remained below 35C. These observations suggest that weather forecasting could be a valuable component of a summer plant.

Although seedlings planted on July 10 had one of the lowest survival rates, their condition was significantly better than seedlings planted on all other dates. This observation may be a result of differences in initial size and drought tolerance. Larger seedlings are known to be less resistant to drought conditions compared to smaller seedlings. Seedlings planted later in the season had larger initial heights and higher height:RCD ratios than those planted on July 10.

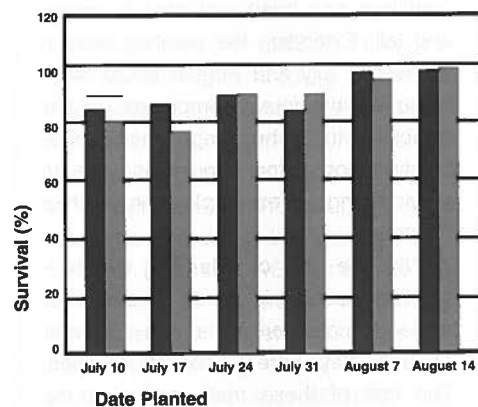
Several symptoms of desiccation

were observed in the larger seedlings planted after July 10. The stems of many were limp and dehydrated, and in some, the terminal leaders had broken off or become brown and wilted. On some seedlings, the needles had fallen off in a one-inch band three quarters up the stem.

The seedlings in this trial were active or bud-initiated and shoots were succulent current-year growth, and as such, were likely susceptible to heat damage at time of planting. Possibly another stock type would be less susceptible to heat and drought. Another trial, to be established in 2002, will compare summer planted current and reflushed stock to spring planted overwintered stock (control).

Based on these preliminary results, mycorrhizal inoculation, stock type options and adaptable plant schedules based on weather forecasting may improve summer plant success. Survival and growth following the first winter could change and will be important measures of establishment success.

Ryan Murphy, a forestry graduate student working with Bowater, LUSTR



Survival, after one season in the field, of jack pine seedlings grown with or without mycorrhizae and planted on different dates throughout July and August, 2001

Co-operative Inc. and Dr. Jian Wong of Lakehead University Faculty of Forestry and the Forest Environment recently received a National Science and Engineering Research Industrial Post-Graduate Scholarship to continue the work on this trial. He will analyze survival and growth for the next two seasons and will support these observations with physiological tests.



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Accréditation des compétences

par Fabien Simard, ing. f., Directeur général

L'AETSQ, durant les derniers mois, a dû mobiliser ses énergies autour d'un dossier crucial pour notre industrie. Il s'agit de la remise en question de la valeur des traitements sylvicoles et du rejet potentiel de la grille québécoise des taux pour l'exécution mise en place par le MRN. Nous étions tous solidaires à penser que des modifications majeures dans la structure d'allocation des contrats auraient un impact négatif sur nos entreprises. Cette éventualité nous a poussés à améliorer nos contacts avec nos partenaires tel que RESAM, CCFQ et CIFQ. Les discussions autour de cette problématique nous ont rapidement permis de prendre conscience des forces et des faiblesses de notre industrie. On a vite reconnu que l'entrepreneur forestier était trop souvent relégué à son rôle d'exécutant et n'était pas toujours identifié comme un réel partenaire de l'aménagement durable de nos forêts. Fort de ce constat, il nous est apparu urgent, pendant qu'on assiste à la multiplication des systèmes de qualification, de trouver notre voie afin de valoriser l'image et la réputation de la sylviculture québécoise. On a donc fait le pari que la promotion de la mise en place d'un processus d'accréditation des compétences des entreprises dans l'industrie des travaux sylvicoles permettrait non seulement de redorer notre image, mais favoriserait aussi le recrutement et la stabilisation de notre main-d'œuvre qui est le fer de lance de nos opérations. Il nous fallait donc rapidement convaincre les intervenants.

L'AETSQ a tenu son congrès annuel provincial, à Québec au Manoir du Lac Delage, du 12 au 14 février 2003. Le thème : « L'accréditation, un avenir

prometteur et durable », a vraiment soulevé les discussions de fond attendues. Le débat a pris son envol avec la présentation de communications. Après le mot du président, monsieur Vital Tremblay, on a assisté à trois exposés. Dans un premier temps, monsieur Claude Lebel de Norbord nous a entretenu de système de qualification et de certification et nous a rapidement convaincus de la justesse de son titre soit : un besoin partagé. Ensuite monsieur Serge Ruel du ministère des Ressources naturelles nous a fait part de la vision d'un chef d'une unité de gestion quant à l'importance de la réalisation des travaux sylvicoles tant pour l'atteinte des objectifs forestiers et socio-économiques en région. Il a su démontrer l'impact et la nécessité de garantir l'implantation de saines pratiques dans l'exécution des travaux. À titre de troisième conférencier, monsieur Normand Lesieur d'Hydro-Québec TransÉnergie nous a présenté leur système de qualification d'entreprises pour les travaux de maîtrise de la végétation. Sans être une réelle accréditation, le processus qu'ils ont mis en place permet de tracer un portrait objectif de leurs entrepreneurs. Mais le principal intérêt de cet outil, c'est qu'il favorise l'amélioration continue de leurs fournisseurs.

Il n'en fallait pas plus pour initier le forum sur l'accréditation. Le but premier étant certes de connaître l'opinion des participants quant à l'intérêt et la nécessité de la mise en place d'un processus d'accréditation des compétences des exécutants en travaux sylvicoles, qu'ils soient entrepreneurs indépendants ou membres d'une association. L'assemblée a rapidement établi le consensus autour de l'importance de la mise en place d'un

système de qualification crédible qui nécessiterait le concours et l'expertise d'auditeurs externes. L'ensemble des discussions a permis aux différents intervenants de préciser les différentes options qui étaient sur la table. On a largement disserté sur la définition des termes et sur le caractère optionnel ou obligatoire d'un tel processus. Les représentants de l'industrie nous ont instruits des démarches à caractère individuel qui s'opéraient dans leur industrie quant à l'implantation d'ISO 14000 et des autres normes de qualification. Tous étaient convaincus que c'était la seule alternative pour répondre adéquatement aux exigences de leurs clients et aux attentes du public. Les représentants du MRN se sont dit intéressés à la démarche, tout en précisant qu'il fallait tout mettre en œuvre pour améliorer les conditions de travail des ouvriers sylvicoles sans perdre de vue la qualité des travaux à des coûts raisonnables.

Suite à ces recommandations largement appuyées par les membres de l'AETSQ, il a été proposé, lors de l'assemblée générale annuelle que : « Suite aux interventions ainsi que la conclusion des différents partenaires au forum, les membres de l'AETSQ ont mandaté le conseil d'administration de monter un comité avec les partenaires afin d'élaborer une accréditation des compétences dans l'industrie des travaux sylvicoles ». C'est donc avec optimisme que l'on élaborera les outils nécessaires pour mettre en place un système de qualification adapté à notre industrie. Nous sommes confiants que cette démarche nous permettra de valider notre rôle d'intervenant majeur en aménagement forestier.



Skills Accreditation

by Fabien Simard, RPF, Executive Director

In recent months the AETSQ (Association des entrepreneurs en travaux sylvicoles du Québec) has had to focus its efforts on a crucial concern for our industry: the revision of the costing of forestry practices and the possible elimination of the Quebec Ministry of Natural Resources' rate schedule for work done. We were all agreed in thinking that major changes in the contract-granting structure would have a negative impact on our businesses. This possibility encouraged us to improve our contacts with our partners such as the RESAM (Regroupement des sociétés d'aménagement du Québec), CCFQ (Conférence des coopératives forestières du Québec) and CIFQ (Conseil de l'industrie forestière du Québec). Our discussions around this problem enabled us to become quickly aware of the strengths and weaknesses of our industry. It was soon recognized that the forestry contractor was too often relegated to a worker role and was not always identified as a real partner in the sustainable management of our forests. In the face of this realization, it appeared urgent to us, while we were cooperating in the development of qualification criteria, to go our own way with respect to promoting the image and reputation of Quebec forestry activity. We therefore took the attitude that establishing an accreditation process for company skills in forestry work would not only enhance our image but would also have a positive influence on recruitment and the stabilization of our labour force, which is the spearhead of our operations. We were thus obliged to convince our stakeholders without delay.

The AETSQ held its annual provincial conference at the Manoir du Lac Delage in Quebec City from February 12 to 14, 2003. The theme "Accreditation for a Promising and Lasting Future" certainly provoked thorough discussion. The debate began with the keynote speeches. After the President's (Vital Tremblay's) greetings, we listened to three presentations. Claude Label of Norbord Industries spoke about qualification and certification systems and soon convinced us of the aptness of his title: "A Shared Need". Then Serge Ruel from the Quebec Ministry of Natural Resources communicated his administrator's vision of the importance of forestry activities both for the realization of forestry management objectives and for the socio-economic health of the regions. He demonstrated convincingly the need for, and the effect of, ensuring the implementation of sound practices in carrying out forestry work. The third speaker, Normand Lesieur of Hydro-Québec TransÉnergie, outlined their method of qualifying contractors for vegetation control work. Although it was not a genuine accreditation, the process they had instituted allowed the objective profiling of their contractors. The chief interest of this technique, however, was its emphasis on continuous improvement on the part of their suppliers.

These addresses were an effective introduction to the open forum on accreditation. The prime objective was, of course, to ascertain the opinion of the participants with respect to the value and the urgency of establishing an accreditation process for the skills of forestry workers, regardless of whether they are independent contractors

or members of an association. The meeting soon reached agreement on the importance of setting up a credible system of qualification, which would involve the assistance and expertise of external auditors. General discussion allowed the various participants to clarify the different options on the table. There was lengthy debate about the definition of terms and whether the process was to be voluntary or mandatory. Industry representatives described the particular practices current in their industries with respect to the implementation of ISO 14000 and other certification standards. All were convinced that this was the only choice if they were to respond adequately to the demands of their clients and the expectations of the public. The Ministry representatives showed an interest in the move, but stressed the need to make every effort to improve the working conditions of forestry workers without sacrificing the quality of the work at a reasonable cost.

To follow up these recommendations, which enjoyed wide support among the members of the AETSQ, it was moved in the annual general meeting that "in response to the submissions and conclusions of the various participants in the open forum, the members of the AETSQ authorize the Executive to set up, in consultation with our partners, a committee charged with devising a system of skills accreditation in the forestry industry". We are therefore proceeding confidently to lay the basis for creating a method of skills qualification adapted to our industry. We are optimistic that this undertaking will allow us to assert our role as a major player in the area of forestry management.

INDEPENDENT SILVICULTURALISTS ASSOCIATION



by Gaston Damecour

Jaakko Pöyry Consulting's (JPMC) 1/2 million dollar report: New Brunswick Crown Forests: Assessment of Stewardship and Management was introduced in the Winter 2003 issue of Canadian Silviculture. The report was funded by the Province of New Brunswick (33%) and the New Brunswick Forest Products Association's six forest companies managing the ten Crown licenses (66%).

The report catalysed discussion and important public consultation on the province's overall approach to the management of the Crown's forest resource. The Province announced that a select legislature committee will be struck to consult with the public. Minister Volpé indicated, "...this form of consultation will best represent the various ideas of what the future of forest management of our Crown lands should be... All groups or individuals interested in the future of our forests will be invited to intervene and share their vision with the Select Committee of the Legislature."

New Brunswick is a largely rural population with many urban citizens having direct or close ties with the forest through the industry or recreation. Public participation has progressed from somewhat passive audience to expecting active and informed responses. The Select Committee format offers significant transparency and balance. Several issues from the various consultation camps are already being brought forward in anticipation of the Select Committee's hearings.

This public consultation is likely to be the most exhaustive ever undertaken by a provincial government. The consultation

camps at this time appear to be:

- The Province of New Brunswick
- The six forest companies that manage the province's ten Crown Timber Licenses
- Major sub-licenses
- Smaller sub-licenses that may not use spruce/fir
- Private woodlot owners who sell round wood to the industry
- Environmental non-government organizations (ENGOs)

Some of the issues raised to date:

- Faced with a fiber shortage, the industry's current configuration reflects important investments in modernization and rationalization of production facilities.
 - To what extent is there overcapacity?
 - What configuration do we want? (the previous liberal government introduced the concept of value-added as the desired source of growth for the sector)
- The impacts on the species forest composition resulting from the proposed doubling of the Crown's softwood production through reforestation:
 - on those non-spruce/fir forest businesses who have been making significant economic inroads with previously less desirable/valuable species;
 - on the naturally regenerated forest;
- The annual 50 million dollar silviculture program is probably beyond the province's financial capacity. Should industry be called to finance such a program?
 - What guarantees are required?
 - How do they impact the public's ownership rights and future land use options?
 - How would these evolve over time?
- The business case for adopting the report's recommendations.
 - Will the sector's employment increase?

- What are the impacts on economic benefits to businesses that, for a variety of reasons, do not continue to invest?
- What is in it for the province?
 - Are there liabilities?
- How will such an increase in the Crown's fiber supply affect the private woodlot sector's ability to:
 - sell softwood products at a "negotiated" price?
 - sell non-spruce/fir products at prices that reflect the quality and value?
- justify investing in forest management?
- Will the proposed intensive forest management methods that involve selected softwood species and a variety of stand tending methods impact on the natural forest?

The report presents the senior forest industry's vision. This important consultation process will bring several other perspectives to the process.

The events suggest the status quo is in question. The proposed intensive forest management regime will influence the type, level and intensity of silviculture intervention and, significantly, its funding.

Gaston Damecour is a registered professional forester. He is a senior consultant and principal of AGFOR, a New Brunswick-based forest and management consulting firm. Mr. Damecour has been instrumental in bringing about significant changes in the forest sector by representing both governments and industries on such issues as health and safety, forestry equipment standards, industrial relations, wood allocations and forest management policy. He has assisted communities and businesses in initiating change and/or dealing with various interest groups.

PRINCE EDWARD ISLAND

FOREST IMPROVEMENT ASSOCIATION

by Wanson Hemphill, Manager



Greetings from the land of 22,402 private forested parcels containing 235,509 ha of forest and owned by 16,641 persons of which 37.4 % are farmers. Rain, soft ground and weight restrictions are in place.

The Forest Enhancement Program offering incentives for non-clearcut forest silviculture treatments offers an exciting new way to encourage owners to get a management plan and follow through on treatment suggestions. As with any new program, there are some adjustments, but the future looks good as long as the political will remains there.

PEI Model Forest Outreach Project has taken off with 18 group

representatives meeting regularly to get started and approve projects before fiscal year deadlines. For project names, please see the new and developing FIA website at www.forestimprovement.ca. This site is intended as an information site for PEI forest owners, forest industry, governments and the public with the latest newsletters and links to market information, forest management, safety and certification. An industry directory as well as buy/sell and employment pages are being developed.

Island contractors and owners are very supportive of a new poplar veneer mill in Miramichi. Sending wood to the highest end use and value benefits the forest and creates employment and wealth. Island owners and contractors are tired of giving

away their poplar for low stumpage and breakeven delivery prices for OSB. Many remember the good old days when Nelson Forest Products paid \$175/cord for poplar logs and the rest went for pulp. If the usable small diameter can be reduced to around 7 inches, decent stumpage can be paid, poplar will be popular and marginal mixed wood stands become viable.

PEI WCB rates have come down again this year by 9.3% saving Island contractors \$63,947. While safety information and increased mechanization have contributed to reduced injuries, the safety first attitude remains the most important safety factor.

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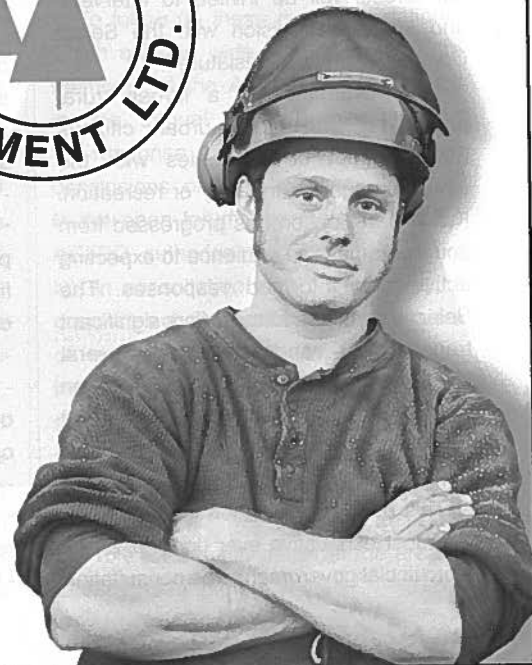
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SILVICULTURE CONTRACTORS ASSOCIATION

by Ed Davidson, President



As my term as President of the Nova Scotia Silviculture Contractors Association concludes, I feel the past 24 months have been unprecedented in our provincial private land silviculture industry.

Where once we had a healthy and robust business, factors and forces are presently pointing in another direction to the detriment of this small business community. Certain patterns are dominant and clearly painful:

1. The Registry of Buyers and Schedule of Silviculture Credits has led to a widespread depression and reduction of rates paid while refusing to alleviate any of that weight.
2. Communication between higher levels of the Department of Natural Resources and industry groups is not as effective as it could be.
3. The N.S. DNR appears at odds with itself. On one hand the department is approving sub-standard forestry practices for some, while on the other hand trying to point the finger of blame solely at contractors for problems generated by the present system.

4. Advice given by the private sector to the department is most often ignored, disregarded or totally dismissed. A prime example was a recent field trip organized for the Forest Technical Advisory Committee. Although private industry members went out of their way to put the event together to show the practical impact in the field, government members deemed the opportunity to be of such little importance that they had no representation at the event.

5. Despite claims to the contrary, the DNR is still "driving the bus". The industry is subject to their demands, all jobs are subject to their approval, and all credit points are based on being compliant with their standards.

It is no wonder then that a high level of frustration seems to run throughout our sector.

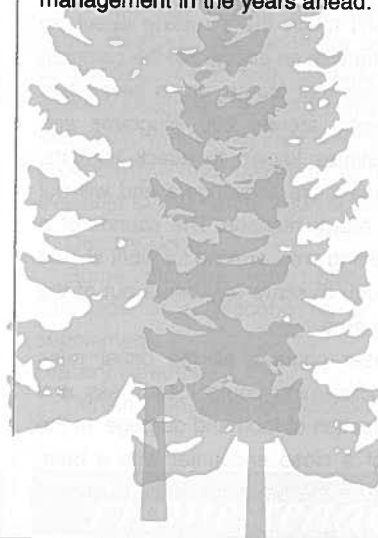
In retrospect, it seems the Department may have calculated the ramifications of the Registry and the Schedule of Credits and deemed the private land industry expendable in order to allow their model for forest sustainability to mature.

I sometimes think, it is an inherent personality trait for anybody in business in our province to see a problem as

an opportunity. In a perplexing, but unwarranted twist, the true benefactor of that tenacity trait has become government. Looking outward then, private land contractors will most likely continue to experience real economic challenges while searching for new ways to improve efficiency in order to survive.

In spite of the status quo, and perhaps because of it, I encourage those who elect to stay in the private land industry to fortify themselves with optimism as they prepare to meet the future.

In closing, I wish best regards to all (both private and public sectors) as we pursue the goal of successful forest management in the years ahead.



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by John Murray

Protection against potential bear encounters

Black bears are a fact of life in many areas of Canada especially in Northern Manitoba, Ontario, Quebec and New Brunswick. They are not found on Prince Edward Island, in Southern Saskatchewan, or in Southern Alberta. Although seen in a variety of habitats, the black bear prefers heavily wooded areas and dense bush land. Maximum numbers are probably attained in areas of mixed coniferous deciduous forests. Densities in favourable habitats are one bear to every 3 or 4 km².

The potential for encounters with wildlife has been a routine aspect of forestry work since the earliest days. But there isn't much that's routine about an encounter with an animal like the common black bear that stands up to seven feet tall, weighs around 200 kilograms and is sometimes known to attack humans. Black bears are scavengers and will not usually attack humans. The sounds of a tree planting crew arriving for work should be enough to scare any bears out of the planting area.

In bear country, all the usual rules apply concerning camp cleanliness and the protection of food and garbage. In the event of a close encounter with a bear, make sure the bear has a clear escape

route, then make whatever noise you can and wave your arms above your head to make yourself look larger. If these tactics don't frighten the bear away, slowly back away from the bear. It may stand upright or make huffing sounds. This is its way of saying that you're too close. Give the bear more space. Noted Canadian wildlife biologist Dr. Stephen Herrero has spent most of his career studying bear attacks. He contends that a canister-type air horn used by boaters is the most effective way to convince bears to leave an area.

The use of pepper spray or mace has sometimes been recommended for use by forestry workers. However, many bear behaviourists do not agree, advising instead that by the time the bear is in the effective range for pepper spray 4 - 5 feet, it's almost upon you anyway, and the resulting attack might cause the person to accidentally spray themselves, making it difficult to try to fight off the bear. The spray also might only serve to further enrage the bear instead of driving the bear off. One experiment with pepper spray involving grizzlies saw the spray used to cover areas of the ground near known bear areas. When the grizzlies were observed at the spray site, they were seen rolling through the sprayed area and

deliberately attaching the scent to their coat—so much for deterrence.

For those who chose to use it, one major manufacturer of pepper spray advises them to practice drawing the pressurized canister from its holster and discharging the spray before taking it into the bush. The manufacturer warns against carrying the spray in a pocket, knapsack or other bag. When transporting spray, the hood should be kept over the head of the canister, which holds the safety clip in place. When packing the spray, users should be aware of any other items that might crush or puncture the canister. Never leave the canister in direct sunlight or in a hot vehicle, stowing it instead in the trunk of the vehicle or a chest cooler.

The key to avoiding bear encounters in the work area (away from camp) is noise, keeping food items tightly sealed in your personal pack and working as much as possible in fairly tight small groups of three or four people. The Ontario Ministry of Natural Resources brochure, 'Living with Black Bears in Ontario' is available as a free download from www.mnr.gov.on.ca/MNR/pubs/pubmenu.html

Editor's note: the practice of planters bringing dogs is preventative. Especially the larger breeds of dogs have learned the art of defense by being offensively noisy. Bears hate being harrassed, and unless very hungry, will avoid the nuisance of noisy threatening dogs.

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PREVENTING

Tree Planting Injuries

by Dr. Delia Roberts



Peter driving arms

Pilot study

A recent pilot study carried out in British Columbia showed that;

- Planters work at 40-60% of maximal oxygen consumption (60-75% maximal heart rate) for approximately six hours.
- Average fitness levels were only just a little higher than the values seen in people who do not exercise
- Total calories eaten as well as the timing and types of foods eaten were not optimal for providing energy during planting and for recovering from planting
- There was significant muscle wasting and suppressed ability to fight off infections or repair damaged tissues as the season progressed

- Blood sugar levels were low enough that reflexes and mental concentration would not be as sharp as usual

Main Study

Based on the pilot study, the objectives of this study were to determine if improving fitness levels or diet could enhance planting productivity and quality and/or reduce the number of injuries occurring during planting.



Simon Alain with heart rate monitor

Fitness Group

Some planters trained for 8-weeks before the start of the season using high-intensity intervals, Thera-band, and body

weight exercises. Workouts were done 6 days per week, but were generally only 20-30 min long.

Results of training:

1. More than 80% of training planters completed the program.
2. Aerobic capacity was improved by about 15%.
3. Trained planters planted faster for longer putting in approximately 250-300 trees/day more.
4. They also experienced 40% fewer injuries or infections.

Recommendation:

Improving your fitness level prior to the planting season will help you plant more trees and stay healthy and injury free. Other measures specific to the demands of planting (wrist, arm, shoulder, back and leg endurance and/or flexibility) may also help reduce injuries and improve productivity. This program should be available to you for the 2004 season.

Dietary Group

Some planters were given either Gatorade or a Placebo as a dietary supplement.

Dietary Results:

1. Drinking Gatorade or placebo helped

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keep *fluid* in the body and eat at bag ups

keep fluid in the body. Gatorade also stopped blood sugar from dropping too low.

2. Eating at bag ups also kept blood sugar levels from dropping.

3. These changes prevented muscle wasting and helped stop the suppression of the ability to fight off infections and repair damaged tissues.

4. 30% of planters had iron levels low enough to impact energy production negatively.

5. Levels of stress hormones were extremely high after 5 days off from planting. As many injuries were sustained on days off as occurred during planting, and those occurring on days off were more serious.

Recommendations:

- Using Gatorade or adding a small amount of sugar ($\frac{1}{8}$ - $\frac{1}{4}$ cup/L) and salt ($\frac{1}{8}$ tsp) to water and drinking at the rate of 500 ml/hr during planting will prevent dehydration
- Planters can check for dehydration by weighing in before and after planting, as long as clothing is identical
- Small snacks of low fat food should be eaten at least once an hour to stabilize blood sugar
- Eating a large carbohydrate based snack or meal within 1-2 hours of stopping planting will speed up recovery



Lisa Planting

- Total food intake should be higher in carbohydrates and lower in fats than the current planting diet. Target values are 60-70% carbohydrates, 15-20% proteins and 15-20% fats

- In addition to their normal food intake when not active, planters should consume approximately 6.8-7.8 kcal/min of planting activity (not including bag ups or travel time) to balance energy used and calories consumed. Another way to figure this out is to multiply weight in kg (including bag weight) x hours of activity x between 5 (for females on level ground) to 7 (for males on steep ground)

- Fats require approximately 3 hours to digest, proteins require 2 hours and carbohydrates require anywhere from 5 min to 1 hour depending upon the type and amount of fibre. Food intake in the

morning should allow time for food to be digested prior to planting

- Storage iron in the form of ferritin should be checked by the regular medical system at least 8 weeks prior to planting. Supplements should ONLY be used if necessary (ferritin levels are less than 30 mg/L) as iron can be poisonous in excess. They also cause constipation or diarrhoea, and bad gas – so DON'T take iron unless you have to!

- Planters should consider the effect of sleep loss and excessive use of recreational substance on their ability to plant, and thus make money. Maybe there are other ways of blowing off steam?

For more information contact Dr. Delia Roberts, Selkirk College, Castlegar, BC V1N 2Z1
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FOREST HEALTH

Bio-invasion threatens forested ecosystems

by Lynda Chambers



*Immature Nun Moth
courtesy M. Keena US Dept. of Agriculture*

but foreign fungi as well could potentially kill thousands of trees and disrupt North America's forest ecosystems. The National Forest Strategy identified that the mitigation of the impact of exotics on the forest ecosystems is a critical priority.

"The best counterattack is to stop the introduction and establishment of exotics in the first place because once they're settled in the woods, eradication campaigns are rarely successful," says Dr. Eric Allen, head of the Forest Health and Biodiversity group at the Canadian Forest Service's Pacific Forestry

Centre in Victoria. Dr. Allen has done extensive work on non-indigenous species that impact forest ecosystems — their biologies, their movement with international trade and the assessment of mitigation measures.

Since many "introductions" are through infested solid woodpacking material (SWPM), countries around the world are implementing a global standard for its regulation and treatment. In June 2003, for example, Canada, the US and Mexico will implement International Standards for Phytosanitary Measures (ISPM) 15.

Forest hitchhikers, stowaways and freeloaders of the creepy, crawly variety arrive in Canada daily from exotic locales. They hide in wooden pallets. They lay eggs in wooden bins. And they bore and burrow into the wooden crates, spools and boxes used to package, support and brace imported goods — anything from granite blocks to cable used in forestry to foreign sports cars.

This bio-invasion, as it's often called, is the cause of considerable concern because the inadvertent introduction of not only insects that are non-indigenous



*Adult beetles mining shoot
Courtesy of Natural Resources Canada - Canadian Forest Service*



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the nun **moth** *is a significant threat to the forests of Canada*

ISPM 15 requires use of a treatment for woodpacking material that is known to be effective against most pests and the application of a globally-recognized mark as proof of "pest-free" status.

Stopping the "establishment" of exotic forest pests is a different matter. It requires the vigilance of foresters, woodlot owners, silviculture workers and others who spend time in the woods.

"More than 30 species of bark and wood boring beetles have already been intercepted in western Canada



Female Nun Moth with characteristic black & white colouring. Courtesy of M. Keena US Dept. of Agriculture

Sciences and the Chinese Academy of Sciences.

"What we've done is draw up a "wanted list" of exotics so that people will be able to easily recognize a threat when they see one", he adds.

On this "wanted list" are the Pine Shoot Beetle, the Eurasian Nun Moth, the Brown Spruce Longhorn Beetle, the Eight Spined Spruce Bark Beetle, the Lesser Cedar Longicorn Beetle and the Asian Long-Horned Beetle. Some are too similar to indigenous insects to be easily recognized. But the Pine Shoot Beetle and the Nun Moth, in particular, are definitely worth watching out for.

The pine shoot beetle is one of the most destructive shoot feeding species of beetles in Europe. In North America, all native pine species are potential hosts but the preferred species are red pine, Scots pine, and ponderosa pine. When beetle populations are high, balsam fir, eastern white pine, Norway spruce, and larch are also attacked. Larvae, pupae or adults can be found under the bark of

since 1992 and six are now established in British Columbia", says Natural Resources Canada research scientist Dr. Leland Humble.

"It really helps to be aware of what the larvae, pupae and adults look like, what damage they cause, and where to look for them". Dr. Humble's work at the Pacific Forestry Centre focuses on detection and involves collaborative studies with Chinese researchers at the Jilin Provincial Academy of Forest



*Antennae on a Male Nun Moth
Courtesy of S.J. Kinelski / B. Glowacka - Warsaw Forest Research Institute, Poland*

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dead or stressed trees in spring, usually before native bark beetles. Adults create 2-mm holes when exiting tree stems and 2-mm to 3-mm entrance holes when attacking new shoots. First and second year shoots droop and become yellow or red in early summer. Dead shoots from current or previous years may be evident on the ground. Shoots damaged by the pine shoot beetle will have 2-cm to 10-cm long tunnels and may have circular entrance holes near the broken end.

The nun moth has seriously defoliated Sitka spruce, Douglas fir, Grand fir and lodgepole pine in Denmark, making it a significant threat to the forests of Canada and especially to those of British Columbia. Adults are highly variable in colour, ranging from almost black to chalk white. Newly hatched larvae are about 4 mm long, black and have protruding hairs almost as long as the body. Mature larvae reach 30 to 35 mm in length and vary from basic light to dark brown to grey, green or yellow. Eggs are round, brown to purplish in colour, 1 mm in diameter



Head markings on Mature Nun Moth Larvae
 Courtesy of P. Garabalinski / B. Glowacka - Warsaw Forest Research Institute, Poland

and laid in clusters. In pines the immature larvae feed only on male flowers which can lead to total destruction of next year's flowering buds. Severe defoliation of more than about 70-80% will cause mortality of spruce trees within a year. At high population levels larvae also defoliate understorey shrubs.

Exotic Forest Pest Advisories are available from the Canadian Forest Service online bookstore at: <http://bookstore.pfc.cfs.nrcan.gc.ca> or by calling 250-363-0771. You can report any suspected sightings of these and other exotic pests or their damage by calling 250-363-0600.



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