



CANADIAN
SILVICULTURE

Summer 2002

**Stocking Standards
Threat of Wildfire**

**Focus on Safety
Forest Regeneration**



ON THE COVER:

Growing Threat of Wildfire
 Canada's forests are under a severe threat from wildfire.
 by B. A. Blackwell & R.W. Gray

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CANADIAN SILVICULTURE is published four times a year by EMC Executive Marketing Consultants Inc., 6058 187A Street, Surrey, BC V3S 7R6. Phone 604-574-4577, Fax 604-574-2196 e-mail: silviculture@emcmarketing.com. Copyright Canadian Silviculture Association. Subscription rates: 4 issues per year - \$30.00 Canadian Publication Mail Sales Agreement #40026059

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Editorial

Dirk Brinkman, Editor

The Missing Capital Entry on the Public Forest Books

Silviculture treatments are designed to either maintain or enhance the capital value of the forests. But the capital value of the forests has always been a missing book entry in public forest accounting.

In the late eighties a UK team put together "Blueprint for a Green Economy" which recommended that renewable natural resources like forests should be on the government books as capital entries. That way, an unsustainable liquidation of forest capital would not simply be accounted as increased GNP and government revenues. Applying Generally Accepted Accounting Practices (GAAP) would result in liquidated natural capital being written down. The capital writedown would offset the short-term revenues and differentiate between unsustainable and sustainable or enhanced resource use. Annual GAAP capital entries would make governments more accountable to the public for its management of the forest landbase asset.

There are several reasons why there has never been such an entry. Canadian voters (and international customers) value Canada's forests, not only for their annual timber production, but also for their recreational revenues, conservation and habitat values, dynamic biodiversity and carbon functions. Integrating all of these values for a province's natural forest asset capital entry is dauntingly complex. This valuation could not be undertaken without completing public land use plans, current inventories, sustainable forest management plans and sustainable forest policies. Also, the cost of Sustainable Forest Management (SFM) has always been seen as unaffordable by government. Only recently has the potential been considered of making SFM results-based, in the hope that its delivery is affordable by industry.

With the highest recreation, conservation and habitat values in the world as well as some of the highest timber

values, Canada has led the world in resolving the conflicts of interest between the environmental movement and the forest sector. This unique dynamic has evolved in some of the highest standards of SFM practices in the world. The possibility that privatized SFM may be affordable sets the groundwork for a Canadian province being one of the first to make a GAAP capital entry for its natural resources.

Protecting forest capital value would require that all users in the forests are subject to sustainable practice codes. Though Canada's natural forest products leave a green footprint compared to the rest of the world, the other forest users do not. Responsible and well educated foresters, skidder operators and loggers resent the way mining companies operate without consideration for sustainability. They have been able to drive through streams, degrade soils, start slides, abandon seismic lines and pipelines and re-seed former forest areas with invasive species without much consequence.

The June 2002 edition of National Geographic published a strong indictment of Alberta's fractured forest habitat and conservation value. Blaming forty years of criss-crossing "by an estimated half million miles of roads, pipelines and 15' corridors used for seismic testing" and clearcut harvesting, the magazine reported Alberta has fractured over 50% of the habitat and conservation value of Alberta's formerly wild forest areas. The article resulted in a rare apology by Ralph Klein to the 40 million international National Geographic readers.

To avoid the political drama of writing down forest asset values, all users in the forest, including mining, will have to share a uniform continuity of sustainable practices.

The WSCA recently presented a Forest Grow Plan to BC's government that would build the forest asset value. A context of improving forest ecosystems and capital

value will create its own momentum.

BC could hold international, environmentally endorsed auctions for its one thousand year plus age wood. In fact, all across Canada, the forest sector could age-grade for higher timber value—250 year old eastern white pine will command premium prices for furniture—raising timber value.

New destination towns centered in unique ecotourism regions like Banff and Whistler would raise the economic benefits of local forest recreation, tourism, habitat, conservation and biodiversity values in those regions.

Increasing connectivity between existing parks and conservation areas with designed corridors of wilderness areas and ecologically sensitive practices can multiply habitat and biodiversity values as well as economic benefits.

Completing a strategic policy context for carbon can enhance the carbon credit trading value of good silviculture or land use management.

An integrated assessment of all forest benefits to create a capital forest asset entry will increase public recognition of forest value, and create silviculture opportunities to maintain and enhance that capital value.

In supporting this simple accounting initiative, once again, the interests of the silviculture industry are once again congruent with the interests of the public.

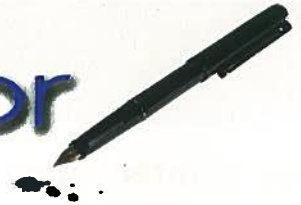
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Forest Restoration

Commercial Thinning

October 2002

Letters to the Editor



Responses to the Tree Improvement article in the Spring 2002 issue of Canadian Silviculture.

Scott Paper Limited has been managing poplar stands in British Columbia for approximately 40 years. For the entire period we have been utilizing improved varieties of poplar (non GMO) that have yielded improved plantations. Both the fibre quantity and quality (mainly fibre brightness) has been enhanced compared to natural stands. Currently we reach green up on our extensively managed stands, which are conventionally managed, by mid-June the year following planting (give or take a week). The average daily height increment is approximately 1.0 cm. The site index base age 10 years (SI_{10}) of these stands are 20-22 m with a conservative MAI of 15 m³/ha.

Dan Carson RPF
Silviculture Operations Forester, Scott Paper Ltd.

You state: "In B.C., present legislation requires the use of appropriate improved seed whenever it is available ... Despite the law, there are a number of formidable challenges facing those currently working in tree improvement to convince all seed users and the general populace that this is good legislation..."

The challenges are:

- Refuting the claim that improved seed is less diverse (it is actually more diverse than natural seed);
- Refuting the claim that improved seed is a genetically modified organism (it isn't);
- Convincing users that tree improvement will produce better wood, quicker (it can);
- Convincing users that tree improvement will reduce short-term plantation establishment costs (it can).

While these challenges are all satisfactorily addressed in your discussion (and I support your assertions), there are two significant challenges that the article does not address: ecological suitability and increased risk associated with improved stock; and inappropriate use of improved seed.

Suitability

Given that the genotype of an organism in a particular area is a testament to past success, altering the frequency of a particular

trait will, other things being equal, reduce the organism's success in the long-term in terms of damage or mortality. For example, taller Douglas-fir, other things being equal, will be more prone to breakage and blowdown. For short rotation plantations on highly productive sites these higher risks are perhaps acceptable (lower likelihood of damage and higher margins to cover any increased costs). However, the legislation in BC requires improved seed be used on all sites, regardless of rotation length or inherent risk of damage.

Regarding parental diversity, even if it increased the fit of an organism to the environment, which it does not, it is only genotypic variation (which is irrelevant because the crop will never be allowed to reproduce); the phenotype is uniform by definition.

The challenge is: Will the trees produced from improved seed be as hardy as the native stock on a given site; will there be more value at harvest time?

As you state: "A valid comparison within present operational plantations has proven futile to date."

Tree improvement should be limited to intensively-managed plantations (agricultural land) until we have a rotation or two under our belts - some proof that the benefits outweigh the costs.

Inappropriate Prescriptions

Obtuse results of the legislation are also possible. For example, the only weevil resistant sitka spruce available in BC is a clone; planting this organism exclusively would not be prudent, yet the legislation forces the forester to do exactly that. Other silvicultural tools exist to control pests (an alder overstory for sitka spruce, for example) that don't require tree improvement, yet with the current legislation these prescriptions would not be allowed without DM approval.

The challenge is: Who decides when the use of improved seed is inappropriate?

The gains to be achieved from tree improvement are clear and easily understood - the costs are not. Until we have a better handle on these costs we should not be risking our investment in an unproven technology.

Colin Buss, RPF
Assistant Forester, TFL Forest Ltd., Johnstone Strait Operation

Ontario Forestry Safe Workplace Association

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Tree planter safety

by John Levesque

The concept of “working smarter, not harder” is especially relevant to tree planting. Safe and efficient tree planting is all about preparing the body for the work, easing into the physical rigours of the daily planting routine and learning to “read” the subtle and not-so-subtle messages the body sends about its condition.

Tree planting throws up a whole array of physical and psychological challenges, from the harsh and changeable wilderness environment in which the planting is done to the stress-building inducement of piecework. But the greatest risk every tree planter faces is of developing a strain and sprain injury that can wipe out an entire planting season—not to mention a season’s income.

Earlier this year, in the first step of its new mandate to deliver occupational health and safety information, consultation and training to Ontario’s silviculture industry, the Ontario Forestry Safe Workplace Association (OFSWA) developed and produced *Health and Safety Resources for Tree Planters*. The package consists of six information booklets and brochures, a training video and five safety meeting presentation guides geared specifically to the needs of tree planters. These print materials will be the basis for on-line interactive training early next year. Arrangements are being made with employers to develop the on-line training as a pre-employment tree planter health and safety certification program for the 2003 tree planting season in Ontario.

Health and Safety Resources for Tree Planters covers everything from dealing with wildlife encounters and wilderness first aid to safe travel on logging roads, harmful substances in tree planting operations and preventing strain and sprain injuries. “In the course of our research and development of these products, we noted that musculoskeletal injuries were by far the greatest hazard in the industry, so we focused a lot of our efforts on techniques and strategies designed to reduce and eliminate the

risk of such injuries,” says John Murray, Coordinator of Program Development and Communications with OFSWA.

Musculoskeletal injuries, commonly known as strains and sprains, occur when excessive stress is placed on muscles, joints, tendons, ligaments and nerves by repetitive motions, awkward postures, heavy loads and jarring forces—all of it on rough bush terrain in tree planting. The injury can be sudden or have a gradual onset depending on a planter’s physical condition and the intensity, frequency and duration of exposure to the risk factors.

Tree planters can significantly reduce the risk of injuring themselves, especially during the first few weeks of strenuous planting, by getting into good physical condition before the planting season begins. A personalized fitness program that strengthens muscles and improves the flexibility of tendons, joints and ligaments should be arranged through a gym or fitness centre. For those who are already reasonably fit, the conditioning program should start several weeks before work. For those who are out of shape, the program should start several months ahead of time.

Core strength in the chest, back, legs, shoulders and arms is important to withstand the handling of heavy loads. Working out with weights that are safely within the individual’s range of capability helps develop that strength. Strengthening and stretching the muscles of hip, knee and ankle joints are also very important. Prospective planters should

improve their cardiovascular fitness level through aerobic exercises such as biking, in-line skating, skiing, jogging and other activities that build stamina and endurance. Being in good physical condition at the start of the planting season helps tree planters deal with the physical demands of the job and has the welcome side effect of improving their productivity.

Once the season has begun, planters must be able to recognize the signs and symptoms of injury, including the difference between “good pain” (stiffness and soreness that dissipate overnight) and “bad pain” (persistent, worsening symptoms that result in weakness, rigid movements and exhaustion). Strain and sprain injuries can be detected and treated before they become serious if tree planters familiarize themselves with their body’s reactions to the physical stresses of the work and if they report any early problems to supervisors and qualified first aid personnel. Planters should seek and follow the advice of supervisors and more experienced planters on the early care and treatment of physical complaints.

Another smart planting strategy is to work with the right tools and personal equipment, and to develop the proper techniques for using them. For example, planters should buy boots with solid ankle support and soles that offer good grip on rock and wet ground. Their shovel should be lightweight and properly sized for their height. Keeping the wrist straight when gripping the shovel reduces the risk of injury to the wrist and arms. A light grip on the shovel eases the stress on the fingers throughout a day’s planting.

Proper balance of the tree bags, with well-adjusted waist and shoulder support straps, distributes the load so that the hips can do some of the work. The middle bag, resting directly over the base of the spine, should be lightly loaded. The notion of “planting from both sides” is an important consideration. Planters who periodically switch the shovel from one hand to the other



and who can retrieve a seedling from the bag and place it in the ground with either hand ensure that one side of their body isn't taking more than its fair share of the punishment.

In addition to an exercise program to help planters prepare for the demands of the planting season, warm-up, stretching and cool-down exercises should be performed before, during and after the workday. OFSWA has developed an exercise "cue card" for that purpose. "It's a laminated card that depicts a series of warm-up, cool-down and stretching exercises," says Murray. "The card is attached to the tree planters' clothing or bag straps and serves as a guide and a reminder to carry out these important daily routines." Many planting companies supply workers with these exercise cue cards available from OFSWA.

The strenuous work of tree planting, often done in hot weather, demands a lot of fluid intake to replenish the body's natural supply. Water is the most effective remedy, since water is what the body loses during work. A planter's vulnerability to strain and sprain injuries increases when the cells in the muscles, tendons and ligaments are starved of nutrients because of poor hydration or nutrition. Fatigue brought on by insufficient water and food intake also raises the risk of injury from slips, trips and falls on the rough terrain. Planters need to drink plenty of water during the day and satisfy a more robust appetite at mealtimes.

Here are a few other rules for strain and sprain injury prevention:



- Don't pad or modify a piece of equipment or tool that's causing pain—replace it with the right equipment.

- Don't work with worn-out gloves, boots or other gear—discard and replace them.

- Be honest with yourself and others about pain—others might know the cause and the cure.

- Don't try to mask pain with painkillers or other drugs and continue working—that's a prescription for a more serious injury.

- Don't skip on sleep—it gives

damaged tissue a chance to repair itself.

- Cut your body some slack—slow down when it's hot, cover up when it rains, bundle up when it's cold.

- Keep constant watch over your body's requirements and limitations—eat, drink and be wary.

Tree planters who develop efficient work practices and learn to monitor their physical condition eventually overcome the soreness that all planters experience at the start of the planting season. Their tree bags and shovel start to feel lighter, their aches and pains diminish, they fall asleep instantly at bedtime and wake up hungry and refreshed. They also have the satisfaction of watching their daily planting count climb along with their income. That's because they're working smarter, not harder.

John Levesque works with the Ontario Forestry Safe Workplace Association.


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ALL MAKES LEASING

by Chris Serratorre

Brush saw and chainsaw safety

The chainsaw and its cousin, the brush saw are two of the most dangerous hand-operated power tools known to the forest industry. However, most foresters would agree that the chainsaw is by far the most dangerous of the two, especially with an unguarded and exposed cutting area where the chain and its dozens of cutters are turning under high power in excess of fifty miles an hour. The most serious of chainsaw incidents, often resulting in devastating injury is known as kickback. In a fraction of a second and without warning, a chainsaw kick back can throw the cutting bar back toward the operator with blinding speed and stunning force. Hazards associated directly with the chainsaw itself are not the only ones an operator will face. Felling trees is a very hazardous activity with dangers arising from improperly felled trees, chicots and spears. Using a chainsaw in silviculture operations often means the operator is bending over into very uncomfortable postures which makes solid control of the saw while it is cutting, extremely difficult.

The brush saw also presents many hazards relating to its cutting function as well as to the terrain in which the operator must work. For example, a type of kickback action that occurs when the incorrect area of the blade is used to start a cut or when the blade comes into contact with a rock or other obstacle can cause the business end of the brush saw to quickly come into contact with the operator's foot or leg causing serious injury.

Both of these kickback scenarios are just the tip of the iceberg in terms of the many hazards seen in chainsaw and brush saw operation. Every year hundreds of silviculture workers in Canada find themselves in situations like these when either struck by the cutting surfaces of these machines or struck by what they are cutting, suffer serious strain and sprain effects, or injuries arising from vibration and noise.

Working safely with these specialized high-powered tools requires a combination of supervised practice and training, properly maintained saws, personal protective equipment and adherence to approved safe operating procedures and techniques. No worker should ever be allowed to use these dangerous tools in actual work situations without proper training

and before demonstrating competence in a supervised environment. It is the employer's responsibility to ensure that each saw operator is properly trained and receives an on-site orientation and evaluation before letting them loose with a saw. It is the worker's responsibility to use the tools correctly and to follow safe operating procedures.

These safe operating procedures should deal with the potential hazards and set out proper methods of machine operation that are clearly understood by the operator in order to carry out the work safely.

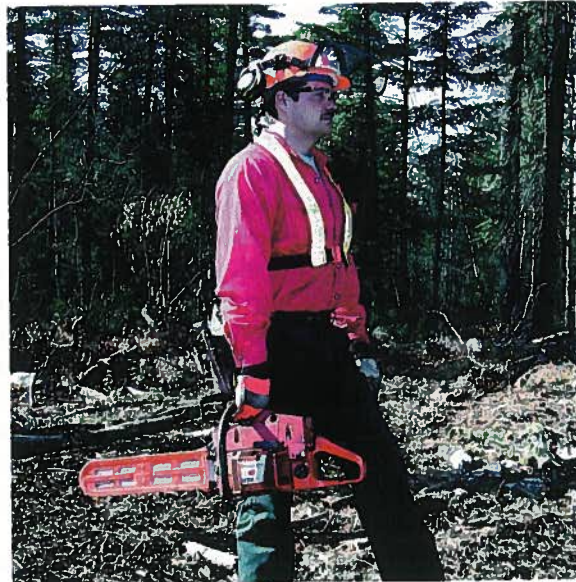
Choosing the right tool for the job is another important factor. For tree felling you must consider the size of the wood being cut, the topography and type of underbrush and potential obstacles

near the cut area that will be encountered. All of these factors will help determine the proper chainsaw for the job. In most silviculture situations the ideal choice is a small to medium sized saw, one that is lightweight and easy to maneuver in dense brush. Larger, more powerful chainsaws are better suited for logging operations.

For the brush saw operator, it is also important to know the size and type of material to be cut before selecting a saw. There are many types of saws and cutting blades. Using a saw that is not designed for the job at hand is an injury waiting to happen. Not only is it important to have the right saw for the job, it is

also necessary to have the right choice of cutting blade. The blade must be designed for use on the saw and it must be the right blade design for the type of cutting involved. Always refer to the saw manufacturer's instruction manual to ensure that the blade meets the specifications required.

The safe operation of these two cutting tools also depends heavily on proper maintenance. The saw's components along with their designed safety features must be maintained and in good repair. The cutting surfaces must be sharpened to the manufacturer's standard. The saws must be inspected, tested and adjusted at the beginning of each operating period. When the saw is shut down for re-fuelling, it's also an ideal time to conduct another visual inspection for defects as well as checking the condition of the cutting blade or saw chain cutting surfaces.





Proper sharpening and maintenance of the cutting surfaces will allow the saw to work at its optimum performance capability. Dull or damaged blades or saw chain cutters make the operator's job more difficult and increase the potential for injury, especially the deadly kickback reaction. Replace damaged or worn parts immediately.

Personal protective equipment (PPE) is the operator's last line of defense when exposed to the hazards of saw operation. Standards for PPE in Canadian silviculture operations will vary depending on jurisdiction. However, Canadian forestry and silviculture industry best practices dictate that the PPE characteristics that are the most effective include the following: CSA approved hard hats; safety boots with cut resistant surfaces, steel toe and shank, non-slip soles and strong ankle support, properly laced to the top with loose pant cuffs tucked in; cut resistant pants or chaps and chainsaw gloves for chainsaw operation and proper gloves for brush saw operation; CSA approved hearing protection (muff-style attached to hard hat), face shield (attached to hard hat) and safety glasses, high visibility clothing, and an ergonomically designed brush saw carrying harness. Additional safety equipment should also include a field first aid kit with compress bandages, a whistle to summon assistance in an emergency, and a field machine tool kit containing the necessary items used for safe field maintenance and repair.

Using these powerful tools in rough wilderness terrain brings on other hazards. Slips and falls encountered when walking on rough and uneven terrain can cause painful ankle and knee injuries and if the saw is running and you are not in control of it, disaster can happen. Wildlife encounters ranging from confrontation with bees and wasps to encounters with bears are always a threat. Physically demanding work in extremes of temperature, especially hot weather, can bring on hazards associated with heat exhaustion and sun stroke. Noise, vibration and exposure to carbon monoxide also must be dealt with safely. Physical exhaustion and fatigue can lead to careless or uncontrolled use of the saw and that's when kickback or exposure to a rotating cutting blade can occur.

It's a tough job—and as the saying goes, someone's got to do it. But that someone better be a worker who is in good physical condition, has the proper training and supervision, is equipped with the right tools that are properly maintained, is following safe work practices and is wearing the right PPE!

Chris Serratorre is a Consultant Trainer with the Ontario Forestry Safe Workplace Association.

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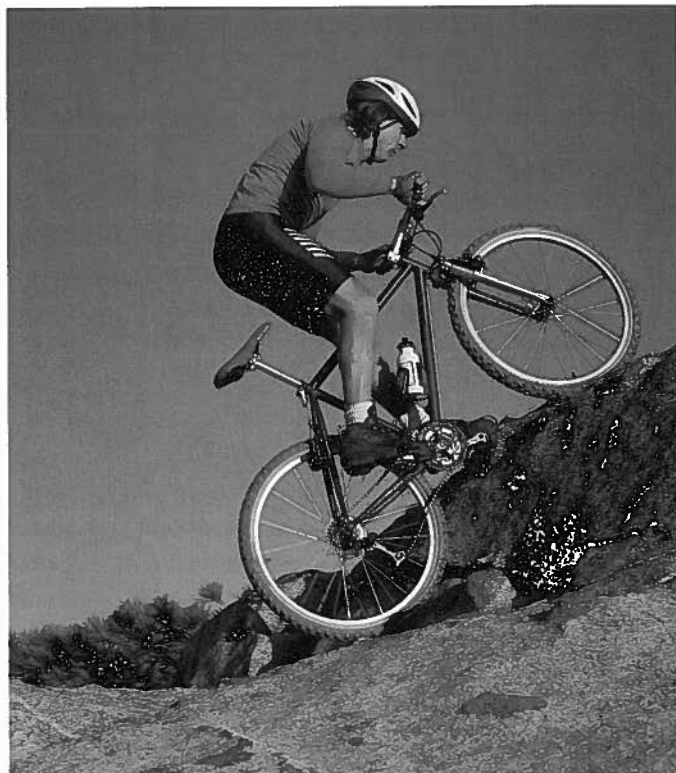
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Sports Science Meets Tree-Planters



Can a tree-planter be compared to an Olympic athlete? It's not as far fetched as you might believe. Dr. Delia Roberts of Selkirk College in Castlegar, BC is working to bring down injury rates and help planters increase their productivity. Working together with Weyerhaeuser BC Interior Forestlands Division, Roberts examined 10 tree-planters and found they exercised at work rates high enough to increase the levels of stress hormones, cause the breakdown of muscle tissue, and impair the nervous and immune systems, similar to changes seen in elite athletes. These results were not too surprising when you consider that planters carry nearly 35% of their body weight over 16km of rough terrain, bending around 200 times/hour and driving their shovels into the ground around 1600 times/day.

Based upon the findings of this pilot study, Dr. Roberts has used the latest sports science techniques to devise two different approaches to keeping planters in top form throughout the season. "The human body is extremely adaptable," says Dr. Roberts. "If you use the right techniques you can prepare it to withstand remarkable work loads without damage." This season 25 planters who will be working for Weyerhaeuser Grande Prairie Operations preferred contractors began exercising in February. They have followed a training program that has focused on enhancing the way that the nerves and muscles work together as well as improving general fitness. While they had to commit to following the program six days/week, most of the workouts were less than 20 minutes long. "It feels just like it does when

I'm planting", "I feel totally pumped and ready to plant" and "I can't believe how strong I feel" are but a few of the planters' comments.

Another of the major findings of the pilot study was that planters' blood sugar levels were so low that their nerves could not function optimally. So this year 20 planters will receive a dietary supplement designed to correct this situation. Dr. Roberts and her staff will be monitoring an additional 20 planters who will receive a placebo, but they won't know who is who, until the study is all over. "It's extremely important to determine if the observed changes are due to the treatment (the training, or the dietary supplement) or just due to environmental or other factors" says Roberts.

The results should be analyzed by next fall, and some practical recommendations made in time for next season. "This work is only of value if it generates some workable solutions that can realistically be utilized by silviculture workers, it's my feeling that it will not only help planters' but may have broader applications for forestry workers" concludes Dr. Roberts.

Ergonomic Shovel helps planters

In an effort to reduce planter injuries, BushPro Supplies has developed an ergonomic shovel. The two principle concepts behind the ergonomic shovel are to allow the wrist to remain at its natural angle and the thumb to be placed where it naturally wants to go. The theory being that when the wrist and thumb are in their most natural and relaxed position the stresses of repetitive motions are minimized.

In addition to the two principle innovations just mentioned, BushPro added three minor innovations.

1. The grip is tapered, thicker at the forefinger end and thinner at the small finger end.
2. The grip has been kept purposely narrow so that it will be comfortable for planters with smaller hands. Planters with larger hands can customize the size of the grip using bicycle grip tape, foam, etc.

3. It is easy for planters to customize the length of the blade.

Ed Walters of BushPro Supplies explained, "Another ergonomic issue that the planters can address themselves is to create a small angle (5% to 10%) between the plane of the blade and plane of the handle itself. Not everyone agrees on the theoretical benefits of this procedure, but I personally feel it makes sense."

100+ prototypes have been developed this year and have been distributed by WSCA contractors to select planters. The results will be carefully surveyed by the WCB. If all goes well, BushPro will make the handle commercially available in 2003.

IMPACT OF STAND TENDING ON WOOD QUALITY

by Les Jozsa

Introduction

Canada has eight forest regions, each with a characteristic mix of tree species. We also have a vast range of climate, soils, aspects, and elevation. There are 22 common commercial softwood species, and 14 common hardwood species. Each of these species can grow in a mixture with others, while some can grow in pure stands. All of these species will respond in their own way to a variety of silviculture treatments. The proper choice of stand treatment will depend on stand condition and the desired end product.

There are about 300 large and medium-sized forest products companies in Canada, each having its own mill and product situations. Many have their own forest management professionals, trying to do the best they can to supply their operations, while dealing with the forest, wood supply, mill configuration, market situations, and public expectations. As the industry shifts from harvesting old-growth stands to managed second-growth stands, new challenges have to be faced. In intensively managed second-growth forests, trees may be grown from genetically improved seed stock and be subjected to spacing, thinning, fertilization, and pruning. Accelerated growth and earlier harvest will lead to a greater proportion of juvenile wood in lumber and other solid wood products, as well as in pulp. The technical properties of juvenile wood may be different from those of mature wood, and may affect the utilization of the material in many important ways. For example, in New Zealand most companies are continuing to grow high-value radiata pine stands on 25-year rotations, through properly timed and implemented density control and pruning. In the USA, southern pines are harvested with a large proportion of juvenile wood, because of short rotations, resulting in problems with strength and stiffness, and dimensional stability of lumber. It is essential

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that potential problems with wood quality be identified in Canada to allow the industry to make plans to ameliorate them for all commercially important tree species.

Background

In the mid-1980's, Forintek reviewed the state of research on the strength properties of second-growth woods. Although these properties were studied mostly on small, clear specimens of wood, the results clearly showed lower strength and stiffness of juvenile wood, compared to mature wood in Douglas-fir. In-grade testing (utilizing full-size lumber) confirmed these results, and the Douglas-fir Task Force was initiated. Since then, Forintek has conducted research on the impact of stand density (number of stems/ha) on wood quality for several Canadian softwood species, including lodgepole pine, western hemlock, white spruce,

western larch, jack pine, balsam fir, and black spruce. These studies looked at the fastest growing trees by diameter class to document potential negative impacts on lumber strength and stiffness, lumber grades and yields, and ultimately product value. The rationale for this research assumed that if decreases in wood quality attributes were not noticeable in the fastest growing trees, then trees grown under average managed stand conditions would not produce inferior quality wood either.

Lately, a comprehensive approach is being followed to evaluate silvicultural treatments (e.g., thinning in S-P-F) in eastern Canada. This strategy includes treatment costs, harvesting and transportation costs, and lumber processing costs in the financial analysis. Total stand value (\$/ha) is then compared with the cost (\$/ha), to calculate the benefit/cost ratio. Completed projects

include initial spacing in black spruce, and pre-commercial thinning in balsam fir and jack pine.

Key Results

In all our projects completed to date, there is a recurring theme suggesting that if we want to maintain old-growth-like positive wood quality attributes in our second-growth managed stands, we need to apply conservative stand density control measures.

During our field-work it became apparent that in a 100-year-old stand tree diameter was an excellent proxy of stand density for all tree species. So much so, that we came up with a rule-of-thumb for lodgepole pine: if there were 1900 live stems/ha, then the maximum tree diameter at breast height (DBH) was 25cm; at 1100 stems/ha = 32cm DBH; and at 750 stems/ha = 40-45cm DBH. The emphasis is on

Principal Features of a Tree Stem... and the Basics of Hardwood Structure



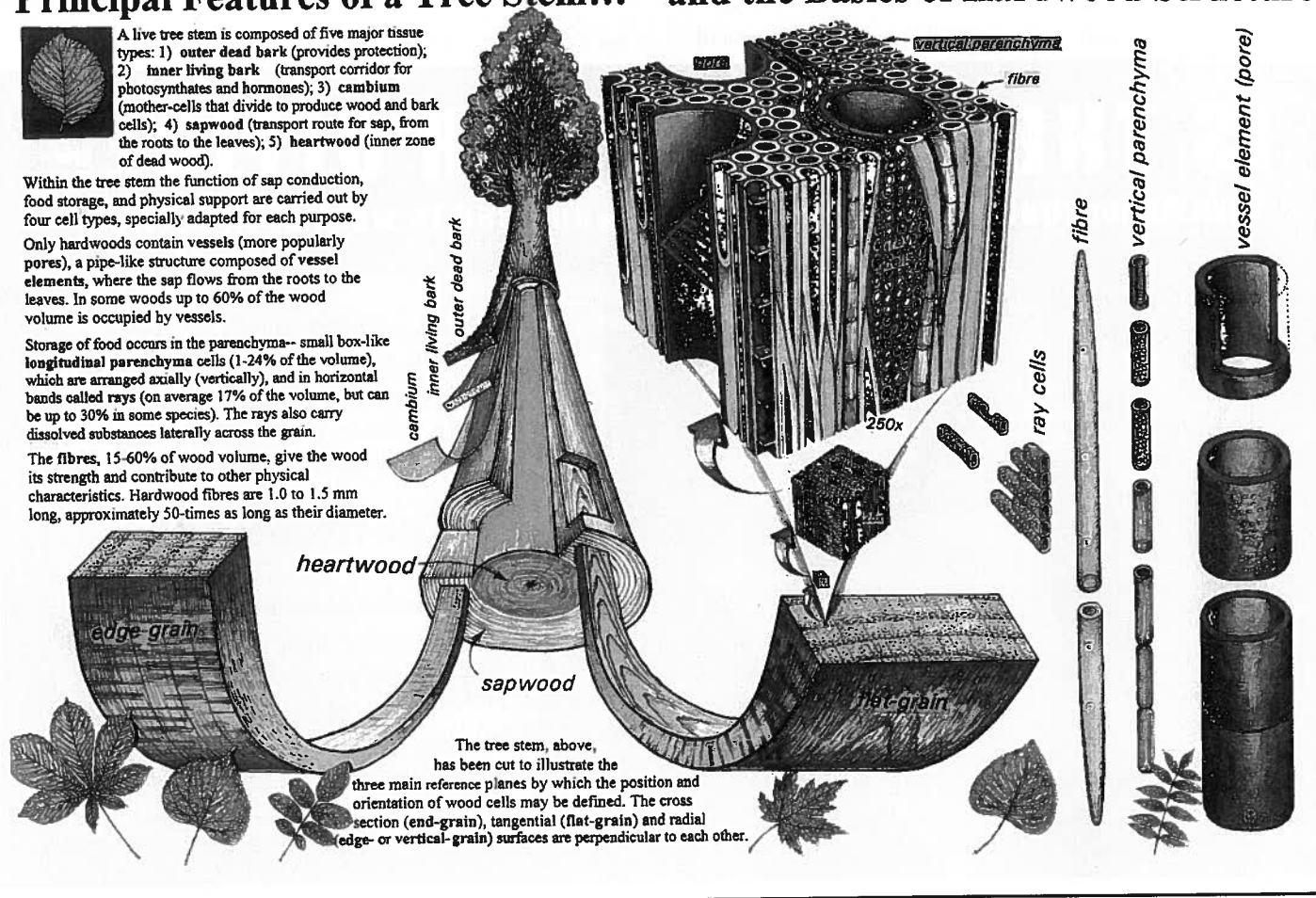
A live tree stem is composed of five major tissue types: 1) outer dead bark (provides protection); 2) inner living bark (transport corridor for photosynthates and hormones); 3) cambium (mother-cells that divide to produce wood and bark cells); 4) sapwood (transport route for sap, from the roots to the leaves); 5) heartwood (inner zone of dead wood).

Within the tree stem the function of sap conduction, food storage, and physical support are carried out by four cell types, specially adapted for each purpose.

Only hardwoods contain vessels (more popularly pores), a pipe-like structure composed of vessel elements, where the sap flows from the roots to the leaves. In some woods up to 60% of the wood volume is occupied by vessels.

Storage of food occurs in the parenchyma-- small box-like longitudinal parenchyma cells (1-24% of the volume), which are arranged axially (vertically), and in horizontal bands called rays (on average 17% of the volume, but can be up to 30% in some species). The rays also carry dissolved substances laterally across the grain.

The fibres, 15-60% of wood volume, give the wood its strength and contribute to other physical characteristics. Hardwood fibres are 1.0 to 1.5 mm long, approximately 50-times as long as their diameter.



the maximum, because even in the very open environment of 750 stems/ha, with an average tree-to-tree distance of 3.66m, 56% of the wood volume came from the 20- to 30-cm DBH trees.

Lodgepole Pine Product Yields Related to Differences in Stand Density

Tree and log characteristics, wood properties, visually graded lumber yields, and machine-stress-rated (MSR) lumber yields were determined for 95-year-old lodgepole pine trees on good sites in southeastern BC.

Knot size, even in the most open stand of 700 s/ha, did not significantly limit visually assigned structural lumber grades in the commonly marketed No.2 & Better grade-class (all three stands of 700, 1100 and 1900 s/ha yielded about 94%).

Lumber Strength and Stiffness, and

be representative of future plantation stands.

Douglas-fir Rapidly grown 50-year-old trees were sampled from 6 locations on Vancouver Island, with a stand density of 530 s/ha. Juvenile wood (that portion of the stem that was laid down under the influence of the live crown) was identified as the first 20 years of growth at all heights. This inner "stove-pipe-like" juvenile core made up 50% of the stem volume, whose average wood density was 0.41 (about 9% lower than the "species average of 0.45). The outer mature wood (>20 years of growth) had 0.47 relative density (4% higher than the species average). In terms of strength evaluations, juvenile wood had a bending strength 71% and stiffness 80% that of mature wood.

Managers should realize that second-growth commercial harvests will contain a significant portion of lower quality juvenile wood.

Lately, a comprehensive approach is being followed to evaluate silvicultural treatments (e.g., thinning in S-P-F) in eastern Canada.

MSR Yields decreased as stand density decreased. Visually graded lumber from the 700 s/ha trees did not meet in-grade stiffness and bending strength code specifications for the S-P-F species group from the largest (>35 cm) DBH trees; however, the lumber from 20-30 cm DBH trees met code values.

Implications: It is important to keep in mind that these study results do not apply to the overall lodgepole pine population. Tree selection was limited with respect to site and stand density, and the growth rates were not typical of old-growth lodgepole pine in general, but chosen to

Western hemlock 90-year-old western hemlock trees were examined from 3 natural stands on Vancouver Island. Stiffness values for all grades of 105x105 mm squares obtained from two 930 stems/ha stands met or exceeded existing Select Structural code values for Hem-Fir. All grades of lumber from the 580-stems/ha stand fell below the Select Structural code values, but did meet the No.1 and No. 2 code values if trees were less than 50 cm DBH.

White spruce Roughly 100-year-old trees were selected to represent 30, 40,

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and 50 cm tree DBH classes, from three natural stands. Wood density, bending and compression strength, and stiffness all declined significantly as tree diameter increased from 30 cm to 50 cm DBH. Managers should note that when white spruce is grown at a rate corresponding to 50 cm DBH in about 100 years, mean values of structural wood properties generally fall below averages for the species.

Western larch 45-year-old western larch experimental stands were sampled to represent different stocking levels ranging from 270 to 4,300 stems/ha. As expected, trees in the widest spaced plots grew the fastest. Despite large differences in diameter growth, no significant differences in average wood density of 0.52 occurred between spacings. In the first 4 m of the stem, from the ground up, branch sizes did not exceed 20 mm even at 4.6 x 4.6 m spacing (500 stems/ha).

Impact on Product Quality in Thinning S-P-F in Eastern Canada

Stand density management has a significantly negative impact on lumber quality only when the density is below 2,000 stems/ha.

Earlier stocking density control (initial spacing) has a more significant impact on wood quality than later stand manipulation.

Knots are secondary to wane in lumber downgrades in black spruce (typically small branched), but become more important in jack pine (a large-branch species).

Wood density is the most important variable influencing bending properties, especially in small-branched species.

Lumber strength/stiffness show significant variation within a tree, depending on wood density and knottiness.

Impact on financial returns: The harvesting and manufacturing costs for thinned stands are considerably lower. Therefore, thinned stands tend to have a higher financial return than the un-thinned controls.

Future

For fine tuning silviculture prescriptions, product conversion studies are needed, as performed at Forintek, to fully understand the impact of stand density management on tree/log size, harvesting costs, manufacturing efficiencies, lumber yields, lumber grades, dimensional stability, lumber strength and stiffness, and stand value. ❁

A synopsis of research results at Forintek Canada Corp. Prepared by Les Jozsa, Resource Properties Specialist Emeritus.

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PERSONAL CAMP GEAR

by Dirk Brinkman

Personal Quarters

Wilderness homes range from bent willow boughs covered with clear plastic, through all varieties of mountain tents to the latest in campers and camper trailers. The key to all of them is the creation of a dry bug proofed space that allows air without allowing no-see-ums. All personal camps require rope, tarps and duct tape.

Dogs

The best bear protectors are the bold dogs who will bark and harass bears enough to irritate them so much they consider a visit to the camp or on the block beneath their dignity. Of course, the camp-site or block should not house their den or favourite feeding ground.

Beds

The hardest workers know they need the best beds. Beds must be assembled carefully, including a sleeping bag rated to keep you warm when it is wet and cold on a soft foamy with back up blankets, and pillows.

Raingear

Only the toughest raingear survives the tough slash and relentless driving movement of silviculture.

Knapsacks

Waterproof for dry raingear, lunches, more duct tape, etc.

Lunch Kits

From tupperware to oriental bamboo kits, something to keep lunch from being crushed is needed.

Water Containers

Of all sizes, shapes and materials, from high tech insulated thermos's to recycled plastic containers, they are all found on a working site.

Multi Utility Knives/Pliers

The various useful camping gadgets which each year are superceded by new products are often severely tested.

Bug Repellant

Deet is the most common chemical ingredient of popular repellants—the higher the concentration, the higher the effectiveness and the greater the allergic reaction, the melting of raingear and uncertain health effects. Citronella, tea tree and lavender oils are common herbal ingredients. The multitude of other less expensive solutions that flourish in silviculture camps are still awaiting the Phd thesis that will document and evaluate them. Mosquito coils are also important for debugging spaces.

Sunblock

Sunblock has become an emerging concern with the awareness of the increasing UV radiation—especially for the winter-skins first exposure to spring and summer sun.

Work Clothes

Local community thrift stores do a brisk business with silviculture workers, who do not just wear clothes, but wear them out weekly. The silviculture costume is distinguished by its layers of both tight

and loose garments. Silviculture workers are gourmets of comfortable materials, and know how to layer fleece, cotton and wool to be comfortable and functional.

Socks

The latest sock technology in materials, layers and inserts will be snapped up each year in the pursuit of greater relief from stomping and tromping 9 to 20 kilometers a day on resistant sites.

Gloves

The same as socks but with more wear.

Boots

Comfortable, light, high, water proof and tough, all CSA approved work boot types are used, but Nokia is the dominant rubber boot. Many of the stores who supply the other 'hard' trades like mountain climbing with foot wear, simply will not honor warranties with tree planters because of how quickly they would bankrupt the manufacturer.

Electronic Sound Systems

Portable, truck mounted and with camp boomers, all forms of entertainment electronics from the miniature to the mega, are found wired on individuals, in tents and throughout the operations.

Duct Tape

Duct Tape is imperative in camp. It has been used for taping fingers instead of wearing gloves as well as patching clothes and boots.

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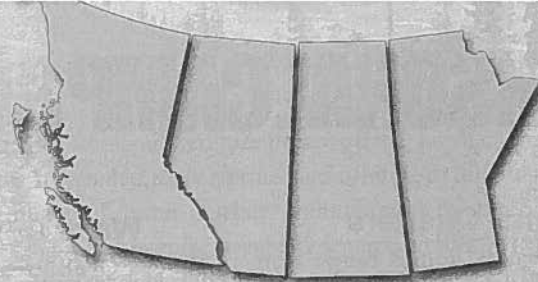
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Western Silvicultural Contractors' Association



B.C.'s forest investment account: another feat of clay

Before they were elected, the B.C. Liberals made a number of promises regarding forestry in British Columbia. They promised to get rid of Forest Renewal BC, which they did with some dispatch and much to the relief of many who felt the Crown Corporation was a bureaucratic misadventure. The Liberals also promised to "increase the allowable cut over time through scientific forest management, proper planning, and incentives to promote enhanced silviculture." This promise they have not approached with the same alacrity as their expeditious severing of FRBC.

Instead government has put in place the forest investment account (FIA). The little official spin this scheme has attracted suggests that it is a novel strategy fitting for the New Era, etc. But people in the business are hardly convinced. Yes, it is novel since the province will now use a private consultant firm as its agent in administering the account; a first in BC for this kind of public funded forestry. And it will be steered by the collaborations everyone hopes will come from the emerging and untested defined forest management area concept.

What is not novel, is that the FIA continues the convoluted practice of taking money from the forest industry through taxes and stumpage and then giving it back to them to spend on forestry after being run through a less than efficient agency, program or account.

At current rates of investment proposed in the FIA some timber supply regions will face reductions in their allowable cut; not the increase the Liberals promised. As for Liberal incentives for industry to invest in enhanced silviculture there are none contained in the forest investment account.

Proper planning and long-term multi-year strategies may be frustrated by being subject to an annual vote in the Legislature. But more importantly, with sustainable forest management (SFM) the main theme, its achievement suffers from a lack of definition. FIA fails to set out the specific SFM goals and outcomes it expects to see FIA proponents live up to. How are we to measure the results of proper planning when the benchmarks are so vague? None of this bodes well for convincing politicians every year that they need to support forestry investments.

The future of forestry funding that the FIA portends is bleak enough. A look at the declines in public spending in this area in the past only makes things worse. The health of the contractor community is a bellwether of the health of public forest investments in the province. Few spacing and enhanced forestry firms are still on their feet. That suggests the forestry work they should be busy doing is in equally ruinous straits. The policies and practices of this government seem to continue that of past governments.

There is of course an elegant remedy. And it is not particularly novel. Much has been said about the need for results-based forestry in the province. This is not a new concept for the reforestation sector. Since the late 80s industry has quite efficiently reforested plantations to a free to grow state on results-based principles. Government has set the stocking guidelines and industry has lived up to those reforestation standards with generally excellent results. Extending this principle to the enhanced forestry and environmental restoration side of sustainable forest management seems like a logical and timely step given the

by John Betts, Executive Director WSCA

promises and policy directions the BC Liberals have set for themselves and the forest sector.

The details of a results-based or privatized approach to maintaining and growing the capacity of B.C.'s forests has been laid out in a W.S.C.A. proposal recently presented to government through a number of venues. Just whether these ideas have captured the imagination of government is hard to tell. Much of forestry in B.C. is largely a conservative culture and new ideas take time to root. As well there have been huge demands put on policy makers to deal with the U.S. trade issue; often at the expense of other needed initiatives.

Nevertheless, there is a chance now for the B.C. government to live up to its promises as well as to do something truly innovative for the province's silviculture program. Letting loose the entrepreneurial energy of the forest sector and the silvicultural contractors in a truly results-based setting for enhanced forestry and habitat restoration could create thousands of jobs now and more forest in the future. This is the time to act. The principles have been laid out. They have been proven in the reforestation program. They need only to be made into policy. The industry can handle the practical end. Some boldness by government and the forest will benefit with little expense to the public and enough efficiency to make it worthwhile to industry. If government can shake its funding habits of the last thirty years it could make a true and enduring forestry program; something many in the industry have been waiting for for years.

Association des entrepreneurs de travaux sylvicoles

du Québec

Par Nathalie Boies, Adj. administrative AETSQ

L'Association des entrepreneurs en travaux sylvicoles du Québec a maintenant sa permanence à Québec et un nouveau directeur général.

Depuis le 29 avril dernier, L'AETSQ s'est installée dans la magnifique région de Québec dans son nouveau bureau. Lors de l'assemblée générale en février dernier, les membres ont majoritairement voté pour que l'Association s'établisse à Québec près des autres organisations pour ainsi éviter les nombreux déplacements lors des réunions avec les autres associations.

Par la même occasion, je remercie Monsieur René Ouellette et Madame Dominique Biron pour avoir fait connaître et grandir l'Association durant son passage dans les bureaux des "Consultants Plani-forêt Inc" au Saguenay-Lac-St-Jean. Cela a permis à l'association de prendre son envol sur une base solide grâce à René et Dominique. Merci!

De plus, Monsieur Fabien Simard, ingénieur forestier de formation a été nommé au poste de directeur général de l'Association le 29 avril dernier. Dans ses nouvelles fonctions, Monsieur Simard aura comme mandat de s'occuper des dossiers chauds de l'AETSQ et de continuer à faire connaître d'avantage l'Association des entrepreneurs en travaux sylvicoles du Québec. L'AETSQ a fait un excellent choix en nommant Monsieur Simard au poste de directeur général. D'une part, pour son expérience comme directeur des opérations à diverses compagnies et de l'autre côté pour son expérience de travail aux Etat-Unis durant quelques années. Félicitation dans vos nouvelles fonctions Monsieur Simard!

En terminant, mon vœu le plus cher est que l'Association des entrepreneurs en travaux sylvicoles du Québec demeure en place et qu'elle grandisse de jour en jour dans sa nouvelle démarche. De plus, elle continuera de défendre les entrepreneurs comme elle la toujours fait. Avec Monsieur Fabien Simard en poste, cela ne peut être que bénéfique pour nous tous. Longue vie l'AETSQ!

By Nathalie Boies, Administrative Assistant

The AETSQ (Association des entrepreneurs en travaux sylvicoles du Québec) now has its headquarters in Quebec City and a new managing director. Since April 29, 2002, the Association has been installed in its new office in the magnificent Quebec City region. At its general meeting last February, a majority of the members voted in favour of locating the AETSQ in Quebec City close to related organizations in order to avoid frequent travel to meetings with other associations.

I take this opportunity to thank Mr René Ouellette and Mrs Dominique Biron for their success in publicizing and developing our Association during its stay in the "Consultants Plani-Forêt Inc" offices in the Saguenay-Lac-Saint-Jean area. Thanks to René and Dominique, the Association can now move ahead on a solid foundation. Thank you!

In addition, Mr Fabien Simard, a forestry engineer by training, was appointed managing director of the Association at the April 29 meeting. Among his new duties, Mr Simard

will have responsibility for dealing with the AETSQ's day-to-day affairs and will continue to make the work of the Association better known. His appointment as managing director is an excellent move for the AETSQ, both because of his previous career as a director of forestry operations for a variety of companies and because of his years of experience in the United States. Our congratulations on your new post, Mr Simard!

In conclusion, my fondest wish is that the AETSQ may remain in its present location and that it may grow from year to year in this new phase of its existence. It will continue, moreover, to defend the interests of all forestry service contractors, as it has always done. With Mr Fabien Simard in charge, the results cannot fail to be positive for us all. Long live the AETSQ!

**Monsieur Fabien Simard,
ingénieur forestier de formation
a été nommé au poste de
directeur général de
l'Association le 29 avril dernier.**

Prince Edward Island



Forest Improvement Association

by Wanson Hemphill, Manager

Summer has arrived in the land of potatoes, golf courses, red-haired girls and 280,000 hectares of forest. Approximately 4,000 hectares will be harvested with 1000 hectares replanted in a variety of softwoods.

An exciting new program is expected to be announced in June to provide incentives for forest management plans and new silviculture treatments. This is significant because plans weren't widely available to PEI forest owners since the FRDA times and without a plan, it's hard for owners to understand and appreciate forest management options.

The Model Forest project application is completed with some project ideas including: Best Management Practices, Riparian treatments, Agro-forestry, Demonstration woodlots, Non-timber products, Eco-tourism, Provincial forest use vision, Sustainable forestry island landscapes, Woodlot economic options, Land-use decision tools and Forest stewardship.

Wildlife enhancements

A May 3 workshop in Memramcook, NB helped shed a little more light on the complex subject of forest taxation and the recent intergenerational transfer allowance. However, more clarification is needed in this area.

Here's an interesting comparison of the worldwide direct costs (US/Mbf) of sawing lumber during 2000. This may help explain some trade problems and wood flow.

Country	Labour costs	Stumpage costs*	Total
Chile	33	103	136
South Africa	62	93	155
Brazil	55	109	164
New Zealand	50	129	179
Canada Prairies	82	101	183
Sweden	49	152	201
Canada East	85	119	204
Australia	87	140	227
BC Interior	83	147	230
US South	70	210	280
US Northwest	73	220	293
US Inland	83	219	302
BC Coast	153	222	375

* "Stumpage" includes log costs from private land

Interest in ground hemlock, the local yew with such amazing medicinal properties and harvesting has increased. An April 27 workshop heard about world markets, plantation developments, sustainable harvesting guidelines, prices, third party audits and local drying and processing.

Forest safety is always a concern, especially with the \$10.72/\$100 base rate. Currently our forest harvest sites are not inspected by Occupational Health & Safety because they say they can't find us and 1/3 of the forest land is owned by farmers where OH&S don't have jurisdiction. Inspections and the threat of inspections are a very important tool in the Prevention toolbox where one unsafe operation could affect the group rate for years. We must do more.

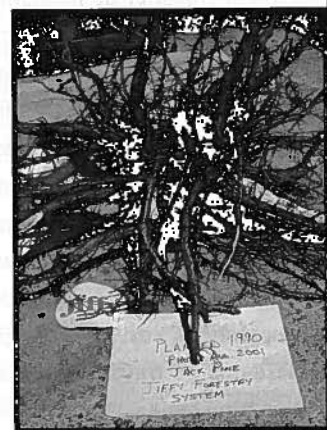
Healthy and safe summer, Wanson

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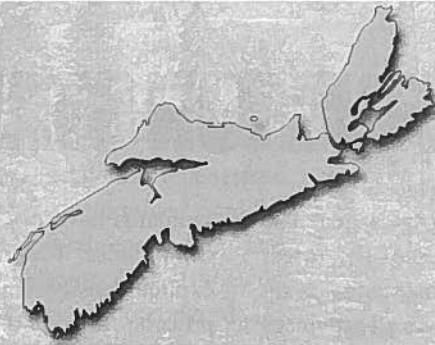


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Nova Scotia



Silviculture Contractors Association

by Ed Davidson

Recent developments in Nova Scotia appear to be bad news for full-time forestry instructors in the Nova Scotia Community College system. A plan has been announced to eliminate the professional forestry worker program at both the Bridgewater and Springhill campus. As of early June, the course on the chopping block will be offered for one more year and then eliminated entirely, leaving only the Port Hawkesbury program. Despite opposing efforts, there are indicators this is a done deal and a new way of providing forestry training is on the horizon.

There continues to be two very different pictures reflecting the health of the silviculture industry here. On one hand, there are accounts of DNR staff saying forest sustainability is being achieved, registered buyers are close to 100% compliant with their silviculture requirements, and the department itself is the catalyst responsible for an influx of 9-10 million dollars of work being done. However, the department has stated at other times that it is not possible to track the amount of money going into the system from the present "user-pay" mechanism. What can be tracked, though, are the total number of credits points allocated. Industry speakers have to be careful about the language issue since dollars and credit points are not the same and attempts to treat them as such tend to be sensitive and confusing.

While all of this is going on, small contractors and consultants still struggle with finding workers, and margins so thin they jeopardize their solvency. No wonder then, a shortage of these businessmen exists to do the work in some parts of the province.

Many of us are anxiously awaiting the results of a report from

the Forest Safety Society of Nova Scotia. The study set out to compare silviculture rates around the Atlantic provinces and Quebec. Early revelations point to differences in the way administration costs are dealt with and how contractors are either paid for these efforts in other areas or, in our case, expected to absorb the extra work.

With the 2002 spring planting season pretty much complete, many contractors have told me it has been one of the worst years ever for getting people and then keeping them. Although it has been a banner year for flies, I suspect the increased turnover factor is linked more directly to our suppressed rates and insufficient incentive to do chemical and mechanical site-prep. The lack of site-preparation challenges the quality of plantation establishment but also forces planters to do more for less.

The NSSCA extends congratulations to the regional wood lot owners of the year! Central Region winner Earl Tanner of Hardwoodlands (public tour Sept 21) and Eastern Region winner Bob Glaze of Orangedale (public tour Sept 7). Special congratulations to out to Les Corkum of Falmouth who will receive his official presentation as the 2002 provincial winner during a public field tour of his wood-lot Oct 4 & 5. We are also pleased to announce that Comeau Lumber of Meteghan, Digby County has been chosen as this year's recipient of the Future Forest Award. This award is given annually by the NSSCA as the contractors' choice in recognition of excellence in silviculture program delivery on small private woodlots. Previous winners are Stora-Enso and Ledwidge Lumber Ltd.



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FOREST REGENERATION STANDARDS

by Neil Stocker

Forest regeneration standards vary greatly across Canada. The reasons for the differing interests and biases of the forest management administrations applying different standards on identical ecosystems (e.g. the boreal forest crosses all provinces and territories) are too numerous to recount in this article. In some cases these interests and biases have changed significantly over time and are still evolving in an as yet unpredictable fashion. Some of these standards may be maintained for many years, others may change within the current year. A summary of the Provincial/Territorial standards is presented in Table 1 (page 22).

Newfoundland and Labrador

Beginning in the east, the Province of Newfoundland and Labrador has recently compiled its regeneration assessment procedures. These are awaiting review and approval before being adopted. The standards indicate a principal concern with the restoration of stand tree populations and conditions to their pre-harvest states.

PRINCE EDWARD ISLAND

With its relatively small size and overwhelming level of private ownership (92% of the forest resource base) forest management is more like woodlot management and is appropriately organized at that scale. Accordingly, crown forest management has a demonstrative role, with the hope that private forest owners will observe and imitate the province's lead. For that purpose, very specific standards and procedures are helpful.

NOVA SCOTIA

Nova Scotia has developed a set of "Technical Standards for Completed Silviculture" which are applied to both natural regeneration and plantation establishments. With the significant level of crown ownership of its forest land base (28%), the Province has a considerable stake in managing its forests to its own standards. The prevalence of industrial forest concerns on most of the balance of the forest base (69%) held in private hands allows for relatively little latitude on the part of the government in the management of these forest lands. Accordingly, the regeneration standards have been designed principally to meet the needs of the government on crown lands.

NEW BRUNSWICK

New Brunswick is somewhat larger in area than Nova Scotia, but with significantly more productive forest landbase under crown ownership (51%). Much of this land is under license to industrial users. Because management responsibilities are shared between the industry and government, forest regeneration

standards have evolved through a process of negotiation and compromise. The end result, with its relatively high stocking and explicit density requirements attests to the effectiveness of the process. In addition to the stocking and density requirements, there are two opportunities/limitations affecting regeneration:

1. More than one commercial species may be planted on a site provided they are compatible and appropriate for the site;
2. Sites supporting tolerant hardwood or hardwood-softwood (map types) are not to be replanted with (exclusively) softwood species.

QUÉBEC

The largest province in the country also has the largest forest land base of any province or territory in Canada (83.9 million hectares). The vast majority of this land, some 89%, belongs to the crown. With its distinctive cultural origins and history, Québec has evolved in a unique pattern, which has reflected itself in its forest management style. Because much of the crown land in the southern, more commercially developed part of the province has been allocated to "zones d'exploitation contrôlée (ZEC)", there has been an interest in achieving regeneration standards which are achievable and acceptable to the small scale industries partnered within these zones. Hence, the standards appear to be less rigorous than those of some other large provinces, but reflect the diversity of forest site types encountered in Québec.

ONTARIO

Ontario has recently developed and implemented its "Silvicultural Effectiveness Monitoring Manual for Ontario". This is a companion to the Forest Management Planning (FMP) process, and is used to determine whether specified area objectives have been met. Minimum objectives for a particular stand are described in Silvicultural Ground Rules (SGRs) contained within an FMP. Additional objectives may be specified to reflect diversity in stands and values.

MANITOBA

Manitoba's forest renewal standards specify the quantities of regeneration required on forest lands, and indicate as well the types of forest into which each site could develop. These forest renewal standards are applicable to even aged stands following fire, clear-cutting, scarification, seeding or planting. Failure to achieve appropriate site-specific regeneration standards indicates a need for reforestation activity.

The standards specify the numbers of living, healthy stems per hectare needed at the end of a set regeneration period to

produce acceptable forest stands at maturity. Sets of stocking standards have been developed for naturally regenerated softwood sites, planted softwood sites, and naturally regenerated hardwood sites. The choice of standard is determined from the original species occupying the site for natural regeneration, and from the species planted on the site, for plantations. If they do not achieve these standards, the sites are considered not satisfactorily regenerated even though they may be forested.

SASKATCHEWAN

Regeneration standards are presently under review and will most likely be those negotiated between government and FMA licences.

ALBERTA

Alberta has a very prescriptive approach to forest management standards. In an environment characterized by popular support for business-driven initiatives, government has to be very careful to specify precise standards for forest management. Accordingly, regeneration standards may have somewhat lower thresholds than in other provinces, but they are very clear and unequivocal. Because of the last two attributes, two of the Territories, which have recently assumed control over their forest resources, have adopted Alberta's model for regeneration standards.

BRITISH COLUMBIA

Under BC's Forest Practices Code, regeneration standards have been replaced by Free-to-Grow standards. These standards have been established across BC's six regions, 13 treed biogeoclimatic zones, 97 subzones and 126 variants of subzones. For each of these subzones and variants there is an individual and often unique set of standards. Each of these standards specifies primary, secondary and/or tertiary preferred conifer species, acceptable broadleaf species, individual stocking standards (target and minimum for preferred and acceptable species, allowable regeneration delays, early and late assessment dates, minimum tree heights and crop tree to brush heights. These standards reflect the incredible range and diversity of BC's forests, the enormous amount of biogeoclimatic study that has been conducted within the forests, and the reliance of the province's economy on its forest resources.

YUKON TERRITORY

The Yukon Territory, instead of re-inventing the wheel, has adopted the established standards of a similarly forested Province, Alberta. With minimal staffing and resources, it is much wiser to adopt (at least temporarily) the standards of a better-staffed and equipped organization working with similar species in a comparable environment.



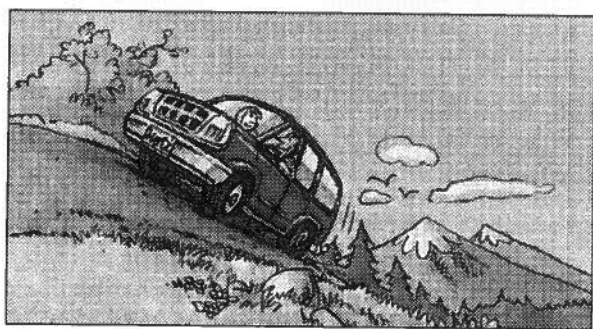
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Eastern Canada

Table 1. Provincial/Territorial regeneration standards across Canada

Province/Territory	Stocking (minimum)	Density (stems/ha)	Plot Size	Timing	Remarks
Newfoundland and Labrador	>70%	Merchantable stumps + 5%	1.26 m radius (5 m ² = 1/2,000 ha) and 1.78 m radius (10 m ² = 1/2,000 ha)	1 to 5 years post harvest (balsam fir) 3 to 5 years post harvest (black spruce)	Allowance for mortality (Source: Basil English, Senior Management Planner, Department of Forest Resources and Agrifoods)
Prince Edward Island	70%	2778 +/- 5% to 3086	(Not specified)	(Not specified)	(Source: George Coade, Senior Forestry Technician, Forestry and Land Resource Modeling, Department of Agriculture and Forestry)
Nova Scotia	80% (natural) 85% (plantations)	1500 living, planted or natural, commercial species.	(Not specified)	(Not specified)	2.4m X 2.4m spacing (Source: Schedule 1 - Technical Standards, Forest Sustainability Regulations)
New Brunswick	>90%	1800 to 2500 (forest sites) 1800 to 3000 (farm land sites). Based on 1/250 ha (40 m ² = 3.57 m radius) plots	1.26 m radius (5 m ² = 1/2,000 ha; stocking) 3.57 m radius (40 m ² = 1/250 ha; density & quality).	(Not specified)	Wild seedlings are not acceptable. Planted seedlings must be native commercial softwood species and/or Norway spruce. Container stock must meet prescribed height, root-collar diameter and total dry weight specifications. (Source: Private Woodlot Silviculture Manual 2002)

Central Canada

Table 1. Provincial/Territorial regeneration standards across Canada

Regeneration Standards Across Canada					
Province/Territory	Stocking (minimum)	Density (stems/ha)	Plot Size	Timing	Remarks
Québec	60% (or else 10% more than the pre-harvest stocking)	990 to 1200 hybrid poplar, birch, oak, other intolerant hardwoods, sugar maple, hemlock, tolerant hardwoods 1500 to 2000 fir, spruce, jackpine, larch, cedar 800 to 1100 red and/or white pine (uniformly spaced)	(not specified)	2 to 4 years after harvest (depending on species and regeneration method)	Seedlings at least 15 cm tall and 1.4 m to 2.1 m minimum inter-tree distance (depending on species) (Source: Manuel d'aménagement forestier, 3 édition)
Ontario	As specified in Forest Management Plan		Silviculture Ground Rules		
	Identified acceptable species free from competing vegetation (within the range of minimum – target – maximum) Two alternate procedures have been developed for the measurement of regeneration: "Silvicultural Treatment Assessment and Reporting System (STARS)" and Free-Growing Regeneration Assessment Manual for Ontario" (FRAM). The Ministry of Natural Resources has endorsed neither procedure as yet.		(not specified)	Either prescribed maximum number of years to reach Free-to-Grow (FTG) for even-aged systems, or number of growing seasons elapsed since the last disturbance for unevenaged systems	Minimum regeneration standards for clearcut and shelterwood systems are determined as part of the SGRs: Target tree species (desired or crop) and acceptable tree species; minimum height of target and acceptable tree species. (Source: Silvicultural Effectiveness Monitoring Manual for Ontario)

Western & Northern Canada

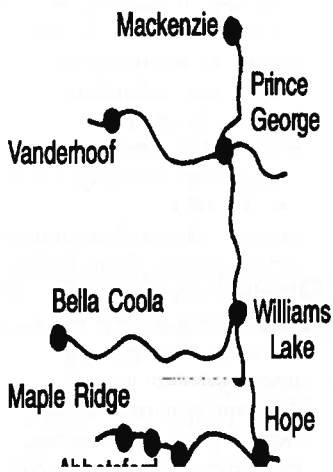
Regeneration Standards Across Canada

Province/ Territory	Stocking (minimum)	Density (stems/ha)	Plot Size	Timing	Remarks
Manitoba	15% to 80% (depending on species and forest type); 90% (SW @ yr 10)	164 to 6463 (at year seven, depending on species and forest type)	3.57 m radius (40 m ² = 1/250 ha)	5 to 7 years after disturbance	Stocking assessment: all SW > 0.20 m and HW > 1.0 m tall are tallied. Well-established trees (e.g. Black spruce > 1.0 m) well spaced from one another are counted. (Source: Forest Renewal Standards – Manitoba Conservation, Forestry Branch)
Saskatchewan	(Standards presently under review)				(Source: Pat Mackasey, Energy Resources and Mines)
Alberta	70% to 80% depending on species, cutblock area classification and date of harvest	5000 to 7000 (depending on species)	1.78 m radius (10m ²)	4 to 8 years after harvest	SW over 30 cm or HW over 80- 120 cm in height is tallied for density measurements. No more than 10 seedlings per plot may be tallied. Non-native species are acceptable for reforestation only when a comprehensive strategy is detailed in an approved Detailed Forest Management Plan (DFMP) (Source: Alberta Regeneration Survey Manual "Field Edition" effective May 1, 2000) . Regeneration surveys are not conducted; free-growing surveys are used instead. Minimum crop tree heights: 0.8m+/- to 2.0m+/- (species, regionally, and biogeoclimati- cally based) (Source: Establishment to Free Growing Guidebooks in the Forest Practices Code)
British Columbia	50% to 60% (derived from minimums as a percentage of target species; regionally and biogeo- climatically based)	200+/- to 700+/- well spaced preferred and acceptable (regionally and biogeoclimatically based),	3.99 m radius (50m ²)	4 years (regionally and biogeoclimatically based),	
Yukon Territory	70% to 80% (mix of acceptable SW and/or HW species depending on the original stand composition - SW, MW or HW)	No standards specified; stocking requirement indicates 700+ trees/ha required.	1/1000 ha (10 m ² = 1.78 m radius)	4 to 8 years after harvest	Only trees and shrubs equal to or greater than 30 cm in height are tallied for density measurements; densities higher than 10 trees per plot are estimated. (Source: Yukon Regeneration Survey Manual)
Northwest Territories	75% to 80% total depending on species.	No standards specified.	1.78 m radius (10 m ² = 1/1000 ha)	4 to 7 years after harvest	Min crop tree heights of 35 cm to 140 cm dependent on species and original forest cover types. (Source: Northwest Territories Regeneration Survey Manual (Source: Department of Sustainable Development)
Nunavut	(No standards specified)				

Note: These tables report regeneration standards, not free to grow standards.

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NORTHWEST TERRITORIES

The Northwest Territories' Department of Resources, Wildlife and Economic Development, has also taken the expedient measure of adopting Alberta's well-established standards. In a relatively young organization like that of the Territories, a highly prescriptive system offers several advantages. Besides being inexpensive and easy to adopt, objective values, such as those used in Alberta, offer high degrees of confidence and comfort. Conversely, standards based on extensive specialized training and interpretation, such as those used in BC, are time-consuming and require a formidable research effort to develop and adopt.

NUNAVUT

Nunavut has small but significant forest resources, but very limited means to develop and exploit them. Furthermore, road and rail transportation in Nunavut, is nearly non-existent. The costs of harvesting, extracting and exporting the wood is prohibitive. The consequence is that because there is so little harvesting and almost no revenue from the resource, there has been very little in the way of time and/or resources devoted to developing regeneration standards for the Territory.

CONCLUSION

These standards suggest that provinces and territories are polarized to either rigid, specified standards with prescribed assessment procedures, or else loose, negotiated, ends-justified procedures. The main factors that appear to influence the development of these regeneration standards are:

- relative size of the province or territory,
- amount of forest it contains,
- land ownership structure,
- relative importance of the forest to the provincial/territorial society and economy, and
- amount of resources available to research regeneration standards.

As to the future of forest regeneration standards across Canada, it is likely that polarization will continue for the near future (10 years or so). As resource ministries learn more about their forests and land-bases, they will conclude that detailed knowledge has significant impacts on management and outcomes. However, the realization will also occur, that too much detail is self-defeating. Too much knowledge can, and will, compromise standards. The effort to obtain the data will not be justified by the outcomes. Eventually, there will be a gradual convergence of standards across the country. These are likely to be specific standards (less rigorous than those presently applied in some areas) and subject to limited negotiation based on local expertise and other factors.

For more comparative information see Natural Resources Canada. 2002. The State of Canada's Forests 2000-2001 - Sustainable Forestry: a Reality in Canada.

Neil Stocker is a Boreal Silviculturist for the Ontario Ministry of Natural Resources.

Growing Threat of wildfire

by B.A. Blackwell and R.W. Gray

Over the past two decades millions of hectares have been damaged by wildfire in the United States due to conditions similar to those now occurring in BC. US fires have resulted in significant human and economic losses, and have cost taxpayers billions of dollars to suppress. The US put in place a \$1.2 billion annual fuels and forest health management program. Without similar preventative intervention, a similar fate may await BC.

Since 1994, the U.S. has seen 15 million hectares burned in wildfire, thousands of homes lost to fire in the wildland-urban interface, forty fire fighter's lives lost, and \$4.5 billion spent on the direct suppression and immediate rehabilitation of wildfires (United States General Accounting Office 1999). The escalation of wildfire activity has been defined as a crisis, and has been associated with a loss of ecosystem health and stability. Between 1988 and 1999 the National Forest Health Monitoring Team inventoried over 9.5 million hectares of forestland mortality caused by insects, disease, air pollution, and abiotic factors (United States Department of Agriculture National Forest Health Monitoring Team 2000). In addition to current attack levels, the Team has documented that another 24 million hectares nationwide is at risk to insect and disease attacks. These elevated levels of attacks, and increased wildfire activity over the past two decades have partially been attributed to the impacts of long-term fire suppression; this has been well documented in the literature (Mutch 1994, Society of American Foresters 2000). The U.S. has embarked on an ambitious program of fuels and forest health management in response to what researchers believe is a "brief window of opportunity", spanning 15 to 30 years, for effective and aggressive action before uncontrollable, catastrophic wildfires become widespread (Covington et al. 1994). The U.S. government plans to address 1.25 million hectares per year, of National Forests alone, with mechanical, manual, and prescribed fire treatments. Congress has appropriated \$12 billion over the

next 10 years to fund the planning and implementation of treatments. As of June 3, 2002, natural resource managers in the U.S. have prescribed burned 500,000 ha.

Are these problems applicable to British Columbia? That is the question that many fire managers and foresters are currently asking. In B.C., many ecosystems in the southern half of the province have more in common with ecosystems of the Pacific Northwest than they do with the rest of Canada. Similar to the U.S., the dry Interior forests of B.C. have been negatively influenced by the interruption of historic fires. In many of these ecosystems, fire suppression has resulted in excessive tree ingrowth into forest stands and encroachment into areas that were historically grasslands. Associated with the processes of

ingrowth and encroachment is a growing accumulation of both surface and overstory fuels. Increased fuel loadings and changes in forest structure result in a shift away from forests that were previously influenced by low severity surface fire, to forests where high severity stand replacement fires are now the norm. This shift in fire severity has many negative ecological consequences including increased nutrient losses, altered

soil properties, destruction of below ground flora and fauna, and an overall long-term loss of site productivity. The ecological outcomes of high severity fires are in great contrast to the historic low severity surface fires, which typically resulted in a nutrient flush, a vigorous plant response, and limited net change in soil properties and site productivity.

Associated with fire suppression related changes in forest structure is the increased incidence of insects and disease. Higher stocking levels have resulted in increased competition for moisture and nutrients, which typically has increased tree stress and hence susceptibility to attack. Over the past decade we have seen a dramatic acceleration in the attack levels of Douglas-fir bark beetles, Spruce Budworm, and Mountain Pine Beetle



Courtesy, Canadian Forest Service

throughout British Columbia. In many stands higher insect attack incidence levels can be attributed directly to changes in stand conditions associated with fire suppression in combination with successive mild winters. The current Mountain Pine Beetle epidemic in the central interior of the Province has been linked to global climate changes, but there has been limited discussion regarding the ecological changes associated with a changing fire regime. It would appear that protecting pine forests from fire has shifted the successional pathway of these forests so that they are potentially more susceptible to the Mountain Pine Beetle.

Other important considerations include changes in wildlife habitats and species distribution guilds. The open condition of many of the dry interior forests has been significantly altered by the changes in composition and structure outlined so far. This has impacted both the quality and quantity of available habitat for those species that depend on these types of forest and has caused a species shift, allowing species that are adapted to closed forests to expand into what were historically open forests.

The current fuels and fire management dilemma that we face in B.C. can be attributed to a lack of public awareness, and our poor understanding of ecological change associated with resource management practices over the past 50 years. Awareness has been heightened by the efforts of the Auditor General's reporting on "Managing Interface Fire Risk" and Provincial government initiatives to create a Wildland Fire Act, however the scale and level of effort required to address the complexity of these problems is daunting.

It is apparent that management of forests must shift to an ecosystem-based approach that integrates an improved understanding of historic disturbance regimes, structure, function, and forest composition. In addition to an improved understanding, large scale application of fuel treatments are required to reduce the current landscape-level risk of catastrophic fire in many parts of the Province. Land managers in B.C. must re-introduce prescribed fire as a viable fuel treatment alternative. The re-introduction of prescribed fire will not be easy and will

require a significant shift in public, private sector and government attitudes toward pre-scribed fire.

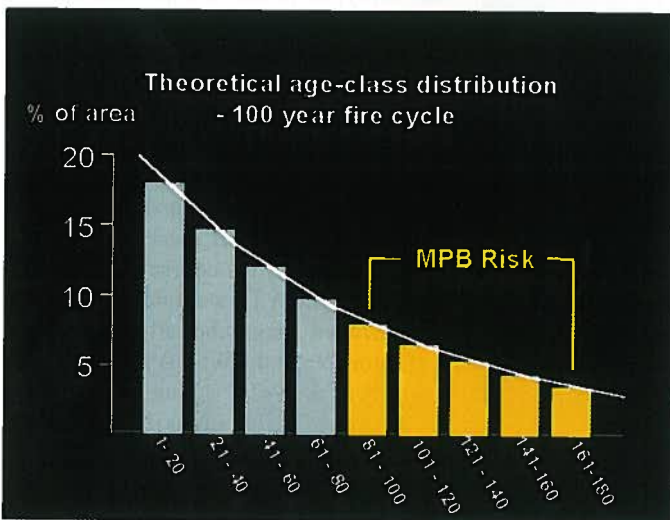
In addition to developing an improved

understanding of the problem and the appropriate treatments, new tools and applications are required to assess risk and prioritize treatment. Tools such as the Wildfire Threat Rating System (Hawkes and Beck 1997) and improved fuel and fire behavior modeling are required.

The cost of planning, designing and implementing these treatments will be significant but as demonstrated in the U.S., the cost of ignoring the problem will be significantly greater through the loss of human life, public and private property, and the opportunity cost of resources foregone.

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by Todd Manning

Wildlife trees are standing dead or dying trees that provide valuable habitat to 80 species of animals throughout British Columbia. That means about 20% of the province's birds, mammals and amphibians depend on wildlife trees for nesting, denning, roosting, perching and feeding habitat. Not that long ago, these valuable sources of habitat were thought of only as dead wood and a safety hazard.

Gradually, over the past decade in B.C., protecting wildlife habitat and maintaining biodiversity have become important forest management objectives. In part, forest harvesting systems have changed to help meet these new objectives. Today, more trees are being retained either in patches or scattered across harvest blocks. These retained trees are great for wildlife habitat but may present a safety hazard. To address potentially conflicting goals, the WCB, government and industry in B.C. together agreed to look at the issue of retaining wildlife trees.

Thus began the Wildlife Tree Committee (WTC). Formed in 1991, the WTC is a multi-agency committee composed of representatives from the Ministry of Forests, Ministry of Water, Land and Air Protection, the Workers' Compensation Board, and various industry, labour and public interest groups from across the province including Canadian Forest Products Ltd., IWA Canada, BC Hydro, and the BC Nature Federation. The mandate of this diverse group is to "promote the conservation of wildlife trees and associated stand-level biodiversity in a safe and operationally efficient manner in forest, park and urban environments."

The WTC developed the two-day *Wildlife/Danger Tree Assessor's Course (WDTAC) - Forest Harvesting and Silviculture Module* for all forestry activities, ranging from tree planting and juvenile spacing, to construction and various types of harvesting systems. The WDTAC is regarded as the best North American model for combining tree hazard and site assessment criteria, with high worker safety standards, operational efficiency, and the maintenance of wildlife habitat. In order to comply with the wildlife danger tree ratings developed by WTC and enforced by the WCB, over 3000 people were qualified by the course over the past four years. The WTC web site can be found at <http://www.for.gov.bc.ca/hfp/wlt/>.

(Editors Note: the WSCA has submitted requests to the WTC asking for a number of changes in the classifications for silviculture, wind speed and other practical adjustments to the program that WTC developed.)

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The Ontario Forestry Safe Workplace Association (OFSWA), in cooperation with the Workplace Safety and Insurance Board (WSIB) and the tree planting industry, is launching Ontario's first occupational health and safety resource package geared specifically to workers employed in tree planting operations across the province. *Health and Safety Resources for Tree Planters* consists of seven booklets and brochures covering such topics as safe travel on logging roads, encounters with black bears, wilderness first aid, the Workplace Hazardous Substances Information System (WHMIS), and health and safety tips of special interest to female tree planters. A training video has also been developed that demonstrates proper pre-employment physical conditioning, along with information about effective body mechanics and stretching exercises to use on the job. The resource package puts a significant emphasis on physical conditioning and strain and sprain injury prevention. It is designed to help employers carry out their responsibility for taking every reasonable precaution to protect the health and safety of workers in tree planting operations.

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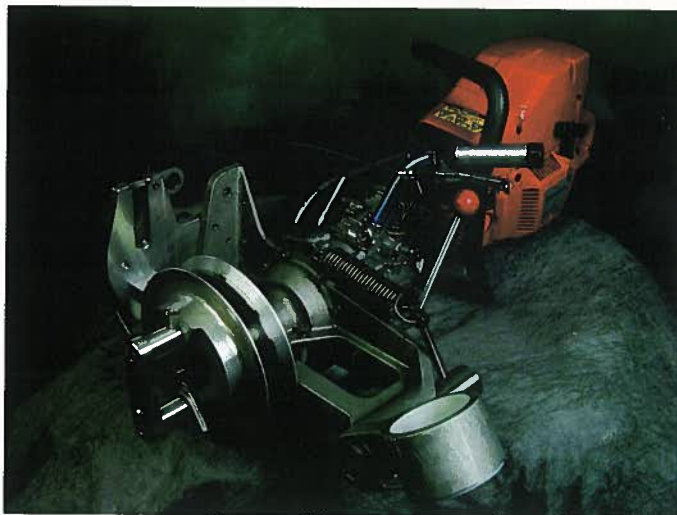
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After 4 years of planting an estimated 700,000 trees in B.C. and Alberta, Tree-planter.com's founder Scott Chisholm formed a small treeplanting and stand tending company. Over the course of 5 years, Sundog Forestry planted 10 million trees and brushed/spaced several thousand hectares.

At the request of our clients, Sundog Forestry pursued an Alberta based "safety certification" that required our company to develop a highly effective safety system and pass a thorough audit. There were many obstacles that had to be overcome to implement top-notch safety principles in a bush environment. Nevertheless we allocated the necessary resources and quickly became one of the first silviculture contractors to earn a *Certificate of Recognition*.

As the interests of the owners changed, Sundog Forestry was shut down. Looking for any possible way to carve out a niche and stay connected to the treeplanting industry, Scott Chisholm founded Advanced Safety Management (ASM) – a safety consulting firm for silviculture contractors. Over the course of several years, ASM built a variety of safety programs, so many in fact that 100 million seedlings are planted each year under the guidance of an ASM safety program.

As ASM guided contractors through the "safety certification" process, it became increasingly clear that employee training was going to be a significant hurdle, especially considering the logistics of season commencement. Quite simply, treeplanting is a hazardous job, conducted in a hostile environment that requires a significant amount of knowledge to be done safely. There just isn't the time to conduct crash courses in treeplanter safety – besides, nobody can learn much listening to a 5 hour lecture in the cook shack on the first day of the season.

Striving to create a better means to conduct employee training for treeplanters, ASM prepared a proposal and took it to Weyerhaeuser. It outlined a plan to create a website where treeplanting contractors could sign up their employees for safety courses that were to be completed before the start of the season. If they could learn from the comfort of their own homes, and have to pass an online quiz, we could ensure improved learning and ease of season start-up. Weyerhaeuser generously sponsored the entire project and Tree-planter.com was launched.

During its first year Tree-planter.com offered 5 courses and trained roughly 1000 treeplanters. Thanks to the Weyerhaeuser sponsorship, there was no need to charge anybody anything to use the website's safety training program.

2001 Courses

- General Forestry Worker Safety
- Wildlife Safety
- Treeplanting Safety
- Helicopter Safety
- Bush Camp Safety

After receiving some very constructive feedback and indications of continued contractor support, Tree-planter.com set out to secure sponsorships for a host of improvements to the website to be completed before the 2002 season. Once again, Weyerhaeuser pulled through with a collective contribution stemming from 5 different mills across Canada. With their sponsorship we had half of our projected expenses covered. In search of the other half, Tree-planter.com approached the Alberta Forest Products Association (AFPA) who helped us secure four more sponsors to cover our remaining external expenses. Many thanks to Vanderwell Contractors, Sundance Forest Industries, Canfor and Alberta Plywood for their contributions.

Tree-planter.com was completely overhauled for 2002 to provide increased ease of navigation, improved contractor

functionality and to add three new courses.

Courses added for 2002

- Microsite Selection
- Stock Handling
- Fundamentals of Quality

Tree-planter.com had some serious momentum moving into 2002. With a host of past visitors returning, university poster campaigns and contractor referrals, Tree-planter.com experienced some phenomenal website statistics. During 2002 we trained roughly 1000 registered trainees, 1800 guest trainees, had over 15,000 visitors and up to 1.3 million hits per month.

Tree-planter.com's online training facility will remain free-of-charge to all silviculture contractors and treeplanters alike. The problem is, we have not completed everything that we set out to do. To us, it is an unfinished project with a few major developments waiting on the drawing board that will make Tree-planter.com more useful, and finally, complete. Subsequently, we are currently launching our funding drive to attract existing and new timber product companies to sponsor the remaining developments.

To learn more about the existing online training facility, or our proposed upgrades, visit www.tree-planter.com.

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