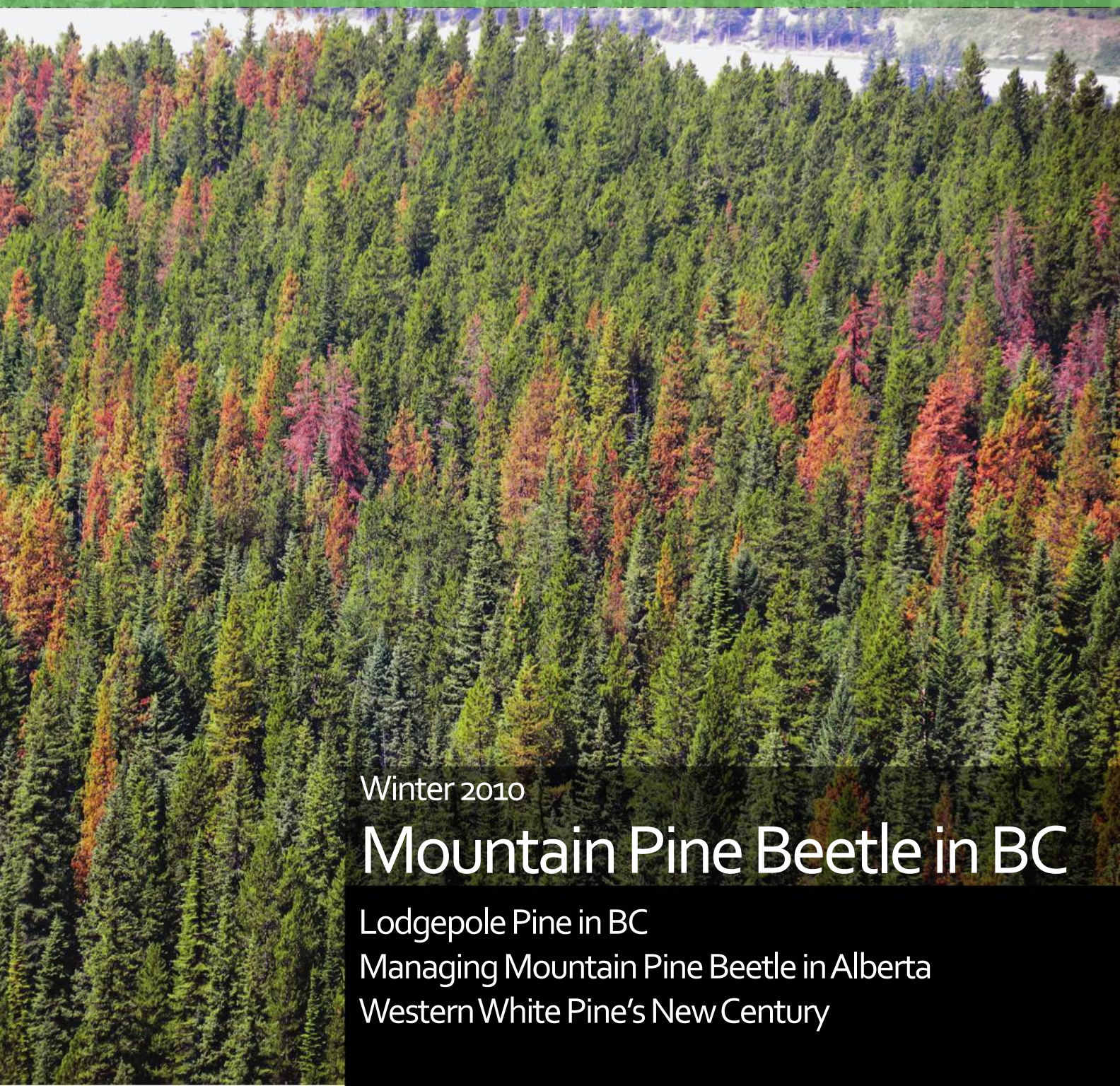
Silviculture MAGAZINE



Winter 2010

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Editorial

by Dirk Brinkman

"The road to wisdom?
Well, its plain and simple to express.
Err and err and err again,
But less and less and less."

- Piet Hein

Over the last century, timber value alone funded almost all silviculture treatments in North America's forests. During the past decade of declining silviculture funding, Silviculture Magazine featured many articles on two emerging value drivers; 'climate change' and 'bioenergy'. After many false starts, and some pulling in opposite directions, the three values of timber, bioenergy and climate action are now being harnessed together to pull new silviculture interventions into the flow of forest change in estates and ecosystems.

A first-of-its-kind Special Report:"*Forests, The world's lungs*"subtitled "*Forests and how to save them*" in the October 1st issue of *Economist* recognizes the biggest global forest challenge is climate change

"there is now more carbon dioxide in the atmosphere than there has been for 4 m(illion) years"

and the biggest global forest opportunity is climate change

"a geological-time honoured-way to sequester carbon…growing forests, natural or planted…is obvious."

Climate change's new forest champion is 'Reducing Emissions from Deforestation and Degradation' (known in UN climate negotiationsas REDD+).

"...there is increasing evidence to suggest that primary, or old growth, forests are seizing the opportunity of a carbon heavy atmosphere to suck up more carbon than they did previously…By one estimate the Amazon rainforest is sequestering an additional 1.3 gigatonnes year, roughly matching the recent annual emissions produced by clear-cutting it."

The UN's REDD not only avoids emissions with conservation, but evolved into 'REDD+' which integrates the removal of atmospheric carbon through afforestation/reforestation/restoration and credit for sustainable or improved forest management across large landscapes.

The Copenhagen Accord's promised initial $30 billion by 2012 for REDD+ is gradually being rounded up. Norway's $1 billion commitment to Guyana for protecting its tropical forests was matched this summer by another $1billion to Brazil for a portion of the Amazon. Billions in private finance are easing REDD+ projects into voluntary markets built within IPCC science in anticipation of integrated international markets.

New Zealand's Kyoto compliant Forest Carbon credits continue to trade into the EU's Emission Trading System at $17-20/tonne. Australian Prime Minister Rudd was replaced by his cabinet for climate promises without action, and the narrow election victory that followed required a coalition with Green MPs to re-form government. Perhaps in anticipation of similar Australian legislation, New Forest just raised $.5 billion.

Though none of the varieties of new US climate policies emerged from partisan rhetoric in 2010, US regional markets continue to test pilot projects in regional standards—all built within the IPCC science framework. California's Climate Action Reserve's forest protocols permit all three climate activities, afforestation/reforestation, avoided conversion and improved forest management and Oregon and Washington have similar standards. BC's Forest Carbon Offset Standards scheduled for 2011 include afforestation, reforestation, conservation and improved forest management, and Ontario, Quebec and Manitoba are poised to be fast followers. Perhaps easing climate's new silviculture projects into a variety of market mechanisms permits us to gradually err less and less and less.

Bioenergy subsidies, introduced by President Bush to reduce forest fuel accumulations, have been continued by President Obama. A McKinsey analysis titled *"Biomass for heat and power"* predicts the EU's projected tripled demand by 2020 will mostly come from forest biomass from good land use practices. It estimated a 55% to 97% full life cycle fossil fuel emission reductions as long as,

"For forest biomass, trees have to be replanted, but the volumes harvested must never exceed the annual incremental growth of the forest."

A requirement that requires diligent silviculture practices. Growing EU demand was predicted to keep long term prices stable and pass expected cost reductions of 25% on to forest owners and producers from processing efficiencies along the integrated supply chain. Using expected future EU carbon prices of $30-50/tonne, the report indicates biomass energy costs would become competitive with coal, gas and oil.

In reality, prices may rise as this analysis ignored emerging bioenergy supply demands from North and South America, Asia and Africa. Conflicts between food, fuel and fibre security will challenge local stakeholders to redefine sustainable land use and integrate climate, bioenergy, timber and other forest values in new land use management plans, with more intensive biomass plantations.

Silviculture contractor association members read a lot of Silviculture Magazine predictions that silviculture markets will do more than recover. This editorial once again promises the two values of climate change and bioenergy will combine with timber to pull more silviculture into North American forests than ever before.

Focus on Safety

BC Forest Safety Council

Revised safety audit tools and the silviculture industry

In June of this year, the BC Forest Safety Council introduced revised audits for small and large companies. The Safety Advisors at the BC Forest Safety Council review audits which now have several improvements that may help smaller companies in the silviculture industry submit easier to prepare audits.

ISEBASE (pronounced "ICE" BASE) is a new reporting level introduced for small companies with 2-5 workers including owners. In addition, ISEBASE companies may have unlimited contractors (aside from their dependent contractors) without having to move to a higher audit standard. Dependant contractors are contractors that derive 100% of their income from one host company, even if they have their own WorkSafeBC account and are paid as contractors. For WorkSafe BC they are generally treated like employees and must be fully integrated into the company's safety systems. An ISEBASE company may also add one additional worker for up to 20 days a year without needing to move to a higher audit standard.

The SEBASE audit now applies to companies that have between 6 – 19 workers, including dependent contractors but not including independent contractors. In determining company size it was recognized that some companies, including silviculture companies, have variable workforces throughout the year. To address this, the Council will use averages when determining company size; as long as the company does not go over 24 workers, and keeps the average under 20 throughout the year, they will only have to submit the SEBASE audit. Companies that exceed the 24 worker maximum or the 19 worker average will need to use the large company or BASE audit.

Until January 1, 2011, a company may choose which version of the appropriate sized audit to use, the original or the revised version. From that time on, only the revised version appropriate for the company size may be used.

To address major risk factors leading to fatalities and serious injuries in the forest sector, Technical Audit Modules (TAMs) were added at the end of the audit. Each company needs to report on the TAMs that apply to their activities.

The two new TAMs that probably apply to most silviculture activities are that of "Camps and Remote Accommodations" and "Chemicals and Asbestos". Other TAMs may apply, depending on exactly what the company does

Reporting requirements for "Camps and Remote Accommodations" if a company own, operate or have workers in accommodations other than a licensed hotel or motel'. The key audit requirement is to properly locate, equip and inspect the camp.

The reporting requirements for "Chemicals and Asbestos" in small companies applies if they have chemicals listed in Parts 5 and 6 of the Occupational Health and Safety Regulation for which an exposure control plan is required. Examples include most pesticides, both applied and present on the seedlings and may include fertilizers.

Large company reporting requirements add 'blood borne pathogens".

The key audit requirement is to have an exposure control plan for high hazard chemicals and biological agents if a company handles them, this includes body fluids that a first aid attendant may be exposed to.

All companies that were SAFE certified in 2008 or 2009 have a 2010 maintenance audit submission due at the end of December 2010. To avoid the year-end rush, it is recommended to be sent in well before the deadline.

If your company certified in 2007 and your certificate expires in 2010, you must complete a re-certification audit, not the maintenance audit option.

Additionally, if your company added or changed a WorkSafeBC classification unit (Classification Unit is the industry your business is involved in, as classified by WorkSafeBC) you must complete the certification audit, not the maintenance audit for your audit standard.

If you have any questions in regard to how these new audit tools may affect your annual reporting we encourage you to contact a Safety Advisor at the Nanaimo office of the BC FSC at 1-877-741-1060 or by email to ridgway@bcforestsafe.org

Read More...

WorkSafeBC's Camp Standards checklist:

www2.worksafebc.com/PDFs/Petroleum/Camp.pdf

The Silviculture Contract Camp Standards:

www.forestsfortomorrow.com/fft/sites/default/files/Schedule%20D%20Camp%20Stds.pdf

WorkSafeBC Exposure control plans:

www2.worksafebc.com/publications/OHSRegulation/GuidelinePart6.asp#SectionNumber:G6.34

More information for chemicals to which this applies can be found at the Canadian Centre for Occupational Health and Safety (CCOHS) site:

www.ccohs.ca/oshanswers/chemicals/

Are We Growing Lodgepole Pine Properly in British Columbia?

By Jeff McWilliams, R.P.F

In BC, while we are justifiably proud of the significant improvements that have been made in reforestation, there is growing evidence that for many years we have been inappropriately managing lodgepole pine reforestation in many areas of the interior of BC. Given the amount of money being spent to establish these stands and their importance to the mid and long term harvest after the devastation of the current mountain pine beetle epidemic, the implications of this problem cannot be overstated. However, while there is a good chance that technical solutions can be found, effective implementation of the necessary changes within the current policy framework could be very challenging.

In BC, stocking standards define the early stand development criteria used to evaluate the success of basic silviculture. Assuming our projections of future stand development are correct, achievement of the standards provides a high level of certainty that the stands are progressing towards the long-term management goals. Stocking standards are established in order to ensure the stand begins on what is believed to be the right pathway for achievement of those long-term goals. They also form the reforestation "contracts" between major licensees (and British Columbia Timber Sales) and the government. The contract is initialized, pre-harvest, when the stocking standards are set and fulfilled when the harvested area is considered free growing (i.e., the stocking standards are met). Licensees are responsible for basic silviculture until the stocking standards are achieved following which the stands revert to the Crown's responsibility until the forest is once again ready for harvest.

Together with the overall forest policy and regulatory framework (primarily the tenure and stumpage system), starting with 1987 amendments to the Forest Act and reforestation regulations and policies, stocking standards have led to good overall reforestation results. However, there should be significant concern for the future development of pine-leading stands in significant portions of the interior of BC.

The Problems

Pine has been extensively used to regenerate harvested sites in the interior of British Columbia over at least the last 30 years. Pine has been a preferred species for reforestation in this area due to its rapid juvenile growth rates, wide ecological amplitude and high tolerance of drought, frost and low soil nutrient availability. However, young pine trees are also susceptible to a wide variety of damaging agents and recent studies have found potential serious incidences of disease

and/or damage in 15 to 40 year old free growing stands in several areas in BC (FREP 2008; 2009; Mather et al., 2010).

Pine often regenerates naturally at moderate to high densities following wildfire or logging. Typically, resultant stands have stems with small live crowns and small branches. On the other hand, our management of pine has focused on producing stands with lower densities that maximize diameter growth on the largest stems. In the early stages of stand development (until crown closure), lower density stands (based on low establishment densities or thinning) generally result in larger live crowns and larger branches. These conditions appear to be exacerbated on better quality sites and can have negative implications for the health and quality of pine.

There are many forest health agents that are commonly found in managed pine stands in significant portions of the BC Interior. The most prevalent serious diseases are the hard pine stem rusts (Western gall rust and Commandra and Stalactiform blister rusts). These diseases are propagated by spores which infect the elongating shoots of the trees. Main stem infections of these diseases on young pine are usually fatal within 20 years. The prevalence and significance of the hard pine stem rusts are related to climate. In general, the most productive BEC subzones/variants for pine are high hazard zones for these diseases.

To further complicate the situation, recent infections of some of the main diseases of pine are not easily identifiable and young stands can still be susceptible to infection until well after free growing is usually declared (10 to 20 years after logging). As a result, many pine stands are declared free growing before the full extent of forest health problems are evident.

In addition to correlations between disease and climate, the incidence and severity of many of the most significant pine forest health agents in immature stands appears to be inversely related to stand density. That is, lower density stands in high hazard areas tend to have higher incidences and severity of disease. Management of pine leading stands to the current target stocking standards of 1200 stems per hectare and spacing of free growing stands in high hazard areas appears to be producing stands which are at high risk to several significant forest health agents.

Finally, in addition to the forest health concerns, many pine-leading stands grown at low densities on medium to good sites (e.g.: Site Indices >18m) or in higher elevations (with frequent heavy snow falls) have common evidence of poor quality. Many of the overstory stems have live crowns >40% and had common heavy branching, forks or crooks and poor taper. It is not difficult to imagine that young stems with these poor quality attributes will make poor quality sawlogs or pulp at rotation.

The Implications

There should be considerable concern for the health and quality of regenerated pine stands in BC interior given the:

- Extensive and ongoing establishment of pine at unnaturally low densities
- Widespread range and incidence of forest health agents which affect pine and the uncertainty about the impacts of these health issues on future stand development

- Potential incremental impacts of changing climate on tree vigor and disease incidence and severity
- Importance of existing managed and future stands to the mid-term timber supply in mountain pine beetle impacted forest management units
- Unsuitability of affected stands for viable subsequent intensive silviculture treatments such as fertilization, spacing, or pruning

Recommendations

Monitoring projects in several areas have confirmed that disease incidence levels are generally high, resulting in uncertainty about the magnitude of the future timber supply impacts. Better understanding of the potential impacts should be a top priority via monitoring programs that track actual stand growth. However, sufficient evidence already exists that necessitates the need to make some proactive short term changes to minimize the future risk.

These changes include modifying the stocking standards to:

- Significantly increase target and minimum densities for pine. Evidence from older naturally established pine stands indicate that many of these stands started with densities of well over 6000 stems per hectare and that these stocking levels were necessary to buffer the stands against losses to forest health agents and the environment. While the magnitude of the necessary density increases are open to debate, it seems logical that we transition our management regimes to more closely mimic the natural development of pine stands. Cost effectively increasing densities likely involves the promotion of natural regeneration (on its own or to supplement planting) by improving seedbeds (increased disturbance of the forest floor and uppermost soil horizons, broadcast burning) and increasing the amount of pine cones that are left scattered over logged areas. Provided that the seedbed is adequately prepared, direct seeding may also be worth trying. Finally, changes to harvest layout, methods and timing may also be effective in encouraging natural regeneration.
- Promote the use of alternative species on suitable sites by maintaining the existing stocking targets for these species (as opposed to higher densities if pine is to be the major species). Pine has been too commonly used as the major species on sites where predominantly non-pine was logged or where other species have been grown in the past. Aside from pine, species such as Douglas- fir and white spruce are also well adapted and can grow into reasonable stands at lower densities.

It is likely that implementation of changes in practices to achieve modified stocking standards will lead to increased costs on many of the sites they apply too. For medium to good sites, within reasonable cycle times from manufacturing infrastructure, these increased costs should be viable and supportable. However, these extra costs are likely not economically feasible on poorer sites far from main centers. As a result of this discrepancy, further changes to stocking standards based on, among other things, location and site quality are likely required. These potentially significant changes have to be considered in the context of re-defining the economic timber harvesting land base and tradeoffs between timber and non-timber resource values.

These recommendations highlight the interrelationship between stocking standards, reforestation results and "non-silviculture" plans and practices. In this way, silviculture is linked to the rest of the forest policy and regulatory system and this is why changes in stocking standards on their own may only have a limited effect on the overall long term quality, resilience and growth of managed stands.

Key concepts which need to be addressed to deal with the root problems associated with pine management and lead to overall improvements in silviculture in BC include:

- An improved linkage between the costs and benefits of long term forest management. The current system does not provide enough incentive for licensees to maximize or optimize (for net value not just volume) their management of regenerated stands over the long run. Without this linkage, non-government investment in silviculture will continue to be non-significant.
- Re-integration of reforestation into holistic management throughout the rotation. While good basic reforestation is the foundation for good management throughout the rotation, it is important for the regulatory system to promote integrated management from harvest to harvest.
- Zonation of the forest land base based on the viability of management intensity. Given that in most of the province, future yields will heavily depend on managed stands and that more intensive management is only feasible on the better sites which are within reasonable proximity to infrastructure. The system should promote increased investment in silviculture on the better sites and reduced expenditures on the poorer sites.

Finally, due to the importance of spending public funds wisely on investments in forestry, prior to implementation of significant intensive silviculture programs in managed pine stands, stand eligibility criteria should be updated. Revisions should be based on more detailed forest health and quality criteria and supported by financial analysis.

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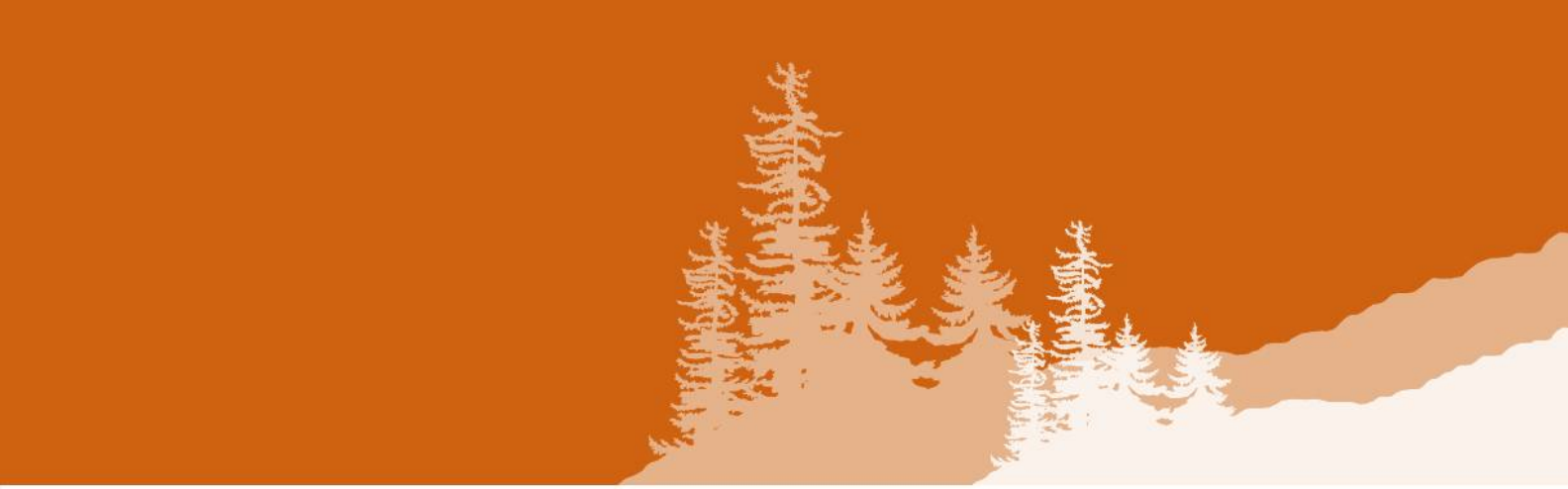
Jeff McWilliams is an R.P.F for B.A Blackwell and Associates with over 20 years experience in the forestry industry. He specializes in, silviculture and stand management prescriptions, management of silviculture operations, strategic assessment and planning for various forest resource applications.

Silviculture Applications to Address B.C.'s Mountain Pine Beetle Epidemic

By Pat Bell, B.C. Minister of Forests and Range

Lodgepole pine secondary structure after MPB attack in the Tweedsmuir area

10 Silviculture



The Situation

The B.C. Ministry of Forests and Range estimates that the mountain pine beetle has now killed a cumulative total of 675 million cubic metres and the cumulative area affected to some degree is 16.3 million hectares.

Although the attack level is unprecedented, the damage to date has not been as severe as originally projected. Five years ago, the outlook was that B.C. would lose 80 per cent of its merchantable mature pine in the central and southern Interior. That projection has changed significantly as diverse terrain and forests with a greater mix of timber species have significantly slowed the rate of spread. The latest estimate is that only 65 per cent of the mature pine will be impacted.

Despite the seriousness of the infestation, B.C. will still have vibrant forests to support a healthy and prosperous forest industry for the future. Of the 4.5 billion cubic metres on the timber harvesting land base, about 1.3 billion cubic metres is mature pine. The mountain pine beetle does not have a predilection for the Interior's spruce and fir stands, or the diversity of Coastal forests largely comprised by cedar, hemlock and other non-pine species.

The cause of the outbreak is attributed primarily to two factors: (1) more than 50 years of effective fire suppression has resulted in large areas of mature and over-mature pine stands; (2) climate change creating warmer winters that cannot control larval populations, and warmer, drier summers that not only improve brood survival and development, but increase the susceptibility of pine to beetle attack.

Lodgepole pine is a major feature of many B.C. ecosystems. It comprises over half the Interior's annual timber harvest, and is critical to the province's economic, social, and cultural well-being. About 70 municipalities, 100 First Nations and numerous rural communities in B.C.'s interior are affected to some degree by the mountain pine beetle epidemic and the projected decline in the mid-term timber supply from significant lodgepole pine mortality. As well as local and provincial economies, the beetle is affecting many forest values, including:

- landscape aesthetics (visual quality objectives),
- water quality,
- wildlife habitat, and
- wildfire intensity and potential loss of investments.

The Beetle-Impacted Landscape

Different factors affect the state of the beetle-impacted landscape. Salvage logging produces large openings with scattered dead and live patches of wildlife trees. The openings will either be reforested naturally or, more often, planted with ecologically suitable species, and will dominate the landscape for many years as the new trees grow.

Stands with unsalvaged beetle-killed pine will form a mosaic of dead trees with individual or groups of living trees depending on the initial percentage of pine, the stands' age and location in B.C., and the level of mortality. Stands with a minor component of pine will change little. High mortality in pine stands, however, will produce a range of understory conditions that determine future stand development.

Other areas with less pine or lower mortality will become more open stands dominated by species other than pine.

Research and stocking studies have identified a number of pine-leading stands with a significant level of non-pine understory stocking. When light levels through the stand increase as the dead pine decomposes, the understory species can release and form the next stand. Those understory trees and the surviving mature trees comprise the secondary structure.

Regulatory amendments came into effect in June 2008 to protect surviving trees from harvesting in pine-leading stands impacted by MPB. These regulatory changes were based upon silviculture research in north-central B.C. forests (Coates, DeLong, Burton, and Sachs 2006) that indicated surviving trees can contribute to the mid-term timber supply over the next 20 to 60 years. Research in Kootenay National Park (Shrimpton, 1994) has also documented that surviving saplings and trees in beetle-killed stands significantly increased growth rates, yielding 200 cubic metres/hectare after 50 years.

There are large areas in the province, however, with pure dead pine stands and few understory trees of any species. Because much of B.C.'s pine has serotinous cones, natural regeneration will only occur after burning. But if unburned, they will often remain as dead, open stands with spotty regeneration of young pine mixed with patches of increased grass, lichen, or herbaceous understories. These areas are candidates for rehabilitation or harvesting with subsequent reforestation.

Some young pine stands have also experienced mortality, but at a much lower level. Such areas with high pine

Subalpine fir secondary structure after MPB attack in the Tweedsmuir area

proportions and mortality and minimal economic value were the initial emphasis of the provincial government's Forests for Tomorrow reforestation program.

Monitoring shows that the peak of the mountain pine beetle epidemic occurred in 2004, but significant areas still have the potential to be impacted, producing additional stands transitioning into the various patterns described above.

The Government's Response

Mitigating the impacts of the mountain pine beetle epidemic will be ongoing for two or more decades. The B.C. government's Mountain Pine Beetle Action Plan is guiding the province by helping to coordinate all levels of government, communities, industries, and stakeholders. The goal is to sustain long-term community, economic, and environmental well-being, while dealing with the short-term consequences of the epidemic. To date, the Province of British Columbia and the Government of Canada have committed more than $956 million ($756 million and $200 million, respectively) to a wide range of mitigation investments, including public safety, environmental restoration, economic diversification, employment opportunities, new market and product research, fuel management, and silviculture.

In response to Not Satisfactorily Restocked (NSR) forest land caused by infestation and wildfires, that licensees are not harvesting, the provincial government introduced the Forests for Tomorrow program in 2005 to reforest these areas. So far, the government has invested $200 million, planted more than 40 million seedlings and completed over 44,000 hectares of reforestation and 364,000 hectares of surveys through Forests for Tomorrow.

As well, over $12 million has been invested to support inventory projects (including non-timber inventories in critical watersheds) and to map beetle spread, research shelf-life (timber quality) expectations, and gauge infestation levels. Innovative air and ground sampling techniques to capture secondary structure information are also being tested.

Looking ahead to the next three years (2010/11 – 2012/13), Forests for Tomorrow is projected to plant another 51 million trees with funding support to continue at about $42 million each year.

Harvesting

The Province has also responded to the mountain pine beetle epidemic by increasing allowable annual cuts to facilitate salvage of impacted timber. Licensees have concentrated their harvesting operations in pine-leading stands, which will assure reforestation through associated legal free-growing obligations.

The global economy and U.S. housing market downturn, however, have reduced salvage harvesting progress, which means large amounts of dead pine will continue to deteriorate and will not be economic to harvest for sawlogs. Accordingly, the government is looking to emerging markets such as wood bioenergy to use beetle-killed fibre.

Fuel Management

Many communities, especially those in the most severely beetle-attacked areas have expressed concerns about increased wildfire risk because of the dead pine. In response to recommendations by the Auditor General and the Filmon Review, after the 2003 wildfire season, the provincial government transferred $37 million to the Union of British Columbia Municipalities to assist local governments in preparing community wildfire protection plans and in undertaking fuel management projects. As well, over $14 million has been expended through the federal/provincial Job Opportunities Program for fuel management projects.

Fuel management is the practice of reducing the build up of forest fuels, primarily around communities to reduce the impact of wildfires. This is done by removing trees and woody debris through logging, pruning, thinning or controlled burns. B.C. has treated almost 42,000 hectares with a high risk of potential interface fire. More than half of the treated area has been in beetle-killed stands.

Land Based Investment Strategy

The province's Land Based Investment Strategy, introduced earlier this year, combines funding from all of the ministry's land-based programs – the Forest Investment Account – Land Based Investment Program, Forests for Tomorrow, forest health, inventory, and invasive plant management. Having one dedicated funding source for all land-based investment programs reduces administrative overheads and directs more funds to on the ground activities.

One of the strategic priorities is to manage the impacts on forest and range resources from pests, diseases, and wildfires. Part of the focus is to:

- reforest areas affected by catastrophic disturbance;
- mitigate the impacts on mid-term timber supply caused by the mountain pine beetle and wildfire through thinning and fertilization;
- increase tree productivity by supporting tree improvement and the use of superior seed;
- assist in recovering ecosystems that have been degraded, damaged, or destroyed by focusing on re-establishing ecosystem function of open-grown forests and grasslands; and
- prevent and mitigate further forest damage by pests and disease.

Cost savings have also been realized by marketing up to 50 per cent of the fibre in what was previously considered uneconomic stands through innovative timber sale licences. The silviculture costs are offset by the value of the timber resulting in rehabilitation of stands that may not have otherwise occurred. As well, 30 targeted assessments have been completed in high-risk community watersheds impacted by the mountain pine beetle. Overall the program is on track to eliminate the backlog of NSR lands by 2015.

As in years past, provincial Aerial Overview Assessments will be completed by October. The results of which will help prioritize forest health spending for next year. Also under the Land Based Investment Strategy, 20,000 hectares will be fertilized to improve the mid-term timber supply, with plans to fertilize another 23,000 hectares for 2011. Ecosystem restoration plans are in place to treat 6,000 hectares of ingrown open forest and native grasslands this fall. Inventory is also underway in 13 priority management units. As well, the Federation of BC Woodlot Associations and the BC Community Forest Association are conducting 919 ha of spacing and backlog brushing.

Other Initiatives

The Ministry has released a silviculture discussion paper, Growing Opportunities: A New Vision for Silviculture in British Columbia, that will lead to the development of a new framework to guide silviculture investments.

Consulting broadly with forest sector stakeholders provided important input that will help achieve its new vision for silviculture. This input is enabling the Ministry to further explore the following proposed key elements of a new silviculture framework for British Columbia. This could include management unit-level strategies for sustainable forest management, focused government funding, resource management coordination and incentives for private investments including the potential to generate carbon offsets through silviculture treatments.

The Future Outlook

The mountain pine beetle epidemic is believed to be the largest ever bark beetle infestation in North America. The challenges associated with managing the environmental impacts of an infestation on such a massive scale are difficult and will require close attention for decades to come. In the wake of the epidemic, the B.C. silviculture industry will have an important role to play helping mitigate impacts to the mid-term timber supply and ensuring that B.C. continues to enjoy healthy and productive forests. This includes reforesting areas that have been salvage logged, fuel management, maximizing the value of land-based investments, and carrying out the new vision currently being developed for silviculture in B.C.

Pat Bell was re-appointed British Columbia's Minister of Forests and Range and appointed Minister Responsible for the Integrated Land Management Bureau on June 10, 2009. He was re-elected as MLA for Prince George-Mackenzie on May 12, 2009. Prior to becoming an MLA, Minister Bell owned a trucking company and co-owned a logging company. He can be reached at 250 387-6240.

Managing the mountain pine beetle in Alberta

By Brett Spady

The mountain pine beetle (MPB) represents serious risk to environmental, economic and social landscapes of Alberta. Ecological integrity for water and other systems which rely on pine forests are under attack from the most destructive native forest pest in North America. Approximately 50 Alberta communities are dependent on forestry for their livelihoods. As such, Sustainable Resource Development (SRD) has monitored and controlled the most recent beetle infestations in the province since 2000. With the large expansion of beetles in the province in 2006, management strategies to renew MPB-affected forests in Alberta became necessary. MPB management in Alberta is based on three strategies: the Beetle Strategy aggressively controls small infestations; the Pine Strategy manages the forest to reduce the impact of MPB before the beetles arrive; and the Salvage Strategy rehabilitates areas that have been heavily attacked.

Alberta's provincial tree, the lodgepole pine, requires fire or hot and dry conditions to activate its pine cones in order to release seeds. Once a pine tree is killed by a MPB infestation, seeds are still available but the ground cover is not suitable for normal regeneration. A secondary disturbance such as fire or mechanised scarification is necessary to allow the seeds to successfully germinate. Unpublished research by the University of Alberta suggests that the viability of pine seeds will decrease over time as cone quality decreases (Teste, et al., 2010), They go on to suggest that rodents and forest floor growth will further affect the ability of the pine seed to succeed. If fire or human-caused disturbances do not occur shortly after tree death (Teste, et al., 2010), Alberta's forests may look different in the future.

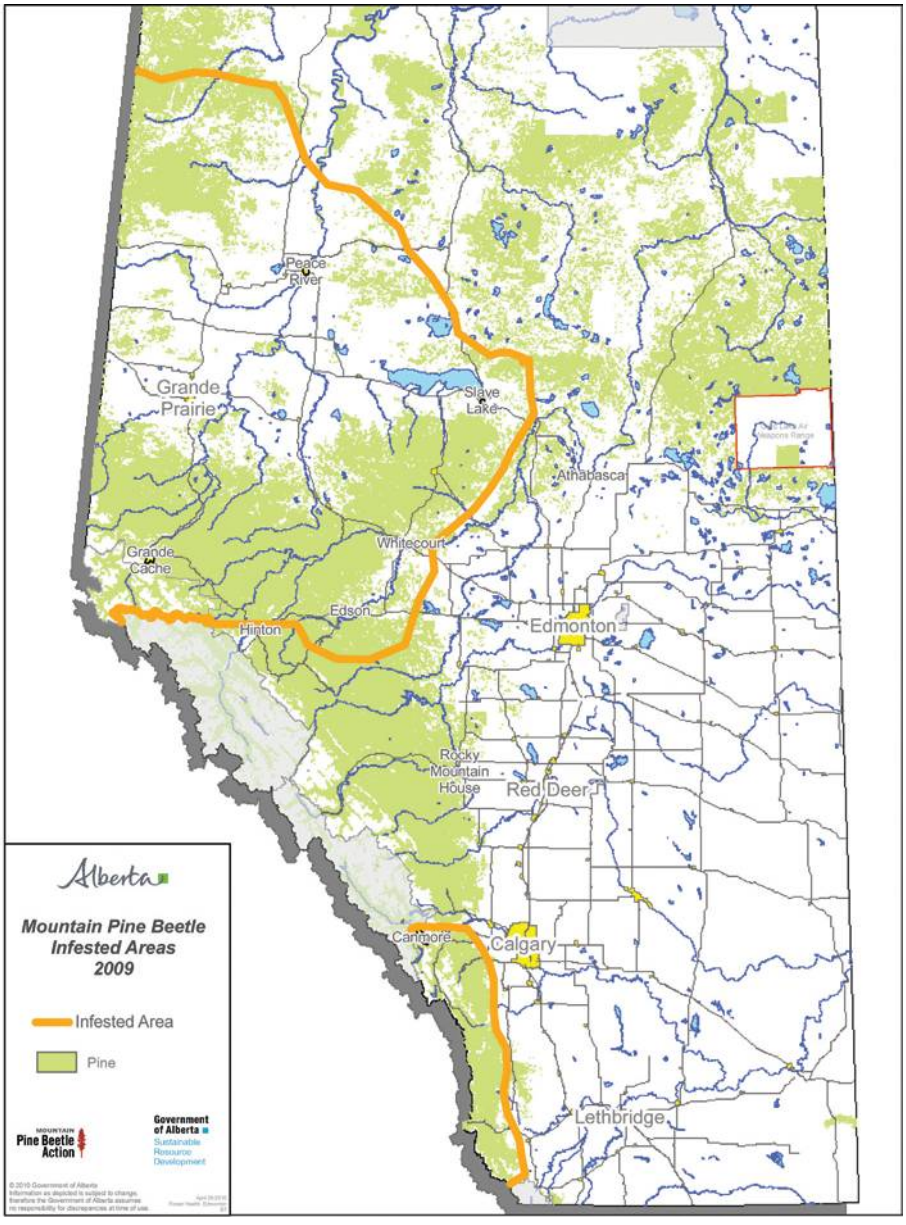


Figure 1: Distribution of pine in Alberta and the generalized area of infestation

In response to the potential need for large amounts of pine seed in the future to replant areas heavily infested, SRD has begun increasing the amount of seed collected in key areas throughout the province. The goal of SRD's pine cone collection program is to have enough seed to replant pine in areas that have difficulty regenerating naturally.

SRD's partners are central to the success of the seed collection program. Industry, the Alberta Forest Genetic Resources Council and the Alberta Tree Improvement and Seed Centre (ATISC) work together to identify strategies and complete the work to protect the genetic variability of commercial and non-commercial tree species. Ten-year seed reserves are targeted for seed zones where MPB threatens forest sustainability. 205,000 litres of lodgepole pine cones were collected under SRD contract in 2010, another 230,000 litres were collected by the forest industry.

Degradation of pine seed viability after MPB attack is mirrored by a decline in timber quality. Depending on the health of the pine stand before attack, acceptable log use after tree death can be anywhere from one year to five years. Pine logs split, or check, after tree death, making it difficult for mills to use the wood for lumber products. Value to industry of standing timber in pure pine stands is estimated at over $8 billion in present-day dollars. On average, over each of the past four years, the forest industry has contributed $836 million in taxes and $44 million in stumpage payments to the Province over each of the past four years and employed nearly 26,000 Albertans (direct and indirect jobs).

If MPB populations in Alberta reach the levels experienced in B.C., analysts expect several major forest companies in this province will experience a 60-80 % reduction in their Annual Allowable Cut (AAC). Currently there are 25 major forest companies (AAC of 100,000 m3 or greater) in Alberta, 14 of which rely on pine; there are also 2 medium and 21 small operators who would be severely impacted by MPB-related declines in their AAC. It is estimated that future decreases in pine harvests due to MPB losses could equate to an annual average 33 % drop in stumpage paid to Alberta by pine-reliant companies.

In the last four years, Alberta has invested over $240 million to control the spread of MPB in the province. In that time, the epidemic has been declared a forest health emergency each successive year. Alberta's aggressive control program is showing positive signs and is supported by forest health scientists as the appropriate activity to undertake. Winter 2009-2010 mortality was high in most areas of the province. This will allow the control work done during the winter of 2010-2011 to be concentrated in areas that did not experience much beetle mortality.

Early and aggressive mountain pine beetle control is very effective and will save trees and dollars in the long term. A modeling exercise

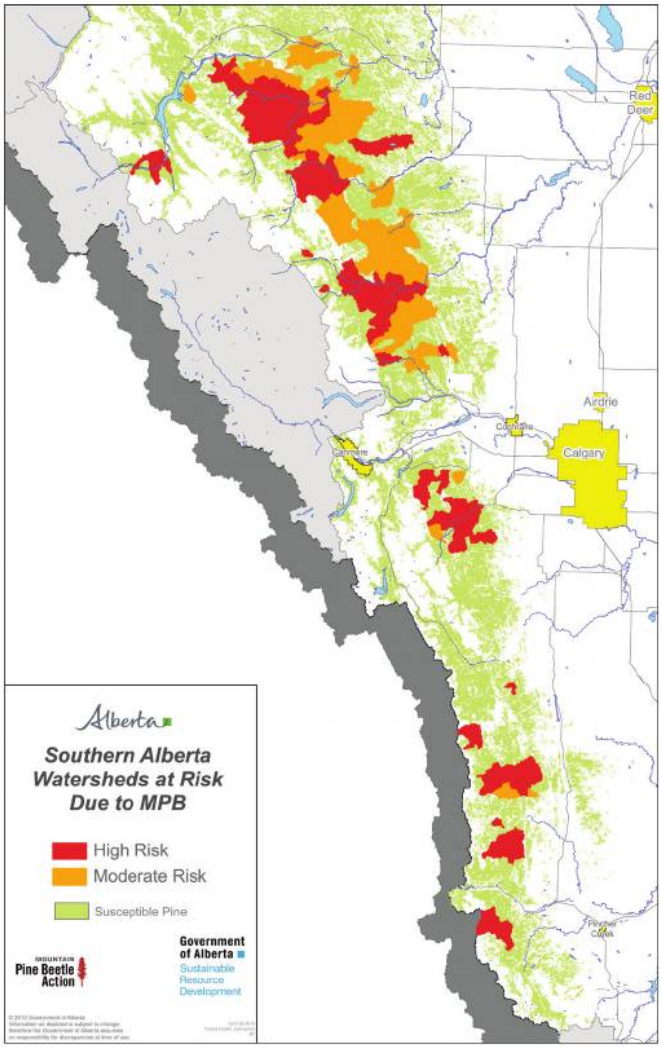


Figure 2: Watersheds at high risk due to mountain pine beetle impact

predicted that if the department was not aggressive in 2009 in the Whitecourt and Slave Lake region and did not invest $7.5 million towards the removal of infested high-risk trees, local beetle populations could have spread to kill an additional 15 million trees over the next 10 years. The same type of control work in 2008 also reduced the beetle population in the area by roughly 50 %. Essentially, by being aggressive in 2008 and 2009, 3.4 years worth of annual harvest for two major companies was protected.

Environmental impact of mountain pine beetle

While this tree species is adapted for disturbance, the potential scale of this current epidemic may adversely affect forest hydrology values; it will continue to endanger two native high-altitude pine species, and remove habitat for caribou and other important species of wildlife.

The goal of the control program in southern Alberta is to slow the spread of MPB along the eastern slopes of the Canadian Rockies to reduce the impact to vital watersheds. In southern Alberta, MPB outbreaks threaten 90,000 hectares of important watersheds that are expected to lose their ability to function properly and would not return to pre-beetle condition without significant forest management intervention to grow a new generation of trees; 8,000 of these hectares are the primary source of drinking water for the communities of southern Alberta and another 5,000 hectares are secondary drinking water sources (Figure 2). Dollar figures cannot be attached to the value of degradation of clean water supplies to major urban centers or loss of fish and wildlife habitat that would follow severe MPB infestations in this region of Alberta.

Once MPB becomes established in priority watersheds, control options are limited to single-tree removal[1] because high levels of harvest will impact the watershed's functionality. Computer modeling of impacts in one B.C. watershed determined MPB attacks on 75 % of mature pine stands, combined with the impact of past conventional harvesting, increased annual peak flows by 60 % and annual total water yield by 30 %. Salvaging of dead pine results in a further increase in annual peak stream flow.

In addition, MPB poses direct and indirect threats to the endangered five-needled pine tree species in high-alpine areas of the province. Whitebark and limber pine are long lived trees that establish and grow at high elevations under harsh conditions that many other trees cannot tolerate. At tree line, whitebark pine helps shade and shelter snowpack, thus regulating downstream flows. The large, nutritious seeds of both pines are an important wildlife food. Whitebark and limber pine form unique forest communities that contribute greatly to the biodiversity of the mountains and hills of Alberta. Seed collection, monitoring and pheromone programs are in place to help protect both species[2].

Currently there are 1.3 million hectares of caribou habitat with some degree of MPB susceptibility. While arboreal lichen food supply increases following MPB attack, negative impacts to woodland caribou can result from salvage operations and widespread pine death. Increased grass and shrub growth due to cut blocks and openings in the canopy provide habitat for moose, elk and deer. The shift of population dynamics in an area will support an increase to wolf population which will negatively affect Alberta's caribou. Single-tree control tactics for MPB are less intrusive on caribou habitat than the harvesting, road-building and reforestation activities that would be required to regenerate extensive beetle-kill areas in their range.

Experience in B.C. indicates wildfires in beetle-killed forests burn faster, hotter, and more unpredictably than 'normal' wildfires and pose significant additional risks to communities. Recent research into forest ecology and fire behaviour in beetle-killed stands indicate that crown fires – the most serious type of wildfire – are more likely to ignite and spread under less extreme fire weather conditions that are typically required.

Research also indicates that when beetle-killed trees remain standing for many years, a larger than normal amount of biomass becomes available as fuel, threatening more intense fire with a large release of heat; such fires are difficult to control and can cause significant mortality of young trees that survived or regenerated after MPB attacks (Kaufmann, et.al., 2010).

The Wildfire Management Branch of SRD is committed to ensuring the safety of its people, communities, ecosystems, natural resources and infrastructure in the event of catastrophic wildfires. Wildfire management specialists work to ensure the increasing risk of MPB wildfire is safely managed. Preventative measures like those offered through FireSmart[3] will help to educate and prepare people and communities for changes to wildfire risk. Faster get away times for firefighting crews, safe working distances and landscape level management is combined to reduce the long term risk of catastrophic wildfire. Certain areas, such as the Mulligan MPB region north of the Saddle Hills may be usable for techniques like prescribed fire silviculture. Landscape management options like prescribed fire and wildfire management zones can be both valuable silviculture tools and wildfire risk reduction tools.

Industry is taking note of the change in economic conditions as well. In Edson, Alberta Newsprint Company (ANC) and the Alberta Research Council developed a new pulp-producing technique to process the large amounts of sap created by pine trees after MPB attack[4]. This effort is a result of a $28 million,

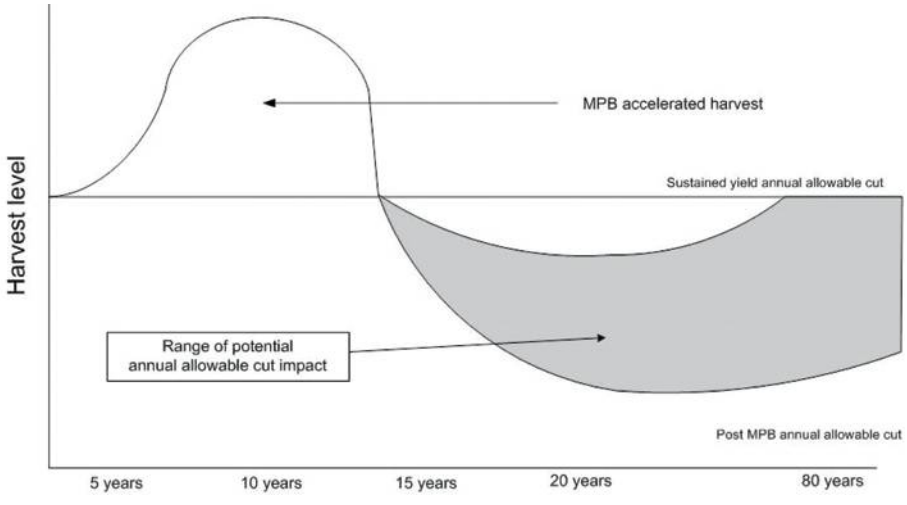


Figure 4: Accelerated harvest graph

three-year project between the Community Development Trust Foundation, Alberta Forestry Research Institute, National Research Council, Woodlands County, and ANC. Millar Western Forest Products Ltd is also pioneering a new mill in Fox Creek which will be able to handle changes to log quality after MPB attack. Changes include cut to length logging, checking and possibly blue stain fungus detection. The ability of a mill to adjust for checks in MPB wood will be a significant improvement because the checks impact the quality and strength of the lumber created. The Fox Creek mill is expected to open in the final quarter of 2011.

MPB perform best under, and subsequently cause the most mortality in, landscape conditions where there is an even-aged, continuous mature pine forest. Forest industry, with the help of Alberta Forest Products Association, is working with the government of Alberta to implement a long term MPB management strategy known as the healthy pine strategy. The goal of the strategy is to reduce the susceptibility of Alberta's pine forests to damage and massive tree mortality from MPB before the beetles arrive. This is completed by re-sequencing the annual allowable cut (AAC) of coniferous trees to focus on pine-dominated stands. Tree age, stand composition and stand density, are all factors that contribute to pine susceptibility towards MPB. New generations of mixed aged stands will be created when harvest is focussed on areas of susceptible pine. This will make it more difficult for a MPB epidemic of this scale to occur in the future. SRD will continue to encourage the use of forest management practices which help decrease this type of event in the future.

Almost all of the timber companies in the province have done revised management plans that focus on susceptible and connected pine. Complimenting the healthy pine strategy is an accelerated harvest plan whose goal is to harvest pine stands before wood quality begins to deteriorate after MPB-attack. Alberta Forest Products Association and other industry partners work to utilize beetle infested stands where possible. These stands are then replanted according to provincial standards.

The following chart shows the impact that the healthy pine strategy and accelerated harvest has had on the volume of pine harvested since 2006.

Table 1: Alberta harvested volume measured in cubic metres

Timber Year	Total pine volume harvested	Volume of pine harvested with MPB [5]	Total coniferous AAC
2006/2007	1,452,705	584,447	15,976,797
2007/2008	3,140,782	2,225,564	16,976,217
2008/2009	3,276,640	2,173,461	18,352,167
2009/2010	4,069,265	3,270,763	18,614,646 (unpublished)

Forest Management Branch

Changes to harvest volumes demonstrate how the AAC has been re-sequenced to focus on pine in accordance with the healthy pine strategy and accelerated harvest. In 2006, MPB-attacked pine made up 3.7 % of Alberta's coniferous AAC, but in 2009 it made up 17.6 %.

Mountain pine beetle forest renewal

SRD is working with industry to strategize harvest in areas most heavily attacked MPB. Forest health managers, wildfire experts, silviculture managers, scientists and members of the forest industry are meeting to prepare a post beetle-epidemic assessment. Issues that will be addressed include: establish rehabilitation priorities to preserve understory and non-pine species, protect key watersheds, reduce fire risk, and identify highly productive sites. Best options for rehabilitation will be coordinated with researchers, industry and SRD's Wildfire Management Branch.

SRD is planning for the future. Research completed through third party organizations like the Forest Research Institute entrenches the science-based management program already in place. Research projects include: effects of MPB on water systems, forest regeneration after a MPB-attack, public and expert understandings of MPB in Alberta communities fire dynamics, and remote sensing techniques and electronic inventories. Appropriate protection of understories will help to ensure adequate mid-term timber supply. Stands which contain more pine will be planned for salvage operations faster than stands that have mixed characteristics because they will take less time to regenerate.

MPB offers challenges and opportunities for Alberta to continue being a leader in forest management. Renewing MPB-affected forests means working together with partners to ensure a safe and sustainable landscape is a reality. Alberta's forested communities depend on the three management strategies which contribute to renewal: effective control, long term pine management and salvage priorities. The healthy pine strategy will ensure future epidemics in Alberta are prevented by creating acceptable age class and species diversity which reduces the ability of the MPB to be successful across the province. SRD will continue to work with various stakeholders to provide resource policy, allocate resources and guide resource stewardship.

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[1] Level I control in Alberta is the process of removing infected trees from the landscape to decrease the level of the infestation in strategic areas.

[2] For more information on pheromone usage please see the Verbenone Use Guidelines presented on Alberta's MPB website: http://www.mpb.alberta.ca/Resources/Publications.aspx.

[3] www.srd.alberta.ca/ManagingPrograms/PreventingFightingWildfire/FireSmart/Default.aspx

[4] Alberta Research Council. "Technology Test Succeeds Against Mountain Pine Beetle." November 16, 2009. http://www.arc.ab.ca/media-resources/news--announcements/2009-news/technology-test-succeeds/ (Accessed August 27, 2010)

[5] Pine volume harvested from identified MPB cut blocks.

Western Canada

Western Silvicultural Contractors Association

By John Betts

MFR NSR figures Not Sufficiently Responsible.

There is some absurdity around the recent confusing and seemingly contradictory figures used to describe the not satisfactorily restocked (NSR) area of British Columbia. These NSR lands are defined as areas "not covered by a sufficient number of well-spaced trees of desirable species". The gist of this broad designation is that NSR lands need to be addressed with some kind of remedy such as reforestation. If we do not address NSR lands the general implication is that their condition today will lead to a future deficiency in timber supply, diversity or eco-system abundance.

British Columbia's NSR area was the focus of a recent opinion piece in the Vancouver Sun in which the authors accused the provincial government of, by its own admission, underestimating the NSR by 700,000 hectares. Those "missing" hectares brought the total NSR close to 1.5 million hectares according to the editorial. Minister of Forests, Pat Bell, replied the NSR was only 240,000 hectares. Subsequent to this exchange, a 39-year veteran of the forest service, whose duties included managing inventory statistics, wrote in the Victoria Times Colonist that the NSR lands in the province likely were as high as 9 million hectares once we included the land damaged by the mountain pine beetle.

> "It is not only today's public that has an interest; the citizens in generations to come have a stake in it all."

In those editorial exchanges we have two supposedly well-informed estimates, one from the Minister and another from a former manager from within his ministry, differing by an order of magnitude. And just to make things more confusing, any diligent effort to sift through the ministry's published documents that refer to the NSR will show a range from 178,000 hectares to 3.7 million hectares. For what it is worth, the WSCA estimates the unproductive NSR lands worth reforesting to be between 3 to 5 million hectares based on what few surveys have been undertaken on the mountain pine beetle land combined with the ministry's estimates of where NSR reforestation would make a difference. It is worth noting, that in the 1980s, British Columbia's NSR area was estimated at 738,000 hectares and was considered a forestry crisis. It led to a major investment from both the federal and provincial governments to restore what were then called "the silvicultural slums of British Columbia".

There are, of course, various explanations for the differences in NSR stats. Some of them are legitimate and some of them are not. For one thing, there are different kinds of NSR. There is gross NSR, net NSR and backlog NSR and even different kinds of backlog NSR. Understandably there are some NSR lands that are not worth the effort to reforest. Some of the above figures reflect those distinctions which account for some of the discrepancy. Additionally, there are NSR lands that disappear because they have been reclassified as unmanaged forests: stroke-of-the-pen forestry. Some NSR lands appear, or do not, depending on the methods used to statistically track them: lost in data translation. Others are not collected anymore since the ministry stopped conducting its ten-year inventory analysis, last undertaken in 1994. And then some NSR figures are simply made up. Such as the factoid that the mountain pine beetle NSR area is 400,000 hectares; we have not surveyed the 15-million hectares of MPB attack in order to know how many hectares are NSR. Yet this has not prevented the minister from saying, rather illogically, that the government fully intends to survey these 400,000 hectares to see if they are growing enough trees.

The NSR figures are important statistics reflecting the state of the regeneration of B.C.'s forests. It is in the public's interest to know these figures so they can properly consider them as a basis for making the stewardship decisions needed to tend this valuable resource. It is not only today's public that has an interest; the citizens in generations to come have a stake in it all. They will inherit the consequences of the decisions we make today. The onus then, is for government to present the NSR figures in their necessary fullness, with clarity and free from cant. In particular if government really does not know what the NSR is in the province, as the present discourse suggests, that deficiency needs to be addressed. The state of our forests is too important to be subject to so much conjecture.

John Betts is the Executive Director WSCA and can be reached at hotpulp@gmail.com.

Ontario

Ontario Forest Renewal Co-operative Inc.

By William F. Murphy R.P.F.

Northwestern Ontario's forest economy of scale

The truth of the matter is, not much is happening in Northwestern Ontario with regards to Silviculture activities. There was an influx of 13 million trees into the system through the Ontario Government-a one time shot so far, and the after effect is we have had systems shutting down or changing direction. What Ontario needs is more mills accepting wood in order to increase tree planting activities.

Where are we now in relation to two years ago? In the District of Thunder Bay and Kenora, not much has changed. One mill opened for a short period and then closed and another has been threatening to open for 3 months. More than 15 mills remain shut down and the volume that existing mills can process per day is limited and they are not running at full capacity. Where does this lead us, tenure reform?

Tenure Reform is the new direction the Ontario Government is taking with its Crown timber. Tenure Reform is the new age formula for allocation of timber resources with the objective of allowing more wood to be harvested by more groups. The question is, will this change result in increased Silviculture activity? Personally I do not think so. This merely changes the people, the groups and the activities within the forest, with respect to who is harvesting and what volumes they are harvesting. Smaller mill owners, contractors and non- timber forest products producers doing jobs on small tracts of land will not significantly render great changes in the silviculture industry. Whatever happens with the Tenure Reform and the resulting changes in ownership, without an increase in mill capacity, no drastic increases in silviculture will occur.

> "Unless there is an increase in the number of mills receiving wood, there are few options for improving the silviculture industry in Ontario."

Within the last year, some of the more prominent silviculture contractors prevented themselves from economic downfall by changing their strategic thinking and getting out of the business of forestry. The forest and management companies are amalgamating their forest contracts and getting services from fewer contractors/consultants. Is this good business practice? Realistically it means putting all your eggs in one basket and only one basket on the market at a time is risky.

Unless there is an increase in the number of mills receiving wood, there are few options for improving the silviculture industry in Ontario. Efforts to bring our forests from cutovers to full mature stands is being hampered by the fact that significant dollars need to be injected into the Forest Renewal Trust in order to pursue additional work on efforts made in the past by way of implementing stand improvements. Is this not why changes were made in the management of the forests to take the stumpage dollars out of the government coffers and put it in a reserve fund to be accessed by the companies based on volume harvested? At the present time, we are inputting very little into the Forest Renewal Trust except for planting up fewer and smaller cuts, some of which "are not requiring any Silviculture activity".

Québec
Association des Entrepreneurs de Travaux Sylvicoles

Par Shanie Lévesque-Baker, Responsable des communications

Les régions du Québec, ensemble pour la valorisation de la forêt et de ses travailleurs!

Durant les dernières années, le secteur sylvicole a souvent été la cible des médias et son image publique en a malheureusement souffert. Forts de leur passion et de leur force de regroupement, les acteurs du milieu forestier se sont mobilisés et ont pris des mesures pour redorer l'image de leur secteur d'activités. Certes, le milieu forestier n'a jamais été à l'abri des critiques, mais un vent nouveau souffle sur les organisations et associations du secteur, qui désirent ardemment retrouver leur appui auprès du grand public.

Pour ce faire, tous les partenaires du secteur forestier travaillent régionalement à trouver des façons originales d'éduquer la population sur les métiers forestiers et leurs bienfaits pour nos forêts. En voici des exemples concrets, qui permettent de faire rayonner le milieu forestier au cœur des régions du Québec.

Des écoles orientées vers la forêt

En plus des activités éducatives réalisées au sein de leur région, l'Association forestière du Saguenay-Lac-Saint-Jean (AFSL) a instauré le projet des écoles certifiées « Forêt et Bois ». À travers ces établissements participants, de niveau primaire ou secondaire, l'élève est l'initiateur d'activités et de projets qui lui permettront de développer une multitude de compétences et de connaissances autour du thème de la forêt. Concrètement, cette initiative engage les écoles inscrites à réaliser annuellement un minimum de trois activités ou projets, qui cadrent avec ce thème. En 2010, 11 établissements scolaires participaient à ce programme, supportés par l'Association forestière du Saguenay-Lac-Saint-Jean.

Rien de mieux qu'un plongeon en pleine forêt

Le Comité sectoriel de main-d'œuvre en aménagement forestier (CSMOAF) a constaté que pour susciter l'intérêt des jeunes et de leurs professeurs à la forêt, il suffisait simplement de les y amener, là où les travaux sylvicoles et l'aménagement de la forêt prennent tout leur sens. C'est pourquoi, depuis 2005, la journée « Viens vivre la forêt » se déroule dans plusieurs régions du Québec, afin de promouvoir ce milieu de travail auprès des étudiants et des intervenants en milieu scolaire.

À l'aide d'ateliers pratiques, le CSMOAF et ses partenaires régionaux s'assurent de faire rayonner chacun des métiers forestiers abordés. Voilà une action concrète et innovatrice, qui permet aux jeunes du Québec de s'initier aux produits du bois et à ses métiers !

Un parcours forestier en Mauricie

De son côté, l'Association forestière de la Vallée du Saint-Maurice (AFVSM) organise depuis 10 ans, des visites forestières destinées au grand public. Ces parcours regorgent d'activités souvent éducatives, parfois sportives, mais toujours très enrichissantes ! Avec un calendrier 2010 comprenant plus de 20 sorties différentes offertes au prix coûtant, la population y trouve son compte à coup sûr. Initiation aux champignons sauvages, atelier de survie en forêt, tournée des plus beaux bâtiments en bois de la région de la Mauricie, l'éventail d'activités est toujours plus riche d'année en année, et permet de se familiariser avec les ressources de la forêt.

Un camp d'éducation en forêt, pour les profs !

Pour sa part, l'Association forestière de l'Abitibi-Témiscamingue (AFAT) a fait preuve d'originalité en mettant sur pied le « Camp forêt des profs ». Cette activité d'éducation consiste à héberger en forêt 26 participants, pendant quatre jours, et à les mettre en contact avec la forêt, la foresterie et les forestiers. Destinée au personnel enseignant ainsi qu'aux conseillers pédagogiques et d'orientation des écoles primaires et secondaires, l'activité en sera à sa sixième édition en 2010. Cette formation sur le terrain leur permet de survoler tous les volets de la foresterie, et donc d'en apprendre davantage sur les nombreux métiers de ce secteur.

Des reboiseurs d'un jour ravis de leur journée de travail

De notre côté, à l'Association des entrepreneurs en travaux sylvicoles du Québec (AETSQ), nous avons notamment contribué à une journée d'initiation au métier de reboiseur. Organisée par l'organisme Reboiseurs du Monde, l'activité rassemblait des politiciens et des personnalités connues de la région du Saguenay-Lac-Saint-Jean. En se plongeant dans le travail des reboiseurs, les participants ont vécu une expérience enrichissante qui leur a permis de mieux comprendre le quotidien de nos planteurs québécois. La journée fût un succès auprès de ses participants, et aura permis de planter près de 4 000 arbres; en plus de participer à la valorisation de ce métier de la forêt !

Quebec
Association of Silviculture Contractors

Translated by Lumi Faucher

Quebec Regions; coming together to promote the forest and its workers!

In recent years, the forestry sector has often been the target of the media criticism and as a result its public image has suffered. In response to this, armed with passion and team spirit, forest stakeholders have mobilized and taken steps to improve the image of the industry. While the forestry sector has never been immune to criticism, a new wind is blowing across organizations and industry associations inspiring them to regain support of the general public.

To achieve this, all partners in the forestry sector are working together regionally to find creative ways to educate the public about forestry professions and their benefits to our forests. Here you will find a few examples of actions that are underway which will enable the forestry sector to shine again.

School-oriented Forests

In addition to educational activities already conducted within their area, the Forestry Association of Saguenay-Lac-Saint-Jean (AFSL) introduced a new "Forest and Wood" project for elementary and secondary schools. The program enables students from participating institutions to initiate activities and spearhead projects which encourage the development of skills and knowledge of the forestry industry.

Registered schools commit to completing an annual minimum of three activities or projects, which are consistent with a forestry theme. In 2010, a total of 11 schools participated in this AFSL supported program.

Nothing Better Than a Dip in the Forest

The Sectoral Committee of Labour in Forest Management (CSMOAF) found that to generate interest of the forest among young people and their teachers, all they had to do is bring them out in the field, where silviculture work and forest management is meaningful. Since 2005, the day "Come Experience the Forest" takes place in several regions of Quebec and serves to promote the forestry workplace among students and school staff.

Through hands on workshops, the CSMOAF promotes various forestry trades and highlights the appealing nature of these professions. This hands-on, innovated program offers the new generation a glimpse into the world of forests products and the trades involving them.

A forest trail in the Mauricie

For its part, the Forestry Association of the Valley of Saint-Maurice (AFVSM) has been organizing forest tours for the general public for 10 years. The tours have educational components and are an enriching opportunity to get physical and explore the forest.

Offering over 20 different tours in 2010, many people have had the opportunity to enjoy a range of interesting topics including: introduction to wild mushrooms; wilderness survival workshops and tours of the finest timber buildings in the Mauricie region to name a few. Each year the activities change to offer unique ways for the community to gain knowledge and experience in the forest.

An education camp in the forest for the teachers!

The Forestry Association of Abitibi-Témiscamingue (AFOLU) has demonstrated originality by setting up a program called "Camp Forest Teacher". This educational activity hosts 26 participants in the forest for four days. It is designed to immerse them in the forest along with forestry sector professionals. The program has been running for 6 years and is designed for elementary and high school teachers, staff and orientation councillors. This field training allows them to gain knowledge of all aspects of forestry, and thus learn more about the many jobs in this sector.

Tree Planting for One Day and Loving it

The Silviculture Contractors Association of Quebec (AETSQ) notably took part in a day of celebration of the trade of tree planting. Organized by the group 'Tree Planters of The World', the activity brought together politicians and public figures from the Saguenay-Lac-Saint-Jean. By immersing themselves in the work of tree planters, participants had an enriching experience that helped them better understand the lives of reforestation workers in Quebec. The event was a great success; 4000 trees were planted and the silviculture trade was positively showcased.

Nova Scotia

Federation of Nova Scotia Woodland Owners

By Mike Hutchinson

Nova Scotia Forest Policy in Transition

As a forestry professional, chances are you've had to answer the question (like I have) "What is silviculture?" at some point in your career. Whether you gave a long-winded, scientific explanation, or a short and sweet version of the term, I'm willing to bet it included the cliché introduction "the art and science of…." in your definition.

If you are a silviculture contractor or worker in Nova Scotia, chances are you're wondering (like I do) why the heck the word "economics" was never added to the well-worn definition of silviculture that almost always begins with "the art and science of tending a forest stand." As silviculture workers, we need to balance art, science and economics every day we step into a treatment area. Whether we're working with a planting spade, a spacing saw, a chainsaw, or a processor, we are the people making the final decision on how the forest will grow. This is a tremendous responsibility. Through our treatments, we shape a forest to suit objectives given to us. These can range from rapid fiber production to ecosystem conservation and/or restoration and anything in between.

Since the spring of 2008, silviculture contractors in Nova Scotia have had a short break from the financial hardships experienced since the downturn in the forest industry going back to 2006. Federal and provincial money was injected directly into the silviculture industry to help sustain rural economies in a time of crisis. Those of us who are still in business have been able to take a cautious breath of fresh air after being in survival mode for so long. Just as we get our businesses back in order and our workers put a little bit of meat back on their bones, we are already looking toward the spring of 2011 and wondering what next year will bring when the government money runs out.

Without delving into the specifics of how our silviculture programs function in Nova Scotia, I would like to outline two deficiencies with the system that threaten the survival of contractors in the province.

First: The required amount of silviculture work to be completed annually is dictated by the amount of wood procured by Registered Buyers in the current calendar year. It is a rather complex credit system, and at first glance, seems to be an effective method of balancing harvesting volumes with new growth. However, the system falters when there is a downturn in the lumber or other markets. Less demand for product means less wood harvested, and therefore less silviculture work is funded that year. The problem this creates is two-fold. The first problem has a negative effect on forest growth. To give a specific example, consider pre-commercial thinning. This treatment is normally done 10-15 years following a harvest. A site that requires thinning on any given year may not be able to be funded within the required "window of opportunity" due to a shortage of funding in those calendar years. The second problem has a negative effect on silviculture businesses. With funding for silviculture being provided by registered buyers based on their current year's procurement, there is no way a contractor can make strategic financial or staffing plans beyond a few months into the future. Something as important as securing future wood supply through prompt regeneration and tending of the forest must be planned better than it is with this piece-meal method.

Valmet tractor and log trailer used to forward wood from selection and shelterwood harvesting operations

Second: Unit rates for treatments have not increased since the creation of the Registry of Buyers program in 2000. Without doubt, this is the single-most discussed deficiency in the program. At this point, most of us are too concerned with securing funding to tackle the issue of insufficient prices for the work we do. While we keep ourselves busy working harder to earn less money, it is easy for supporters of the present system to say "There's no problem with the system, just look at all the work getting done." Everyone around us receives pay increases as the cost of living index rises. This includes high-salaried professionals, right through to minimum wage workers. For quick reference, Nova Scotia's minimum wage has risen from $5.70/hour in 2000, to $9.20/hour in 2010. That is a 61% increase in pay. Now apply that 61% increase to a spacing saw operator's piece rate of $450/hectare (a rough average). That worker could now be earning $725/hectare! Perhaps we could quit complaining about not being able to find any workers because "they all moved out west", or "no one wants to do physical labour anymore," if we were actually able to pay them what they deserved.

I try to follow the policy of not complaining about a problem without providing an idea for a solution, so here it goes. Nova Scotia Department of Natural Resources is in the midst of developing a new forestry strategy, based on public input and recommendations made by selected professionals. Many of the recommendations were in the context of improving sustainability, increasing environmental protection, providing educational opportunities for landowners and forestry professionals and promoting rural economic growth. If the government is interested in developing a strategy that supports these goals, a great place to start would be the revamping of a troubled silviculture program. With the ability to put money on the ground when and where it is needed, forecast availability of treatment funding, and pay workers a modern rate for their work, silviculture contractors could run viable enterprises that would boost rural economies. If we had predictable sources of revenue, we would be able to justify the investment cost of improved training for our workers. This would support a safer and more environmentally conscience workplace.

Mike Hutchinson is a Forest Technician, Silviculture Contractor and Projects Coordinator at the Federation of NS Woodland Owners.

PEI
Forest, Fish & Wildlife Division

by Ken Mayhew, Information Officer

A joint committee of the PEI Environmental Advisory Council and the Public Forest Council recently released a report with their recommendations to government on biomass heat initiatives titled, " Biomass Heat on Prince Edward Island: A Pathway Forward" (www.gov.pe.ca/photos/original/BioMassHeat.pdf). It is part of the province's move to secure local supplies of renewable energy, reduce greenhouse gases and support the rural economy.

In a recently released Request for Proposal document, the province announced interest in purchasing biomass heat for several new or newly renovated public buildings. Under this program, the province will only buy the heat, with the successful company(s) owning and operating the heating system. Heat suppliers will also be responsible for securing supplies of a suitable biomass stock.

The joint committee recommends that forest biomass only be harvested from public or private lands that have a forest management plan prepared in accordance with PEI's Ecosystem-based Forest Management Manual. The plan would have to be prepared by a qualified forester, forest technician or biologist and the harvesting company would be required to harvest in compliance with the plan's recommendations. Committee members also recommend that the province ensure that appropriate planting and silvicultural treatments were included in P.E.I.'s primary private land program - the Forest Enhancement Program (FEP).

The report recommends that government provide the public and land owners with education and demonstration opportunities related to biomass use and harvesting. This recommendation fits nicely with a project being sponsored by the PEI Model Forest Network (PEIMFN). The PEIMFN is developing and implementing biomass focused forest management plans, three on private land and three on public lands, and using these sites to demonstrate different silvicultural approaches for biomass harvesting to land owners, forest contractors, biomass heating companies and the public.

While private land owners who supply forest biomass must have an approved forest management plan, they will not be required to enter the Province's Forest Enhancement Program. However, should they decide to take advantage of the FEP's additional services and incentives, their approved management plan will help them to enrol.

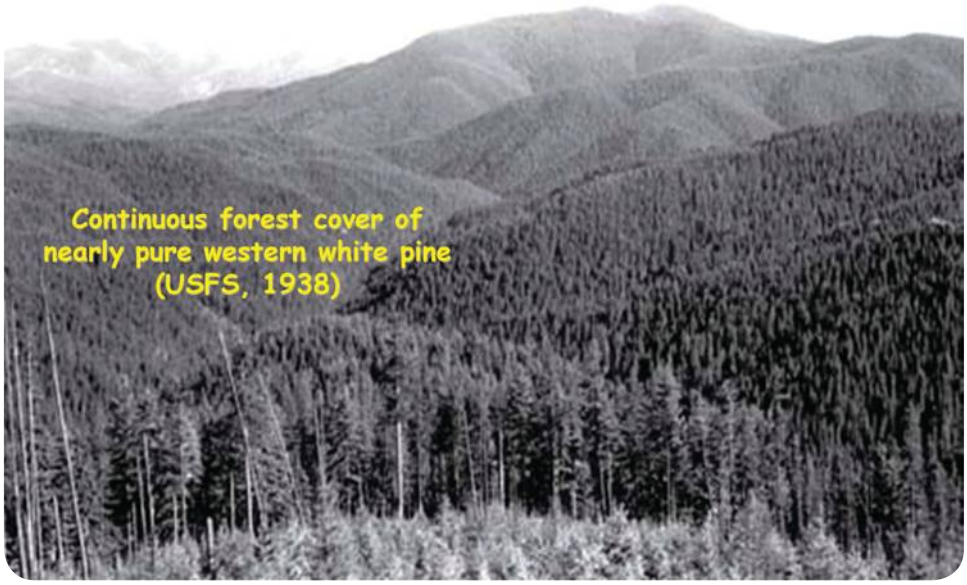
Prepared by Ken Mayhew, Information Officer, Forests, Fish and Wildlife, PEI Department of Environment, Energy and Forestry, Charlottetown PEI

Western White Pine's New Century

By David Noshad and John King

Background

Western white pine has historically been one of the most productive and desirable species in British Columbia. It has rapid growth, clean bole with minimum taper. It has non-resinous straight-grained light wood and second growth, in particular, has high value for veneer slicing for the furniture industry. It is generally tolerant to drought, cold-hardy, non-nutrient demanding and grows well in a wide variety of sites and conditions. It is relatively resistant to crown fires and can even act as a barrier to the rapid spread of fires. It is also resistant to root-rot and is quite browse resistant – making it a good choice in problem areas for browsing and where root disease can be expected.



At one time this species was widely distributed throughout Southern BC and the Pacific North-West. However, over the past century white pine blister rust (WPBR) has been devastating to it and all the North American native white pine species since its introduction. Though often a fatal exotic invasive disease, significant native genetic resistance has been identified. Selecting and breeding these individuals for resistance to WPBR has gradually become viable and active programs to capture this resistance now exist in both Canada and the US.

In B.C. researchers have been involved ever since the rust's discovery on imported infected seedlings through the port of Vancouver in 1910. The last two decades of strong collaborative effort between the Pacific Forestry Centre and B.C. Forest Service's Research Branch the point were seed with marked resistance to blister rust is available for both the Interior B.C. and the Coast. This resistance derived from combining two distinct forms (1) a 'slow rusting' or partial resistance useful where the rust hazard is not too severe; and (2) a major gene that provides total resistance but is still susceptible to breakdown – this gene is found so far only in populations non-native to B.C. (Central Oregon) –whose protection is provided through the pollen.

Benefits of Western White Pine

- A fast growing wood with excellent and valuable wood properties especially valued for second-growth
- Drought and cold tolerant; can grow in a variety of sites and conditions
- Browse and root-rot resistant; ideal for problem areas for these situations
- Relatively resistant to crown fires and can be inter-planted in strips to break up continuous coverage of more crown fire prone species such as Douglas-fir

Results and Prognosis

Evidence to date from both the CFS/BC MFR and USDA Forest Service selection and breeding effort shows twice the level of resistance to white pine blister rust with 65% of planted trees surviving to maturity.

With most plantations on the Coast not at risk of high hazard rust conditions partial resistance strains will do very well but hazard prediction is unpredictable. Safety measures to consider against infrequent high hazard conditions: plant in mixtures; prune lower limbs or get a seedlot in which Major Gene Resistance (MGR) has been added.

Because the selection and breeding effort has not and cannot completely eliminate WPBR we are unlikely to ever see the almost

continuous cover of western white pine across watersheds that existed in many areas two centuries ago. The ultimate objective in these breeding programs might be to aid white pines to co-evolve with this disease as they have in Eurasia, where it is considered a minor disease alongside the usual endemic pests and pathogens that effect conifers.

Conclusion

As we enter this new century western white pine once again has a lot to offer as a plantation species of choice over a wide variety of sites throughout British Columbia. It can be particularly valuable in some of the problem areas for other species because of its resistance to drought, browsing, brush and root rot. It can also be valuable to break up continuous cover where crown fires can be a hazard. Its high value wood is particularly unique in fast rotation forestry and may play a significant role in the wood products industry long term competitiveness. The benefits of these varieties should easily outweigh risks from WPBR. A comprehensive program using both genetic improved seed and good silvicultural knowledge can allow us once more to have this valuable species returned to our forest landscape and help us to maintain one of our natural resources and its companion species for future generations.

Additional Resources

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Breeding for resistance, CA NFOR Orchard, Sechelt, 2004)

Blister rust

Forest Health

By Suzanne W. Simard, W. Jean Mather, Jean L. Heineman and Donald L. Sachs

Too much of a good thing?

Planted lodgepole pine at risk of decline in British Columbia

Lodgepole pine represented 55% of all planted trees in the interior of British Columbia from 2002 to 2009. Reasons for the popularity of this species are plentiful - it has good early survival on a wide range of sites, rapid juvenile height growth, and is easily and cheaply produced by nurseries. Planting lodgepole pine also enables forest companies to rapidly meet free-growing regulations, which require that harvested sites are reforested with desired species and stocking levels within a defined time period (usually 12-15 years), and that the trees are healthy and free of overtopping broadleaf competition (BC Ministry of Forests 2000). However, widespread single-species planting of lodgepole pine also puts plantations at risk of damage from insects, diseases and other climate-related stresses, particularly in mixed native forest types with historically low lodgepole pine presence. Recent evidence that these fears are justified is the thousands of hectares of lodgepole pine plantations that have been lost to mountain pine beetle, Dothistroma needle blight and hard pine stem rusts (Woods et al., 2005; Kurz et al., 2008; Woods and Bergerud, 2008). Interestingly, the increasing seriousness of these losses has not dampened enthusiasm for planting lodgepole pine in BC. Current free-growing guidelines continue to make it the most attractive species to plant and the Province assumes it will remain healthy and follow yield projections to maturity once declared free-growing. There is no formal monitoring process in place to verify this assumption.

Climate change may place lodgepole pine under even greater stress because of increasing temperatures, shifts in precipitation patterns, and greater frequency of extreme weather conditions (IPCC, 2007). Climate change may also alter the relationship between lodgepole pine and the co-evolved insects and pathogens that damage it through effects on host resistance, pest virulence, and the timing of critical life-cycle events. Insect and diseases that were constrained by climate norms and caused only minor damage to pine in the past may increase in importance with shifts in regional climate. Forest management practices have the potential to amplify pest damage further by simplifying stand composition. Understanding the effects of climate and silviculture practices on lodgepole pine-pest dynamics will be critical for mitigating forest decline with climate change and predicting forest productivity in the future. Given these concerns, we asked the questions:

- Do lodgepole pine plantations remain stocked and healthy after they are declared free-growing?
- What are the causes of damage?
- Is the risk of damage associated with regional climatic, site, location, or silviculture treatment factors?
- Are these conditions expected to worsen with climate change?
- Can changes in management practices help avoid future problems?

Research on the status of free-growing lodgepole pine plantations

In 2007-2008, we randomly selected 66 lodgepole pine plantations from the BC government silviculture database (RESULTS). The sites were >15 ha, planted with lodgepole pine between 1977 and 1992, and had met provincial standards for free-growing by 2007. The sites spanned six biogeoclimatic zones (ESSF, ICH, IDF, MS, SBPS and SBS) (Figure 1). At each site, we sampled an average of nine 50 m2 plots. Although this sampling density is lower than is specified for operational survey standards, the plots were randomly located to be as representative as possible of individual sites. We assessed:

- Total, well-spaced and free-growing conifer density
- DBH of well-spaced trees and height class of all trees
- The presence of damage from insects, disease, animal or abiotic agents on each

Table1. Average stocking, damage and free-growing status of lodgepole pine plantations by biogeoclimatic zone.

BEC zone[1]	Total conifers (stems/ha)	Lodgepole pine (stems/ha)	Damaged lodgepole pine (%)	Free-growing (stems/ha)	Proportion of sites meeting minimum stocking standards	Proportion of sites with >100 stems/ha above minimum standards[2]
ESSF	2807	1500	54.8	862	90	70
ICH	3359	1611	66.2	702	29	29
IDF	2462	2120	36.1	812	100	60
MS	3107	2350	42.2	912	86	62
SBPS	4043	2759	68.6	851	80	20
SBS	4320	3769	58.8	850	75	75

[1] Biogeoclimatic zones are Engelmann spruce-Subalpine fir (ESSF), Interior Cedar-Hemlock (ICH), Interior Douglas-fir (IDF), Montane Spruce (MS), Sub-boreal Pine and Spruce (SBPS) and Sub-boreal Spruce (SBS).

[2] Stands with a free-growing density within 100 stems per hectare of the minimum stocking are considered a very high risk of not achieving their full productive potential (Forest Practices Board, 2003

tree, and whether it was serious enough to affect free-growing status

For each site, latitude, longitude and elevation were used to generate climate data from the web-based tool, ClimateBC (Wang et al., 2006). Information on silviculture treatments was obtained from the RESULTS database. We used logistic regression analysis to determine the odds of a damaging agent occurring by calculating the odds-ratio (the multiplicative factor by which risk changed when the independent variable increased by one unit). The odds-ratio occurs on a logarithmic scale, where a change of 'x' units of the predictive factor corresponds with a change in risk of the damaging agent equivalent to the odds ratio raised to the power of 'x'. Odds-ratios above 1 indicate increased risk and those below 1 indicate decreased risk.

Have lodgepole pine plantations remained stocked and healthy after declared free-growing?

On average, the study sites were stocked with 2,352 lodgepole pine/ha or 3,350 total conifers/ha at age 15-30 years (Table 1). Across all sites, 55% of the lodgepole pine we sampled suffered some form of damage, of which 90% was serious enough for the trees to be rejected as free-growing. Because of this damage, free-growing standards were no longer met on 70% of plantations in the ICH zone and 27% of plantations over all zones. Damage was the primary reason trees were rejected as free-growing, but minimum spacing and, to a lesser degree, height requirements also prevented individual stems from being free-growing, even when they were healthy. Only 5% of sites had >1100 free-growing stems/ha, indicating that most fell substantially short of provincial free-growing targets (1200 stems/ha on most sites), even after discounting for natural self-thinning rates. Natural regeneration was common (>1000 stems/ha on 73% of sites), but most were not free-growing because they were either too short or too clumped. Low free-growing density was associated with lower total stand density.

Table 2. Summary of odds-ratios (logarithmic scale) for select climatic, site and silviculture treatment factors predicting the presence of select damaging agents.

Damaging agent	Climatic and site predictors				Silviculture treatment predictors				
	Mean coldest monthly temperature	Mean warmest monthly temperature	Number of frost-free days	Soil moisture	Juvenile spacing	Brushing	Pruning	Broadcast burning	Mechanical site preparation
Western gall rust	1.837	11.048		0.761	1.443	1.396	1.774	0.573	
Atropellis canker	2.114				50.89			10.765	
Stalactiform rust							2220.45		24.119
Comandra rust						0.259	57.377		
Pine needle cast			0.926	1.085	101.922	0.174	0.337	2.004	
Mountain pine beetle	21.074		2.244	0.591		12.792			
Pine terminal weevil	6.426	0.098				3.867	.323	2.489	
Warren's RC weevil				2.686					
Sequoia pitch moth				1.726					1.751
Armillaria root disease				3.618					
Tomentosus root disease						0.185			
Dwarf mistletoe		0.017	1.559	2.205					0.044
Snow and Ice				2.060				2.483	

Red values indicate an odds ratio >1, thus predicting an increase in the damaging agent with an increase in the climatic or site predictor, or with the application of a silviculture treatment. Green values indicate an odds ratio <1, this predicting an improvement for trees with an increase in each predictor. White cells indicate no effect as predicted by logistic regression.

What were the causes of damage?

Lodgepole pine suffered damage on all sites. We recorded a total of 36 damaging agents in our study, but not all agents occurred on all sites. Most damage was caused by hard pine stem rusts, particularly western gall rust, which occurred on all study sites and affected one-quarter of the stems (Figure 2). Many other agents also caused damage, with the most prominent agents being Atropellis canker and Sequoia pitch moth in the ICH zone, snow and ice in the ESSF zone, lodgepole pine terminal weevil in the IDF and MS zones, Stalactiform blister rust, Comandra rust and Atropellis canker in the SBS zone, and Comandra rust and Stalactiform blister rust in the SBPS zone. Foliar diseases were common but generally not serious, while root diseases (Armillaria, Tomentosus), animal damage (squirrel, deer, bear), and abiotic damage (drought) were less common but serious in localized areas.

What were the risk factors leading to damage?

Risk of damage from serious agents such as hard pine stem rusts, root disease, and mountain pine beetle increased with latitude, coinciding with the increasing prevalence of lodgepole pine in northerly ecosystems (Table 2). In the case of western gall rust, Atropellis canker, and mountain pine beetle, risk of damage increased as temperature of the coldest month got warmer. We also found that increased

risk of damage from Sequoia pitch moth, pine needle cast, pine terminal weevil, and dwarf lodgepole pine mistletoe was associated with warming and/or increasingly dry climatic conditions. Risk of damage from most agents increased under wetter soil moisture conditions, which generally favour spread of pathogens. The exceptions were mountain pine beetle and western gall rust, which were more prevalent under drier site conditions, possibly because pine resistance was lower under drought stress. In general, stands appeared to be at increased risk of damage where they had been broadcast burned, spaced, brushed or pruned (Table 2). However, our sampling intensity was low and we did not stratify by silviculture treatment; as a result, these trends require further investigation.

Will risk of damage increase with climate change?

Temperature increases are projected to be greater in more northerly latitudes (IPCC, 2007), and the strong associations between damage, latitude and warming in our study suggests that lodgepole pine will be at increasing risk of damage as climate change progresses. We predict especially large increases in damage from stem diseases because of their strong associations with increasing winter and summer temperatures. Our results also suggest that increasing summer drought stress will predispose lodgepole pine to damage from pests such as mountain pine beetle, Dothistroma, pine needle cast or dwarf mistletoe. Foliar diseases may also become more important with increases in extreme weather events.

How can we reduce the risk of damage in the future?

Our finding that over one-quarter of lodgepole pine plantations have substandard stocking levels soon after being declared free-growing as a result of insect, disease and abiotic damage is cause for concern because of the potential for broad-scale reductions in forest yield relative to projections. Free-growing guidelines that encourage wide-spread management for lodgepole pine in preference to slower growing, shade-tolerant species should be reconsidered. Planting single species stands should be avoided wherever possible and planting of lodgepole pine should be greatly scaled back where it naturally forms a small component of forests, especially in the ICH and ESSF zones. Where site or other factors necessitate planting primarily lodgepole pine, and natural regeneration of other conifer species is limited, foresters should consider accepting a broadleaves as crop species and increasing the planting density to allow for damage losses. Moreover, free-growing guidelines should be adjusted to accept more variable spacing and slower growth rates of natural regeneration. Careful attention must be made to match provenance with site and to maintain genetic diversity to help bolster resistance of plantations against escalating insect and disease problems projected with climate change.

Conclusions

Fifty-five percent of the lodgepole pine we sampled in the southern interior of BC was seriously damaged at 15-30 years. Our results

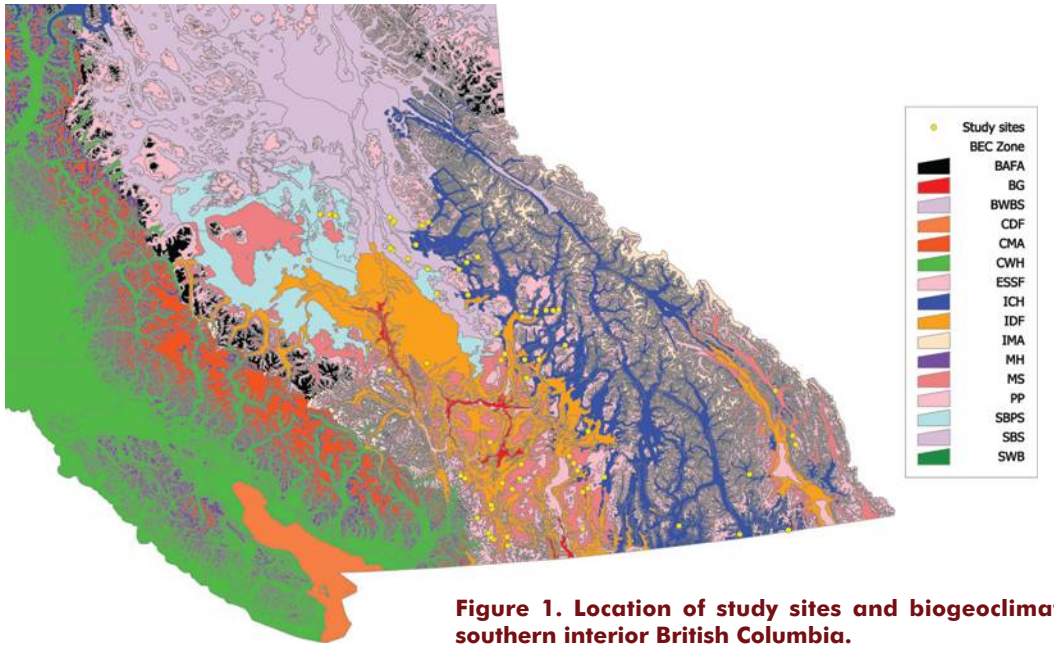

Figure 1. Location of study sites and biogeoclimatic zones in southern interior British Columbia.

suggest that 27% of free-growing lodgepole pine-leading plantations no longer meet free-growing guidelines. Most damage was caused by hard pine stem rusts, but several other agents also resulted in serious damage in localized areas. Increases in winter temperature and summer drought with climate change are expected to increase the extent of damage and reduce yield of lodgepole pine stands that are already affected by widespread health problems. To track mortality, damage and forest development with climate change, a system for monitoring post-free-growing stands over the course of the rotation should be implemented. Reforestation policies should be designed to encourage a greater diversity of regeneration practices with the aim to maintain or bolster ecosystem complexity.

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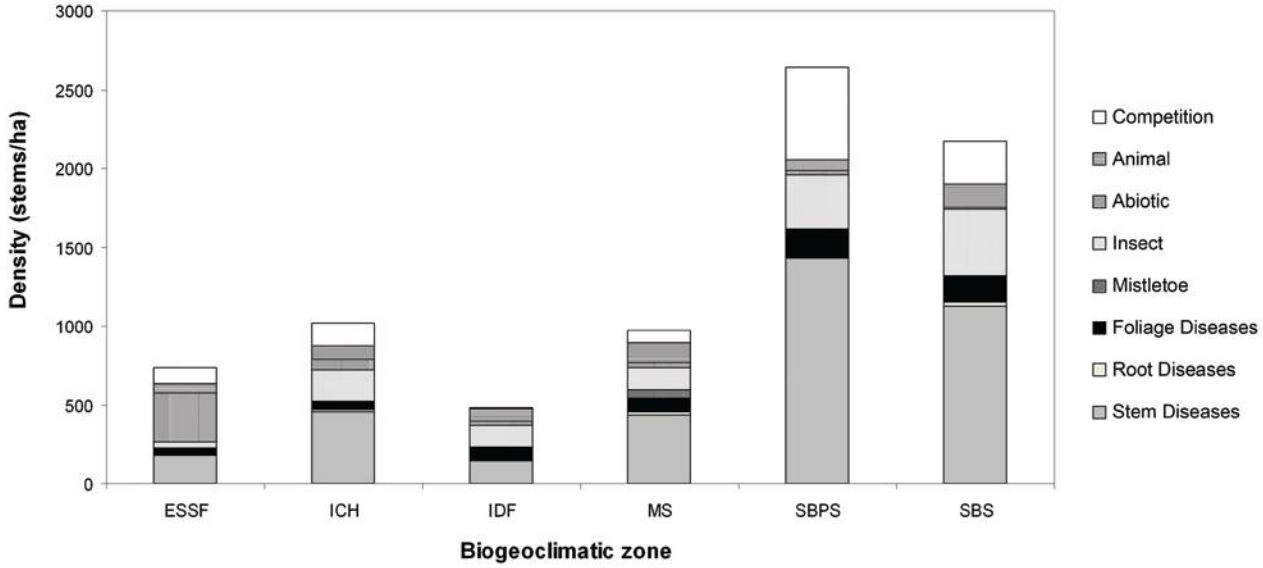
Figure 2. Average total density of trees damaged by agent group in each biogeoclimatic zone.



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