COMPLEX STANDS RESEARCH AND MANAGEMENT CONFERENCE

FEBRUARY 19-20, 2007
SMITHERS, B.C.

PROCEEDINGS

Bulkley Valley Centre for Natural Resources Research & Management
www.bvcentre.ca

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INTRODUCTION

The **Bulkley Valley Research Centre** hosted a dynamic conference in February of 2007, attracting some of the province's top forestry professionals as well as prominent researchers from Alberta and the United States.

This conference was organized as a way for researchers, managers, silviculturists, and other practitioners to update themselves on current developments in the science of managing complex forest stands. In the past 5 years there have been substantial advances in our understanding of complex stand dynamics, in our knowledge of non-timber values, and in an array of simulation models and decision support tools to support decision-making around complex stands. Much of this is driven by the current mountain pine beetle epidemic. Such models continue to be modified and improved. The conference and proceedings are ways to distribute this information more broadly.

Our definition of 'complex stands' for this conference is fairly simple. 'Complex stands' have: multiple tree species, species of multiple ages, multiple layers, a variety of other organisms, and are managed for multiple values.

On the first day of this conference, speakers shared their **different perspectives on complex stand management**. Andrew George Jr. (Chief Skit'den) and David deWit of the Wet'suwet'en, spoke of their Wet'suwet'en Territorial Stewardship Plan. The Chief Forester of British Columbia, Jim Snetsinger, discussed the future of complex stands in BC and implications for timber supply analysis. One of the most significant obstacles to updating forest inventories, and to subsequent timber supply analyses, is a lack of trained people on the ground to carry out the inventories. Eugene Runtz presented a small-scale logger's perspective on partial cutting of visually sensitive landscapes in the Robson Valley. He emphasized the following points: keep your community informed, and attempt to apply different management schemes in various contexts (i.e., try different levels of harvest in different situations, including clear-cutting where appropriate). Carl vanderMark (Industry perspective) emphasized the need for greater flexibility and spoke to some of the forest policy issues that require retooling in order to make complex stand management affordable. This was followed by Steve Chatwin and Bryce Bancroft (the Hydrologists perspective) who concluded that salvage logging of mountain pine beetle-affected stands results in significant changes to streamflow peaks and discharge rates, over and above streamflow changes from grey-attack alone.

Dr. David Coates, Research Silviculturist with the Ministry of Forests and Range, spoke about the challenges facing traditional silviculture in embracing complexity. There is no longer one best treatment option to be implemented. There are choices to be made and trade-offs to be considered across a gradient of conditions. Growing healthy productive forests, with a diversity of structure in space and time, is going to be our best strategy over the long term to meet a range of objectives.

Dr. Charles Canham, Senior Scientist, Institute of Ecosystem Studies, Millbrook, New York spoke on the tension between embracing complexity and simplifying things enough to create a robust simulation model that we can work with and which can inform forest managers. He spoke about the evolution of the SORTIE model as a means of developing an understanding of the whole system based on local neighborhood interactions. A major concern of his is that we are developing models based on parameterization in our current world and yet that world is rapidly changing. Models are the best way to anticipate those changes. This is why long-term monitoring is so important. For adaptive management to work, we need to be able to compare the results of our models against long-term field data.

INTRODUCTION

The second day of the conference focused on active research projects addressing some of the questions and challenges that researchers have encountered over the past 5 years. The three main topic areas were:

1. **Research on complex stands and succession**. To understand and predict stand dynamics and growth of complex stands it is important to understand and quantify the relationship between light availability and tree performance. It appears that the light-growth relationship varies regionally, according to variations in macro-climate, and temporally, according to the age of the stand. Also, understorey tree development varies in aspen-dominated stands compared to conifer-dominated stands. For shade tolerant species such as subalpine fir productivity is strongly correlated with soil nitrogen regardless of light levels. Much has been learned in recent years, and there are still many unanswered questions in understanding complex forest dynamics.

2. **Management and research related to mountain pine beetle infected stands**. This section provided an update on some of the new research that has been undertaken over the past 5 years related to mountain pine beetle. In one study, the TADAM growth model was used to try to predict future productivity of 20 to 60 year old stands attacked by MPB. Another study uses modeling to predict wildlife habitat values following MPB attack and subsequent salvage logging. Emerging evidence suggests that beetle-killed forest, particularly containing residual live trees, continues to provide habitat for a number of species that do not use young clearcuts. In order to understand the cumulative impact of one disturbance process on another, dendroecological research is being used to elucidate the timing of the two-year cycle budworm, and subsequent spruce beetle and western balsam bark beetle outbreaks. Finally, a mountain pine beetle management decision support tool (MPB MDST) was presented in which cost/ benefit, net present value, and mean annual increment metrics can be modeled, according to a variety of stand treatment options grown in SORTIE. Many of these presentations were followed by insightful discussions of model assumptions and limitations that can be found in the question and answer section of the proceedings.

3. **Growth models and decision support tools for complex stand management.** The Prognosis model has been adapted for use in B.C. in order to obtain growth and yield estimates for complex stands. The model was first used to predict outcomes in partially cut complex stands in southeastern B.C. and is now being adapted to project stands following attack by mountain pine beetle. However, MPB-killed stands are more difficult to model because of the more complex mortality and ingrowth/regeneration dynamics. The Tree and Stand Simulator (TASS) model is a spatially explicit model that most often supports traditional silvicultural decisions and timber supply analysis, but is increasingly being used to design, project, and evaluate non-traditional silvicultural systems and stand management strategies, including estimates of wildlife habitat supply. In order to more precisely describe complex stands without the use of plots, a 17-class system of stand structure classification for even and uneven-aged stands has been developed in the Cariboo.

The conference was followed by a two day SORTIE-ND workshop which introduced foresters to the latest software that will offer an innovative approach to modeling complex stand structures. For more detailed information regarding SORTIE-ND, please visit http://www.sortie-nd.org/

SPEAKERS

Dr. Sybille Haeussler

Andrew George, Jr. & David deWit

Jim Snetsinger

Eugene Runtz

Carl vanderMark

Steve Chatwin & Bryce Bancroft

Dr. Dave Coates

Dr. Charles Canham

Marty Kranabetter

Dr. Phil Comeau

Dr. Rasmus Astrup

Cosmin N. Filipescu

Dr. Chris Hawkins

Doug Steventon

Doug Thompson

Dr. Kirstin Campbell

Dr. Valerie LeMay

James W. Goudie

Ian Moss

DR. SYBILLE HAEUSSLER

PRESIDENT, BULKLEY VALLEY RESEARCH CENTRE

Preamble:
The Science of Complexity

The study of complexity is an attempt to get beyond the traditional reductionist approach in science. Science has worked very well at taking systems apart and looking at their individual components and predicting how those components will be behave. Complexity is about looking at the interactions between those components, and that gets a lot more difficult. A second feature when we look at complexity is that while in traditional reductionist science there is usually background noise that you try to extract from so you can get at the true signal, in complexity science, variability is a really important aspect of the system being studied. One of the best ways to sum up the whole idea of complexity in science is the whole is more than the sum of its parts. So when the pieces come together what happens with the whole.

Some of the people who specifically define themselves as complex systems scientists define complexity as those properties in a real world system that can't be adequately understood or predicted by examining any or all of its component parts. So we are studying the phenomenon that occur because of the interactions.

Some of the features that occur in all types of complex systems:

- The relationships are non-linear because of positive and negative feedback loops;
- Open and non-equilibrium systems;
- Highly sensitive to the initial conditions;
- They have memory, or hysteresis, i.e., what happened before is important to what happens later;
- There are often many different scales of interactions, one nested inside the other;
- They have intermittency – big events, catastrophic or massive events seem to happen more often than what might be predicted based on random occurrence;
- There are either no boundaries or it is very difficult to establish where the boundaries are in complex systems; and,
- They have emergent behavior – when a phenomenon arises spontaneously because of the interactions.

Both forests and forestry are complex systems. Forests have many components, they operate at multiple scales. Single species and single age classes are insufficient ways to deal with the complex phenomena forests. In forests we do have emergent phenomena, a classic example being the mountain pine beetle outbreak, where it grew out of one point and became this huge phenomenon. It emerged in multiple centers and coalesced into what we now view as a giant outbreak. We wouldn't have been able to predict it. In hindsight we can say these are the factors that lead to it. But would we be able to predict when the next one is going to arrive? Will we have a spruce beetle outbreak on the same scale?

Forestry too is a complex system. It involves the interaction of ecological, social and economic systems. Technical solutions alone are insufficient for solving forestry problems.

Forestry is on the verge of adopting a complex systems approach. We are very aware that the current challenges we face are not solvable with traditional reductionist approaches. But, complex system science at this point can't provide workable solutions for managers. It's just an emerging science and we don't yet have the tools. The tools are more at the theoretical stage. We are at the

transition stage where I think we need to take a two-pronged approach. One is to use models that push the limits of our traditional reductionist approach by using advanced computing power, and perhaps by linking together various models at various levels that have been developed more traditionally and seeing what new knowledge emerges from those. Secondly, we can use complex systems, approaches, and models at a more conceptual level. If we haven't got the math and the science producing these very detail models yet, we can use the concepts, and adopts those to deal with some of the higher level social and ecological issues that we face. So, we should tackle our problems at an appropriate level of detail. To paraphrase something Einstein once said, "any problem that we approach should be approached as simply as possible, but not too simply". So we do have to deal with complexity but at this point we need to figure what's the appropriate level of detail. We need to find those interactions that are most important – which ones control system behavior; which ones we have the potential to affect in order to change the system.

A local example of emergent behavior: the moose have figured out that it is safer in the Town of Smithers than outside town.

DR. SYBILLE HAEUSSLER

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BIOGRAPHY:

Sybille Haeussler, PhD, RPF is president of the Bulkley Valley Research Centre. Sybille is a professional forester and research scientist whose work addresses the dynamics and diversity of plant communities and ecosystems — with a special interest in complex systems dynamics and the role of self-organizing processes in maintaining ecosystem diversity. Sybille has a BSF (Forest Biology) from the University of BC, an MSc (Forest Ecology) from Oregon State University, and a PhD (Environmental Sciences) from the Universite du Quebec a Montreal. Sybille currently works as a Killam (honorary) and NSERC post-doctoral research fellow for the Forest Sciences Department, University of BC, and before that was self-employed for more than 20 years as the proprietor of Skeena Forestry Consultants, based in Smithers, B.C.

Andrew George Jr.
David deWit

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David deWit

A First Nations perspective on resource management: Forests for everyone

Undoubtedly, the sustainability of our forests and ecosystems are important to our entire population. This is particularly evident for the First Nations of BC, as these indigenous populations have a profound connectivity to their natural environments. Therefore, the sustainability of the natural environment, such as forests, is vital for First Nations cultural and physical continuity.

The Wet'suwet'en of north central BC exemplify the concept of spiritual, physical, mental and ideological connectivity to their traditional territories. The Wet'suwet'en epistemology (theory of knowledge) is dependent upon the continuous and regular use of the resources that the natural environment is able to provide for them. When Wet'suwet'en traditional use patterns change, it has a serious impact on their ideology and socio-political structure.

This presentation will describe some of the impacts of general forestry activities on the Wet'suwet'en culture. More specifically, it will address the importance of sustainability of forest ecosystems for the Wet'suwet'en, and their belief that forest resources are for everyone to utilize – past, present and future.

See next page for Biographies.

ANDREW GEORGE JR.
DAVID DEWIT

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Andrew George

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David deWit

BIOGRAPHIES:

Wet'suwet'en hereditary chief **Andrew George, Jr**. has extensive experience in forestry and Aboriginal lands and resources management. Andrew was the Lands and Resources Manager at the Office of the Wet'suwet'en for eight years before leaving to pursue his culinary interests. He has established countless relationships with government, industry and academic institutions throughout British Columbia.

As Wet'suwet'en Hereditary Wing Chief Skit'den, Andrew continues to be actively involved in the Wet'suwet'en traditional feast system and is deeply respected by the Wet'suwet'en hereditary chiefs, elders and clan members for his knowledge of the Wet'suwet'en territories, traditional system, lands and resources issues, and ability to build bridges with non-aboriginal agencies.

In addition to his resource management, traditional and life experience on the territories, Andrew is well-versed in the tourism sector, where he has participated in Aboriginal resource planning and product development missions to the United States and Europe.

Andrew George is a world-renowned chef and was a member of the Canadian Native Haute Cuisine gold-medal team at the World Culinary Olympics in 1992. He and his teammates were among 13,000 contestants from over fifty countries to enter the competition. They took first place and made history as the event's first native competitors. After winning seven gold, two silver and two bronze medals, George and his team are credited with establishing an Aboriginal presence in international cuisine.

In 1997, George published an aboriginal cuisine book entitled "FEAST". He will be catering the Complex Stands Conference.

David deWit studied integrated resource management in British Columbia and completed a biology degree at the University of Calgary. His background involves wildlife habitat surveys, sensitive ecosystem preservation and wildlife corridor design. He currently works at the Office of the Wet'suwet'en developing an ecosystem-based management tool that will enable the First Nation to manage cultural and natural resources effectively with community, industry and government parties.

JIM SNETSINGER

CHIEF FORESTER, MINISTRY OF FORESTS

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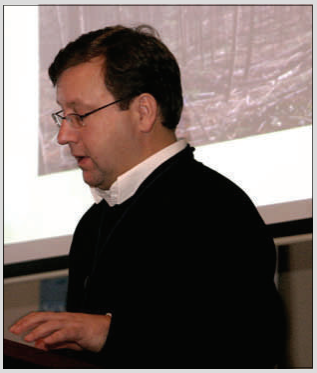
BIOGRAPHY:

In November, 2004, **Jim Snetsinger** was appointed as BC's chief forester.

As Chief Forester, Snetsinger is the senior professional forestry executive of the Ministry, responsible for developing plans and programs to manage provincial forest and range lands. He's the executive in charge of the Forest Science program and is responsible for determining timber harvest levels for each timber supply area and tree farm licence in the province. He also oversees the ongoing implementation of the new *Forest and Range Practices Act* and regulations.

Before becoming Chief Forester, Snetsinger was the regional executive director for the Northern Interior Forest Region. A professional forester since 1981, he's a graduate of the University of Toronto and worked as a forester for five years with BC Hydro before joining the Forest Service in 1986. Since then, he's worked in the former Prince Rupert Forest Region and also served as a regional director for Land and Water BC.



The future of complex stands in British Columbia, and implications for timber supply analysis

This talk comes from the perspective of the Chief Forester of British Columbia who is legally mandated with the responsibility for determining appropriate levels of annual allowable cut (AAC) in 137 forest management units every five years within the province. This determination depends on the best research, growth and yield, and inventory information available at the time of the decision.

Going back to the early 1970s, clearcutting was the dominant practice applied to forests that today would be largely described as old growth. During that time, the province deployed simple growth models, predicated on even-aged assumptions, and regulated harvests based on the Hanzlik formula. Harvest levels were also greater on the coast than in the interior. By 1985, the situation was starting to change; we had produced the first managed stand yield tables for second growth coastal Douglas-fir using the Tree and Stand Simulator (TASS).

Today there are greater public demands on all forest values, other than just timber. There has been a shift toward variable retention harvesting and ecosystem-based management, resulting in the retention of more complex stands following harvesting. The mountain pine beetle selectively removed lodgepole pine from the landscape, leaving a wide variety of secondary structures that are of potential significant to maintaining mid-term timber supplies. Climate change is expected to have dramatic effects on future forest and stand conditions.

It has never been as important as it is today to better describe how complex stands respond to management and how they are expected to grow over the longer term as a result. My next AAC determination is in the Morice Timber Supply Area immediately to the south of the Bulkley Valley, where this conference is being held. This is going to be a difficult task. Fifty-seven million cubic metres of lodgepole pine are at risk of being killed by the mountain pine beetle. As a result, secondary structures will be important to future wood supplies and to the protection of many forest values. Thank you for your interest in this conference and for your work on this topic. It is timely and important to fulfilling my responsibilities as Chief Forester.

JIM SNETSINGER

CHIEF FORESTER, MINISTRY OF FORESTS

The future of complex stands in British Columbia, and implications for timber supply analysis

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QUESTIONS & ANSWERS

Q: Are you planning to address the fact that our current inventory is out of date and in some cases in the province pretty poor by getting another inventory of the provincial forests going?

A: Good question. It was a little over a year and a half ago that the inventory came back to the Forest Service, which as the Chief Forester I was very pleased with. Since that time, we've done a review of our inventory program, which has led to the formation of the Vegetation Resource Inventory Advisory Committee to the Chief Forester and we're developing a strategic plan on what our priorities should be for inventory in the province. We have about a steady state inventory program of about $8 to $10 million a year over the course of the next number of years. The model's a little different now than the model that I grew up in where the Forest Service did all the inventory. We're now working collaboratively with industry. The advisory committee to the Chief Forester will be producing a strategic work plan over the course of the next five years and an annual work plan on which inventories need to be done first, or re-inventories need to be done first. So, we can't re-do the inventory all over the province at once, but we've got a plan in place to do it in the highest priority areas first, and to spend our FIA money as wisely as possible.

Q: Additional information on secondary structure?

A: There should be opportunities to do that through the Vegetation Inventory Advisory Committee.

Q: Do you know if, under the Forest and Range Practices Act (FRPA) it's clear that licensees, FF forest stewardship funders have to fully support all types of harvesting on the ground? For example, the licensee could be carrying out partial cutting and leaving a lot of retention behind, for reasons other than timber. Is it clear under FRPA that the Forest Steward Plan has to support or detail that type of harvesting? We're struggling with that right now.

FRPA standards are currently based on even-aged management. There really isn't any provincial standard that I'm aware of for retained trees, particularly on the coast. Licensees are starting to carry out partial cutting and leaving trees behind, for timber, and for other reasons. We're not clear whether or not under FRPA the licensees have the freedom to deviate from the forest stewardship plans.

A: Difficult question, but let me see what I can do with it. The licensees do have a lot more flexibility and freedom under FRPA. We have been monitoring partial-harvesting on the coast and I'll give you my impressions. The range of partial harvesting is all over the map depending on what ecosystem you're in and what the values are they're trying to manage for. I've seen partial-harvesting from helicopter logging that opens up a significant patch that

allows cedar and Douglas-fir to be planted with good regeneration. And then I've seen other harvesting practices, mostly outside the timber harvesting land base but nonetheless in the productive TSA, where we've had cedar, partially-harvested, leaving a stand of hemlock. Without a lot of light getting to the ground we're not likely to get a lot of cedar. So we're monitoring those kinds of practices and it's not clear under the Forests and Range Practices Act whether there's enough guidance that would require the licensees to specify what it is they're trying to achieve with some of this partial-harvesting activities. So the Coast Region Implementation Team is looking at it. I believe that if we're going to carry out partial-harvesting, and I think it's an appropriate tool in certain spots, we really have to know what the end game is. What's the desired future forest condition that you're actually striving to achieve and how will that management prescription actually get you there? That's a link that I'm not quite seeing yet, so at some point we might need to move to a practice requirement under FRPA that details, and requires that licensee to really think about future forest conditions before carrying out the practice.

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Q: As we're moving out of these pine areas we're going to be moving into the spruce and balsam areas. In terms of appraisals, there's lots of problems with getting proper decay, waste, and breakage factors especially in the spruce balsam stands, given the fact that those inventories were done in the early 1970s. Is this something that's been brought up?

A: It hasn't been brought up yet but I'm sure as we're going to be shifting operations at some point out of the pine-dominated stands into other areas, we'll probably have to have a much better handle on our decay, waste, and breakage. That will come up in the inventory, I'm sure, over time. It hasn't risen to the top of the pile yet, though.

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Q: Getting back to inventory, do you think it's a good model, considering inventory has is come back to forest service, that industry continues to coordinate specific inventories in specific places and the government coordinates the whole thing, or do you think that inventory itself should come back to the government.

A: It's the model we've got and I think it can work. This Cooperative Advisory Council that I've set up is meant to have the Forest Service and the industry look at those priorities across the landscape. It's my opportunity as the Chief Forester to give them where I think the priorities should be for them to chew it over and then for them to come back and produce a strategic plan that actually I endorse and approve. I think what's more critical for this model to work is actually getting the consultants to ramp up their expertise. We've had such a dearth of inventory work done in this province over the past five or 10 years, that the kind of classifiers we need and the kind of inventory people we need just aren't out there. What I want to do is create a stable inventory program of this $8 to $12, and then consultants around the province can count on that work and start to develop that expertise again.

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Q: With respect to seral constraints, what is the seral stage of a stand in which the overstorey has been killed by mountain pine beetle and when does it change?

A: That's a tough question. I'm not sure I quite understand it, but maybe Dave Coates could help me with this one. So, what are you driving at?

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Q: If the land base is being managed for seral, mid-seral, and old-seral, and you must maintain a certain amount of old-seral, then, if your considering your pine overstory and the age at which it is being killed then if the oldest trees are dead, then is the stand old then?

A: It depends on what kind of stand you are in. So that if you are in a stand that is heavily pine-dominated, then it doesn't have a lot of secondary structure in the overstorey, but it still has some understorey in terms of poles and saplings, it probably reverts back to early seral. If that stand is more mixed, with pine as leading but has some spruce and balsam in it and the pine drops out, it probably has more old-growth attributes and mature or old-seral characteristics.

There is no one answer. So foresters really have to take a look at each stand and what the stand conditions are and determine 1) whether or not a stand should be harvested; 2) if it's going to be harvested, how should it be harvested; and 3) if its going to be left, then what are you leaving it for and how will it grow, and will there be enough site occupancy to give you a mid-term timber supply. A whole host of questions.

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Q: You stressed several times in your presentation "other forest values" and I'm wondering if FRPA gives managers the flexibility to really manage for those other values given the language of the objectives in FRPA? I'm asking specifically about the phrase "without unduly reducing timber supply"?

A: I think it does and we've always been practicing with that unwritten objective in mind. And we've had land use plans in place which have zones in them (to protect other forest values), and land use decisions have been made, and trade-offs have been made. I think what that language shows is to take the decisions that society has made around those land use decisions and say yes we want to manage those within a context. The context is those higher level plans that have been established, plus the language that has been established in FRPA. So we still want to maintain a vibrant and healthy forest industry within the province and that's the context that we want to manage in.

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Q: Just thinking about policy. I'm a scientist, so might be a little naïve here. Generally partially cutting can be a little more expensive than clear-cutting. So people who do the partial cutting want some kind of break in stumpage to offset their extra costs. Yet, at the same time the Americans are quite suspicious when we give stumpage breaks to our industry, so there are trade issues involved here. Given this situation how tied are our hands in doing some kind of interesting forestry?

A: Our hands are probably a lot more tied than they used to be. Back about a year and half ago when I was out on a field trip with Dave Coates and others we looked at some of these understorey issues. Dave and Craig Delong said we have to do some research into that. So we did and that work continues. We got FERRIC involved in some partial- harvesting scenarios so we could get an idea of what the costs are in treating some of these stands differently. We are starting to get that information from FERRIC, and I hope I can bring that to the table with Bill Howard and the Director of Revenue Branch. So I don't know exactly how it will interface with the Softwood Lumber Agreement. I think as long as it didn't result in decreased costs, as long as there wasn't any subsidy to industry I think we'd be ok, but I might be a little naïve too. It's probably going to be a lot harder than that.

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Q: Given the changing state of the Interior forest, can you tell me what MoF, ILMB, any other agencies for that matter, are planning with respect to re-examining land use objectives in the light of a mid-term timber supply crunch?

A: The Forest Service is supporting ILMB in areas where there needs to be land use plans re-opened. ILMB has done an analysis on all land use plans to see what needs to be done in terms of opening up land use plans. Other folks like the Omineca Beetle Action Coalition and the Cariboo Chilcotin Beetle Action Coalition are also looking at their existing land use plans to see what changes should, could, or might be made. So there hasn't been a lot of action on that front yet. But I'll note it and see if I can get back to you with a better answer. So far there hasn't been any re-opening of land use plans that I'm aware of.

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Q: Due to the mountain pine beetle, timber supply has been going down for some districts. I'm wondering if you are looking into some redrawing of Timber Supply Area (TSA) boundaries?

A: There's no question when you have an insect like the mountain pine beetle affecting 80% of your mature pine, which in the province represents about 20% of our mature inventory in the timber harvesting land base (THL) there are going to be implications to timber supply. If your question is, have we looked at potentially modifying TSA boundaries as a result – we haven't started to do that yet but it is certainly not out of the question. What we are trying to do is extend the shelf life of this dead timber. One of the things we are trying to do is get other industries in place that can utilize that dead fiber. The milling industries are finding that in a lumber market that is about $260./1000 board feet the amount of decay, drying and checking really plays havoc on their lumber recovery and grade recovery. So what we are trying to do is see if there are other industries, like the pellet industry and oriented-strand-board (OSB), and, you'll see the province come out with a call for bio-energy. We'll see if we can get that dead pine being utilized by other non-lumber producing industries. So what we'd like to see is low grade fiber going to things like OSB and pellets and possibly electrical energy. And then when a stand is harvested that may have been dead a long time but still might have some solid saw logs – some of those logs could go to the lumber producers and the lower grade timber can go to another producer. We'll be looking at lots of ways to try to mitigate this fall-down on communities to reduce the economic impacts, including looking at TSA boundaries and movement of wood from non-impacted areas. There will be all kinds of strategies that emerge over time. But our first goal is to get as much of this timber utilized, so get the right log to the right processing facility at the right time.

EUGENE RUNTZ

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BIOGRAPHY:

Eugene Runtz graduated from Oregon State University with a Bachelor of Science in Forest Engineering. He is a professional forester who worked 10 years on the coast and 20 years in interior British Columbia in the layout of roads, blocks and logging systems. Until recently, he was president and CEO of McBride Forest Industries and is currently a partner with E.P. Runtz and Associates Ltd, in McBride.

Partial cutting of the visually sensitive landscapes in the Robson Valley near McBride, BC

This presentation is about my experience with development of 3,500 hectares of predominantly partial cutting in the Robson Valley east of McBride, British Columbia. Most of the valley is allocated to parks, particularly to the Mount Robson Provincial Park. The areas outside the parks were subjected to a logging moratorium until 2002, when the mountain pine beetle appeared on the scene. McBride Forest Industries was then directed by the Ministry of Forests to harvest in the valley with an emphasis placed on the removal of lodgepole pine. The beetle impacted only about five percent of any one stand at that time, but by 2006 most of the mature pine was dead. Many of the stands included significant representation of other species such as Douglas-fir, western hemlock, spruce and subalpine fir.

Partial cutting was the dominant harvesting system applied for the purpose of meeting Visual Quality Objectives (VQO's). The extent of tree removal was limited to ensure that full and partial retention standards were met.

There are many challenges that must be met to implement partial cuts in visible landscapes, not the least of which is to make them profitable from an industrial perspective. This meant many changes to forest practices. Advanced planning, supported by more intensive field sampling, was needed to really understand the options relating to the use of ground, cable and helicopter logging systems, and to the goal of protecting understorey regeneration. Road location and design specifications had to be carefully thought out. The choice of harvesting equipment and how, when and where it should be used were critical. Careful attention was paid to how these decisions interacted with the provincial stumpage appraisal system. Above all, there was a need to have good communication so that people understood what was going to happen and were in support of it, before operations began.

In summary, there were some lessons learned that I would like to share with you in this presentation.

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Carl vanderMark is a professional forester with 20 years of consulting and industry employment experience in ecosystems of northern British Columbia and Alberta. He has a BSc in forestry and a diploma in forestry (Advanced Silviculture) both from UBC. Carl is currently the operations superintendent for Canadian Forest Products Ltd, Houston Operation. His primary responsibility is to ensure the Houston Sawmill has an adequate supply of fibre consistent with the division's business plan and sustainable forest management objectives.

Carl assumed his current role last summer. In his previous position as planning superintendent, he was responsible for the operation's strategic and landscape level operational planning activities. Key accomplishments over the last several years include spearheading the division's push for sustainable forest management certification and participation in the development and implementation of a corporate-wide SFM and environment management system.

Carl is also an outgoing board member of the BV Research Centre.

Complex stand management: Canfor Houston perspective

Canfor's Houston operation operates primarily in mature, even-aged single-storied stands. Shortly after enactment of the Forest Practices Code, as part of pre-harvest planning activities, the operation began classifying stand structure in order to rationalize silviculture system prescriptions. The presenter provides an overview of the operations experience prescribing silviculture systems for complex stands, elaborates on a specific example as a case study, presents considerations in light of the Mountain Pine Beetle epidemic and finally outlines challenges moving forward, from an industry perspective.

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Steve Chatwin is the acting director of special projects for the Forest Practices Board. Previously, he was the manager of watershed research for BC Ministry of Forests. He has worked in Tanzania, New Zealand and the northern Yukon on soil and water projects and has his BSc from UBC and MSc from the University of Alberta.

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Lodgepole pine stand structure 25 years after mountain pine beetle attack and implications for streamflow

By Steve Chatwin and Bryce Bancroft

The current MPB attack, which began in 1995, is unprecedented in area. There have been previous large attacks, with the most recent ones being in 1979 in the Chilcotin and southern Quesnel Districts. While most of these stands were salvage harvested, there are remnant areas that were never harvested. These residual stands have developed unique structural and vegetative characteristics. Lodgepole pine regeneration under the forest canopy has led to a multi-age and multi-size stand structure. Stocking density on some of these sites exceeds the target stocking for lodgepole pine clearcuts. The mix of understorey and overstorey trees, the standing and downed coarse woody debris, and the vigorous understorey plants have created a diverse plant community with significant structure. Approximately half of the MPB attacked trees are still standing and are often still sound but checked. That suggests that the shelf life for fibre-based, non-lumber products in these dry, cold ecosystems may be 20 years or more. These drier sites also have relatively low levels of total downed wood and are not a significant fire hazard.

There was significant diameter growth increase (release) on most residual stems; however, the standing live volume was still significantly lower than volumes on comparable sites that were not attacked. Only 30 percent of the sites met the target of secondary structure sufficient to contribute to mid-term timber supply. It is unlikely that these sites will provide sufficient timber volumes in an 80-year rotation. Salvage harvesting and reforestation, or possibly underplanting is needed where timber supply is the goal and full site occupancy is the objective.

The hydrologic effects of beetle-killed stands were examined. The insect-killed trees have a residual canopy that can intercept a portion of snowfall. Also, the mortality is never 100 percent and individual trees continue to intercept and transpire water. The standing dead trees provide considerable shade, reducing radiation and snowmelt rates. In order to determine the scale of these hydrological changes, peak streamflow magnitude, timing and water yield was simulated using a computer model for Baker Creek watershed at Quesnel, British Columbia. The MPB grey-attack of the pine stands resulted in annual peak flow increases of 60 percent and annual water yield increases of 30 percent. Projected salvage harvesting of the dead pine results in a further 30 percent increase in peak flows. Flood frequency will also increase; a former 20-year peak flow discharge will now be expected every five years. These changes represent a major shift in stream flow regime.

Lodgepole pine stand structure 25 years after mountain pine beetle attack and implications for streamflow

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QUESTIONS & ANSWERS

Q: I had a point about volumes being lower. Is it that the stuff that survived got bigger than the other stuff filling in, or was it just because it was gappy?

A: Yes, it was the gappy nature of it and because we looked at 25 years after it had died. There had been that whole period where there was ground that was vacant, compared to if you had cut it and re-harvested with a short regeneration delay, so that was the difference. The actual growth of the trees that were there, they were doing well, and the new regeneration was doing well.

Q: Have you considered burning?

A: Burning is a big issue. When ever I bring that up I say "someone else can light the match". There is a lot of worry that something would get away, but I think from a regeneration point of view, yes, especially in areas where there are serotinous cones it would probably be a good idea to at least look into it. It's part of the natural phenomenon, so yes, I think there is a place for it. From a hydrological perspective, we did not consider the possibility of wildfire in the watershed and what a change that would have on the hydrograph.

Q: Are there any plans to model hydrological projections if salvage was a partial cut or some other different types of salvage options?

A: It could be done. You can use the model for looking at specified changes in the canopy cover, the amount of understorey and under story for example – you could do that, but we are not planning on that at present.

DR. DAVE COATES

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Dr. Dave Coates has a BSF (UBC), M.Sc. (Oregon State University) and Ph.D (UBC) in silviculture and forest ecology. He has lived in Smithers since 1979 and he has held the position of Research Silviculturist with the B.C. Forest Service since 1989. He is the leader of the Date Creek silvicultural systems experiment; an internationally recognized forest dynamics experiment that has integrated silviculture with forest ecology and provided silvicultural solutions for biodiversity problems. He is a lead developer of the complex stand dynamics simulator SORTIE-ND. He is currently using the SORTIE-ND model to explore silvicultural issues in stands damaged by the mountain pine beetle.

Silviculture and the management of complex stands

For most of the 20th century forest management objectives for private and public forest landowners were well defined and focused, especially in the northern hemisphere. Owners typically had a clear hierarchy of goals focused on a single dominant objective, most commonly timber or revenue production in a sustainable manner. Forest management is now going through significant changes in most parts of the northern hemisphere and elsewhere. Forest management is no longer the sole domain of foresters, forest owners, forest management agencies and the forest industry.

Foresters are being called upon to implement a wider variety of management systems. The primacy of timber as the dominant objective is giving way to broader objectives such as sustaining the function and dynamics of ecosystems, maintaining ecosystem diversity and resilience or protecting sensitive species, while providing for a variety of ecosystem services of value to humanity. This is especially noticeable on public lands in North America and central Europe, but the trend is not limited to public lands or to North America and Europe. Forest management globally is struggling with this paradigm shift and the discipline of silviculture is at a crossroads. Silviculture is struggling to deal with our new understanding of the importance of complexity in forested ecosystems and to develop practices that incorporate complexity.

There will continue to be much debate on how forests should be managed and on how silvicultural foresters should practice silviculture. One's perspective on the debate, what is important and what is not, and the various shades of grey in between, will be coloured by where you live, the type of forest you work in, the history of the area, and your individual background and training. Protection and production of more diverse forest values demands consideration of the fine-scale variability found within forest stands and an understanding of the spatial and temporal response of forest ecosystems to manipulation. Silviculture needs to focus on the spatio-temporal development of forests after disturbance, on maintaining critical processes in forests and on how tree populations and ecosystem processes interact to affect stand dynamics. I will suggest a new roadmap for silviculture that will allow foresters to better incorporate complexity into their management decisions.

Most forest management today, outside industrial short-rotation forestry, must deal with complexity of either species or structural composition in forests. Foresters should not ignore complexity; rather managing for complexity should be seen as a challenge to be met.

DR. DAVE COATES

RESEARCH SILVICULTURALIST, MINISTRY OF FORESTS

Silviculture and the management of complex stands

QUESTIONS & ANSWERS

Q: Human nature is to want to classify and to categorize, and simplify what is out there so that we can better understand it. So what you are asking us to do is to go against that natural tendency of organization of understanding what is out there.

A: Yes, Our understanding of what is out there has to change the way we look at things. If you accept a lot of the literature on complexity, then simplifying forests is dangerous. We have to come up with ways to understand how ecosystems respond to varying gradients of disturbance as opposed to how ecosystems respond to one treatment.

Q: You mentioned that when you were leaving retention behind, often times it was for habitat purposes, for birds or a particular critter. You mentioned that we should be looking at natural processes as well. Do you have any suggestions about how to go about doing that? So that if someone was laying out a block, what would they be looking for to lay out?

A: I think that what we are currently doing is a really good step in the right direction, i.e., that type of structure that we are leaving behind in our stands. It is more for researchers to figure out innovative ways to understand how structure left behind in space and time affects important processes that maintain healthy forests. So, I don't think you can ask operational foresters to do all that. Forestry researchers have to figure the important factors out in order to provide advise on how to manage the forest in order to meet those kinds of objectives.

Q: Isn't it ironic that you are promoting variability while renouncing intensive silviculture? Doesn't that reduce one of the options for management? So I was thinking that doing silviculture as intensively as possible where it is s possible, and doing these new approaches in other areas – wouldn't that be a more balanced approach given that humanity needs wood?

A: Yes I would agree we need a triad approach. New Zealand is a very good example. They have very intensive agriculture-type forestry in part of the land base and basically protected land base elsewhere. Those are all feasible options and I understand completely what you are getting at. My main point I don't want you to think that I think forestry would be less productive, given these measures, I think we could probably grow more trees for society by changing our practices and having potentially more healthy ecosystems. I mentioned a couple of times that a lot of this stuff around complexity – I'm not sure that I buy it all myself. But if you do buy it, these are some of the implications for silviculture. There is no doubt you should have a diversity of practices on the landscape – intensive to less intensive, A diversity of practices is a very good thing to have. Some mixture of intensive agricultural type forestry, short-rotation forestry, mixed in with other levels of management across the landscape would be a good thing. So I agree with you in that context.

DR. DAVE COATES

RESEARCH SILVICULTURALIST, MINISTRY OF FORESTS

Q: I'm curious how you resolve this change in philosophy against natural disturbance regime in the boreal forest where you may have fires as far as the eye can see. Often it is a stand replacing event with one or two species coming in afterward. So one would presume that that pattern evolved over time and therefore has some resilience. So how do you resolve this view that every place needs to be complex against this natural disturbance regime of the boreal forest?

A: Every place does not have to be complex, as I just said. I do think that we need to study the forest at the neighborhood scale, at the scale of individual trees. We need to understand the processes that control what happens to trees at that scale as opposed to a stand scale. We need to study it there. That does not mean that every neighborhood has to be complex. We need to understand what is happening at the appropriate scale. At the moment the scale of our management is at the stand scale using a plot average. I don't think that works for understanding and for being able to predict how forests respond to different types of disturbance. You have to study it at the appropriate scale – and the appropriate scale is not the stand scale using a plot average, in my opinion. So that's one issue. There is a huge difference between a fire coming back to a couple of species, and a clear cut planted to one or two species. There are vast differences, and I could go into those.

DR. CHARLES CANHAM

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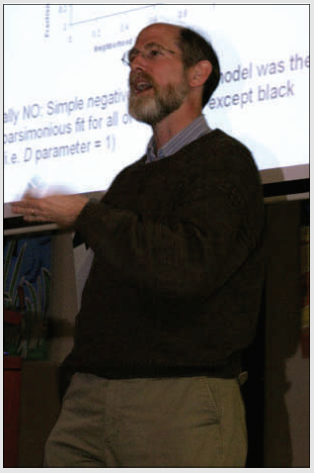
Dr. Charles Canham, Senior Scientist, Institute of Ecosystem Studies, Millbrook, New York, is a forest ecologist who specializes in likelihood methods and the analysis of spatial data. He has been an associate editor at Ecology and Canadian Journal of Forest Research and has an extensive list of publications in leading ecological journals. Charles has a BSc in botany from Montana States University, a MSc in botany from University of Wisconsin and in 1985 he received his PhD in ecology and evolutionary biology from Cornell University.



Ecological perspectives on complex stands

For the last 15 years I have worked with Steve Pacala and John Silandar in developing neighbourhood theory. In the study of trees, their interactions tend to be local, on a small scale and non-linear, such that you can't really describe how stands develop by taking averages across the whole system and projecting them through time. There are strong vertical interactions affecting light, nutrient availability and seed dispersal for example, and weak horizontal interactions affecting these same things. The question that we asked ourselves when we started was, can you build up an understanding of the whole system by understanding local neighbourhoods, local interactions? To help us begin to answer that question, we needed a model like SORTIE or its more recent successor SORTIE-ND, where the "ND" stands for neighbourhood dynamics.

SORTIE-ND provides a spatially-explicit neighbourhood analysis of tree growth, where actual growth is expressed as a function of maximum growth rate, minus effects due to competition, size and site. Alternative mathematical functions were derived and parameterized using maximum likelihood techniques, and the best relationships and parameters adopted for input into the model.

In developing SORTIE we asked some basic questions as discussed further in this presentation. For example, do different species competitors have distinctly different effects? How do neighbour size and distance affect the degree of crowding? Are there thresholds in the effects of competition?

There are a few (unproven) beliefs that I have adopted in the process of working on this topic, particularly if our ultimate goal is to develop meaningful and effective guidelines that can be used by foresters to make forest and stand management decisions. Firstly, there is need for extensive empirical, on-the-ground data, coupled with the application of ecological theory and principles in the form of models, to support reasonable predictions. Secondly, the world is changing, making long-term predictions a fleeting hope, but models at least give us tools to incorporate expected changes in the environment so as to better inform our predictions. Lastly, long-term monitoring such as that implemented by the USDA through the Forest Inventory and Analysis (FIA) plot program, while expensive, is critical to success in this endeavour.