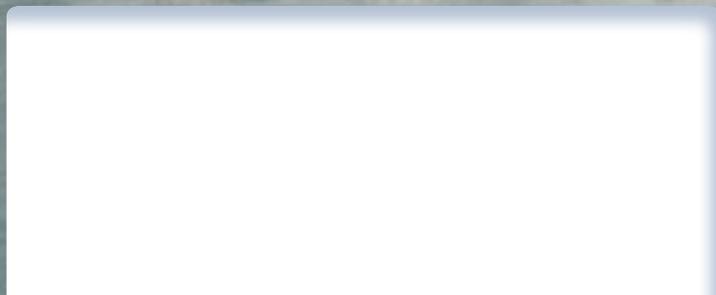




Time to Renew Your Membership



Your Practice Makes a Difference.

Be Sure to Renew Your Membership On Time.

There are three steps to renew membership for:

- Active RPFs or RFTs
- RPFs and RFTs on LOA who are employed and work in BC
- Associate Members
- Transferring Forest Professionals
- Limited Licensees

Step 1 Submit your 2014 Self-Assessment Declaration

Step 2 Notify the ABCFP if there has been a change in your indictable offence status.

Step 3 Pay your fees.

There are only two steps to renew membership for:

- FITs or TFTs
- Retired Members
- Special Permit Holders
- Registered Members on LOA (who are unemployed or work outside of BC)

Step 1 Notify the ABCFP if there has been a change in your indictable offence status.

Step 2 Pay your fees.

Your membership will not be renewed until you have completed all of the required steps.

How to Renew Your Membership

Renew online

The quickest and easiest way to renew your membership is to complete all the steps online. There is a link to the online Membership Renewal page right on the Home page of the website and in the renewal notice sent to you on October 20th.

Renew by mail, fax or in person

You can also renew your membership by mail, fax or in person by downloading the forms available on the Steps to Renew page of the website (click on Members' Area, My Membership and Steps To Renew).

Membership Renewal Timeline Self-Assessment Declaration FAQs

Membership Renewal Process	DATES
A membership renewal notice is sent to each member.	OCTOBER 20TH
Annual fees are due AND, where applicable, self-assessment declarations are due.	DECEMBER 1ST
Administrative fee of \$50 plus GST is added to the fees of members who have not paid their annual fee AND/OR, where applicable, have not submitted their self-assessment declarations. Notices will be sent to those members affected.	DECEMBER 2ND
Final deadline for membership renewal.	JANUARY 31ST
Any members who have not renewed will be struck from the register and notified accordingly soon after.	FEBRUARY 1ST

Top Practice Areas

This year the ABCFP is asking you to tell us your top three practice areas when you renew your membership in order to ensure that we have a representative cross section of the different aspects of professional forestry when we select members for practice reviews.

When is my self-assessment declaration due?

Your declaration is due on December 1, 2014. If you submit your declaration after December 1, 2014, additional charges will be applied to your membership renewal fee.

What happens if I don't submit my self-assessment declaration?

If you fail to either pay your membership fees or complete your declaration (if required) by December 1, 2014, you will be assessed an administrative fee. If you fail to pay your membership fee or complete your declaration by January 31, 2015, you will no longer be allowed to practise forestry in BC.

Can I submit my self-assessment declaration online?

Yes, you can do it online! There is a link to the online Membership Renewal page right on the Home page of the website.

BC

NOVEMBER – DECEMBER 2014

Forest

PROFESSIONAL

**How the CO₂
Fertilization Effect
Impacts BC's Forests**

Should we use BEC For
Climate Change Adaption?

**Results from the
ABCFP's Climate
Change Survey**

2015 ABCFP
Conference and AGM:
Program Details Revealed!



VIEWPOINT
Climate Change:
Greening the Future

STAY SHARP



BC Forest Safety Council
Unsafe is Unacceptable

Slips, trips and falls are the second most common workplace injury. Stay on your feet with proper footwear, being aware of where you step and carrying only what is needed.
It's easier to stay well than get well.

www.bcforestsafe.org

Forestry Through Your Eyes

We want to see forestry in BC through your lenses!

If you capture a great shot and want share it with your colleagues, send it to Doris Sun at: editor@abcfp.ca for a chance to get published.

BC Forest
PROFESSIONAL

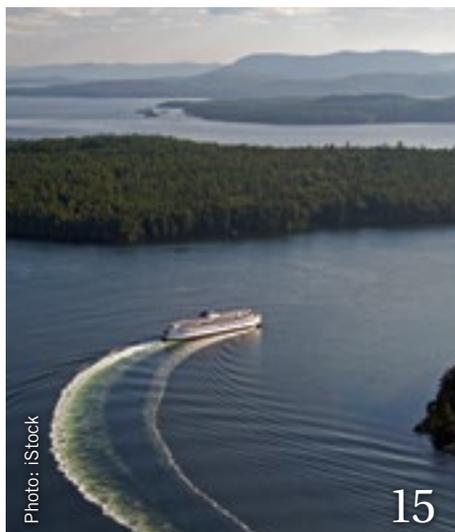
Index

November – December 2014

BC FOREST PROFESSIONAL | Volume 21 Issue 6

Viewpoints

- 11 Climate Change Debate Sizzles On
By DORIS SUN, MJ
- 12 How can BC's Forest Sector Help
Keep Climate Change in Check?
By WERNER KURZ, CAROLYN SMYTH
AND TONY LEMPRIERE
- 14 Informing Forest Management
Policy, Practice and Professionals
in BC: Results from the ABCFP
Survey on Barriers to Adaptation
By HARRY NELSON, PhD, KATHY HOPKINS,
RPF AND CASEY MACAULAY, RPF
- 19 BC's Managed Forests and
Those Bothersome Externalities:
Climate Change and Forest
Pathogens By ALEX WOODS, RPF, MSc
- 20 Leveraging BEC for Climate
Change Adaptation
By DEB MACKILLOP, RPF, WILL MACKENZIE,
RPBIO AND COLIN MAHONY, RPF
- 22 The CO₂ Fertilization Effect and
Considerations for BC Forestry
By BILL CHAPMAN, PhD
- 23 Are Our Forests' Genes
Behind the Times?
By SALLY AITKEN, PhD AND
JACK WOODS, RPF, MSc



Interest

- 24 Ecosystem-Based Management
in British Columbia: Teleology or
Science? By WILLIAM WAGNER, RPF

Conference Pullout

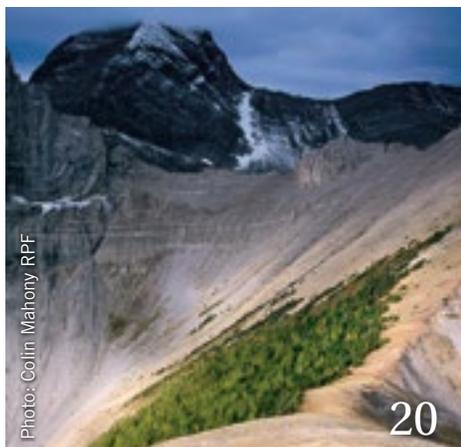
- 15 ABCFP's 67th Annual Conference
and Annual General Meeting

Departments

- 6 Letters
- 26 Ask Mike
- 27 Book Review
- 28 The Legal Perspective
- 29 Member News
- 31 A Moment in Forestry

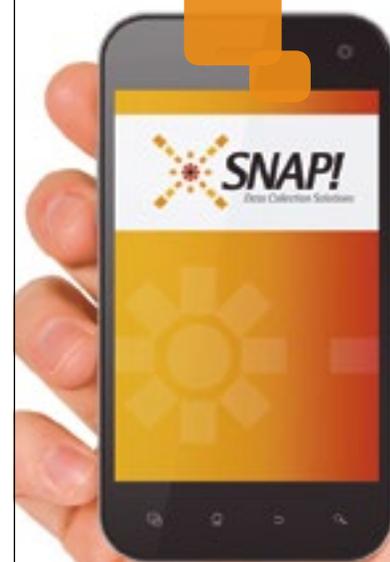
Association Business

- 8 President's Report
- 9 CEO's Report
- 10 Association News



"In the field it has saved us time and simplified field surveys. In the office it has saved us a significant amount of staff time"...

Ricardo Velasquez,
District Silvicultural Forester
Ontario Ministry of
Natural Resources



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ON BACK COVER



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Where is the Voice of Council?

First let me add my voice to the growing list of members applauding the high standard that **BC Forest Professional** has recently achieved both in presentation and content. I am particularly appreciative of the inclusion of contributions from non-forest professionals in the Viewpoints section — it is important to know how we, and our activities, relate to other resource users. As a retired forest professional I pay close attention to the letters, especially those from current members, to hear of their concerns and problems they face in their day-to-day responsibilities.

This brings me to Fred Marshall's letter, "Protecting Beautiful BC" (July-Aug 2014). His is not a lone voice deploring the disparity of the requirements for protecting Super Natural BC among the various agencies and ministries operating on the landscape. From the days of the *Forest Practices Code* forest professionals have been held to account for every natural resource that might be affected by our operations, and rightly so. For other industries such as oil and gas to be free from such account makes a mockery of a forest professional's efforts and clearly does not support provincial resource objectives.

On issues such as this (and, for example the overcutting in the Morice TSA) I think it is necessary for council to at least issue a public statement seeking clarification if not of correction of the situation. It might be politically embarrassing for the association to confront these inconsistencies but it would certainly advance our standing in the public's mind. It would also help answer the question so often asked by forest professionals: "What does the association really do?"

DAVID A. SMITH RPF (RET)

New Column Inspires Code of Ethics Reflections

I was reading the latest issue of the **BC Forest Professional** with great interest, as usual, when I came across a small item headed "New Regular Column," *Reflections on Ethical Requirements*. On reading the little article I was very impressed by the thoughts put forward. We have a responsibility to promote our profession and the practice of forestry.

This article prompted me to re-read our *Code of Ethics* and in particular, section 11.3.6. On re-reading our entire *Code of Ethics* it was easy to see how this section could be passed over or the significance simply missed. Giving further thought to this issue got me thinking that forestry is almost a forgotten industry. At this point I looked up our provincial exports for 2013 and found our total exports from BC to be \$33 billion worth of products, of which \$11 billion were forest products. A full one-third of our provincial annual exports are directly forestry related.

We are continually hearing about oil and gas, coal and minerals but virtually nothing about forest products. Trees are a renewable resource. Forests sequester carbon. Our professional approach to forest practices protects and even enhances fish and wildlife habitat. Protecting forest soils and biodiversity is part of the professional forestry package. In addition forestry supports a significant number of jobs and contributes in a big way to our provincial economy. Why are we the forgotten industry?

We as individuals and as an association have not complied with section 11.3.6 of our *Code of Ethics* as strongly as we should. We need to get out and tell our story. It is a good story. We practise a very high standard of forest management in this province and each and every one of us can take pride in the progress we have made and are making and we need to tell the people of BC about it. I am well aware that many of us are packing a lot of bruises from past struggles but we are past that.

Forestry in BC is a big, important industry and it can become bigger. We have a great story to tell and we need to get out and tell it in every way we can and to everyone we can. Forestry goes on forever and has benefits at every step. Let us stop being the forgotten industry and strive to become our best known industry — number one!

JACK CARRADICE, RFT (RET)

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Timber and Tourism Not Always in Sync

I am writing in response to the forestry and tourism articles in the May-June 2014 issue of **BC Forest Professional**. Highlighting these two intertwined industries, their significance to the BC economy and how they work together (or don't) is timely. There is no doubt that both the forestry and tourism sectors are important to BC economically and culturally. Equally important is the need for these two sectors to work together so that both can prosper, and continue to contribute to the province's GDP and jobs. Tourism is one of the leading contributors to the province's GDP. Nature-based tourism (or adventure tourism) alone generates \$1.5 billion and the majority of visitors are from out of country.

I would like to respond specifically to Ms. Leine's article (*Timber and Tourism: Success in Synergy*). Readers may get the impression from the article that forest practices are highly regulated and controlled, and that the forestry and tourism sectors have good working relationships where communication and coordination of activities are the norm. Sadly, as articulated in Mr. Kellar's article (*Wilderness Tourism: The Other Forest Industry*), these ideas do not bear out in reality and the experience of many tourism operators regarding forestry interactions is negative.

There are several issues and concerns raised by the tourism industry regarding the impact of forestry development on their operations including (but not limited to): quality of viewsapes, environmental practices, fisheries values, recreation features and trails, seasonal operations, changes in access, safety hazards, the rate of planned development, harvest and reforestation.

The view of many in the tourism industry is that the problems between the two sectors are rooted in the provincial regulatory framework. Since the inception of the *Forest Practices Code* there has been poor performance by government agencies towards developing legally binding objectives for non-timber values such as recreation features or visual quality. Furthermore, landscape-level planning has become largely out of date. The objectives that are incorporated into *Forest and Range Practices Act* (FRPA) are too weak, or tend to be vague. In addition, most non-timber values are subject to the policy reference "without unduly restricting the supply of timber."

The FRPA framework removes much of the government oversight of forestry plans and practices, and at the same time makes enforcement more difficult. The lack of information in forest stewardship plans makes it more difficult for Ministry staff to diligently approve these plans, and for the public and stakeholders to meaningfully comment on them. Yet this is the only approved plan under the FRPA regime. There is no incentive for a forest company to propose results and strategies, which can be effectively enforced. Rather, there is a risk of results and strategies being written in a manner where they are extremely difficult to enforce

in practice. This creates great difficulty for compliance and enforcement to build a case when the intent of the objective is not met. We are experiencing this with many objectives including visual quality objectives.

Requirements for forest licensees regarding notification and consultation with tourism tenure holders are rarely adhered to, and if licensees do consult with tourism tenure holders, they seem to be under no obligation to take their considerations and concerns into account in harvesting plans and activities. All too often tourism operators are not finding out about proposed harvesting until flagging tape is put up, or more disturbingly, until the harvesting activities are underway and the damage to their features (i.e. trails) is in progress, in many cases resulting in devastating impact to their business and operations. These findings have been supported in many Forest Practices Board reports. In fact the Board has criticized FRPA's required level of consultation because it fails to live up to the principles of "effective public consultation" and has further stated that in most cases, effective consultation will not be achieved if only the minimum requirements of FRPA are followed (Forest Practices Board, 2014).

It isn't all doom and gloom. There are many examples of good working relationships between forest licensees and tourism operators, and where practices are well managed and sustainable. Unfortunately these examples are despite the regulatory framework, not because of it and are far from becoming the norm across the province. The cross-sector association collaboration that Ms. Leine mentions in her article is no longer occurring.

Ms. Leine does make some great comments regarding the idea of our sectors promoting our forestry resource industry and its heritage as a tourism attribute. We would agree and our sector can do a much better job at this. However the reverse is equally true, the forestry industry can and should be taking a proactive, collaborative position with tourism operators — the coordination of forestry activities can, in many cases, result in mutual benefit and gain for all. When forestry operations are negatively impacting significant portions of adventure tourism tenures primarily due to a lack of consultation and coordination, something needs to change.

Founded in 1999, the Wilderness Tourism Association of BC is a non-profit society, which exists to ensure a sustainable future for BC's wilderness tourism or nature-based tourism industry through leadership, advocacy and stewardship. We are the voice of the roughly 2,000 nature tourism businesses, and 10 sector associations in BC, which are dependent on the natural resource base for their tourism product. We work to protect our SuperNatural brand.

**EVAN LOVELESS, EXECUTIVE DIRECTOR
WILDERNESS TOURISM ASSOCIATION OF BC**

Have a Compliment or Concern? Write us!

The **BC Forest Professional** letters section is intended primarily for feedback on recent articles and for brief statements about current association, professional or forestry issues. The editor reserves the right to edit and

condense letters and encourages readers to keep letters to 300 words. Anonymous letters are not accepted. Please refer to our website for guidelines to help make sure your submission gets published in **BC Forest Professional**. Send letters to:

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Communicating Climate Change

Climate change has emerged as one of the greatest environmental issues of our time. It has driven media coverage, caused scientific controversy and influenced government policy for the past 20 years. Whether or not one agrees that climate change is occurring outside the normal range of variability, or that human emissions of greenhouse gases are affecting the world's weather, climate science indicates that there is a real risk that forest professionals must take into account in their professional practices. The ABCFP has taken steps both to ensure that our members have access to the latest scientific information about forest management and climate change, and that we are recognized as leaders in applying climate change science to natural resource management.

I was in Salt Lake City for this year's joint CIF/SAF conference when I attended a session on communications skills for scientists and forest professionals. One of the speakers lamented that climate science and climate change are not being communicated in a way that deeply resonates with the general public. Studies have shown that the general public often has low science and math literacy, so when we present climate models and discuss scientific uncertainty, we often simply confuse rather than inform.

ABCFP members frequently have to communicate with people who do not have the same scientific background as we do. Here is my advice for forest professionals who wish to improve their level of communications with respect to climate change:

1. **Avoid name-calling.** Too often the response to people who question the theory of human-caused climate change is to accuse them of being "funded by the oil industry," of having a malevolent hidden agenda, or simply of being "deniers." They are told that they are not qualified to express an opinion unless they are climate scientists. I know of no other scientific or professional discipline (other than politics) where it is acceptable practice to simply shout down opposing voices and to attack the messenger. This tactic is unprofessional and brings to mind the persecution suffered by Galileo for promoting heliocentrism at a time when, after all, everyone knew the Earth was the centre of the universe. It probably has the effect of causing the public to give climate science less weight.
2. **Explain uncertainty.** All emerging science has a degree of uncertainty. We should acknowledge that climate models are not gospel and we should be realistic about their limitations. The assumptions behind the various climate models need

to be dragged out into the light of day and clearly explained so the public can reach an informed opinion. Not to do so discredits both sides of the issue. People love a good catastrophe narrative, but if the information is obviously one-sided, or conflicting information is not properly explained, it will cause thinking members of the public to tune out.

3. **Provide a realistic and complete risk assessment.** Climate change is an important issue and the consequences are potentially dire. However, we are being dishonest if we ignore the potential benefits of a warmer climate and focus our message entirely on the negative consequences. For example, there have been multiple cycles of ice ages over the past two million years. Human-induced warming may reduce the risk of the next cooling cycle. Similarly, a warming climate may expand arable areas and growing seasons in some areas while restricting them in others. Current projections anticipate that sustained global warming will cause significant disruption to human settlements and economies — as would another ice age. This is not to suggest for one minute that we simply give up and embrace climate change — quite the contrary. However, we do the public a disservice if we fail to anticipate, explore, explain and prepare to take advantage of any potential benefits.

The role of the forest professional in climate change is to ensure forests are managed in a way to mitigate its negative effects. We're not communicating well to the public if we fail to provide accurate information in a way that is readily understood. Members can access information on climate change in the Practice and Development section of the ABCFP website. 🍷



CEO's Report

By Sharon L. Glover, MBA

Curious About the Discipline Process?

We answer lots of questions from members each week but the most popular topic that causes curiosity is our discipline process. I thought I'd answer some of the most commonly asked questions here.

Who is involved?

The registrar (an ABCFP staff member) has a critical role in determining if the complaint meets the requirements of our Act, but most of the other work required is done by a team of very dedicated volunteers. Once the registrar determines that a complaint passes the tests set out in the *Foresters Act*, the person being complained about is contacted and asked for his/her side of the story.

At this stage, we advise most people to contact a lawyer and do the best job they can at explaining the issue from their perspective. While using the services of a lawyer isn't required, it is up to each member to determine if they want legal advice.

The complaint resolution committee (CRC) is made up of ABCFP volunteers who review the complaint and the response received from the member who is the subject of the complaint. The CRC then makes a recommendation to the registrar with respect to whether an investigation is required. It can also suggest that the parties use an Alternative Complaint Resolution process which may involve a professional skilled in conflict management to resolve the issue. If an investigation is recommended, an investigations committee (IC) is formed (from the standing investigations committee) to look at this specific complaint. If we have a case that requires particular expertise, an external investigator may be hired; however, the majority of the investigations are carried out by volunteers.

Once an investigation is complete, the IC writes a report with recommendations to the registrar in regards to whether or not there are grounds for issuances of a citation. Should the report find no grounds, and if the registrar agrees with this determination, then the case is closed and the parties are informed of the decision. If the report finds there are grounds then the member subject to the complaint is asked to respond to the findings of the report. The report and the response are then

reviewed by the CRC. The CRC then makes a recommendation to the registrar in regards to whether it believes a citation should be issued against a member for a discipline hearing.

When a hearing is required, the discipline committee convenes to conduct a hearing; decide on whether the member has contravened the *Foresters Act* or our bylaws; and decide on a penalty if necessary. Prior to the completion of a hearing, the member has the option of making a conditional admission of guilt. Any penalty arrived at through a conditional admission must be approved by a panel of the discipline committee.

Council's role in the discipline process is to ensure the process is the best it can be within the bounds of the *Foresters Act*.

Why does it take so long?

Each member who is complained against receives a package of information that contains all the evidence submitted in support of the complaint. We then have to give the member time to respond and/or to hire legal counsel. Lawyers sometimes request more information or time to respond. In addition, the complainants might request a deadline extension due to work or personal reasons.

If the CRC recommends that the complaint be investigated, the investigation committee must go to the area of the province where the complaint took place, interview all parties and sometime do a field tour. This process can take six to 12 months or more depending upon the complexity of the case and the availability of legal counsel.

Why don't we see more instances of major penalties being handed out?

As with all professional bodies, the ABCFP takes the idea of administrative fairness very seriously. We presume that members are innocent until it can be proven that they did breach the *Foresters Act* or ABCFP Bylaws.

There is a range of penalties available to the discipline panel. In addition to our policy of publication of the guilty member's name, the penalties can include: a fine; requiring the guilty member to take remedial courses; and/or stripping the guilty member of his/

her practice rights either temporarily or permanently. Removing someone's right to practise forestry is very serious and isn't a penalty that is applied lightly, it is weighed against the severity of what happened.

Why aren't there more complaints?

Complaints are expensive and time consuming — both to those who initiate a complaint and for those who are being complained against. We feel that a complaint should be reserved for serious and important matters and not for differences of opinion. We've created a number of programs to help diffuse practice differences. We'd prefer to give members the opportunity to improve their professional practice and learn from their mistakes early on instead of having to go through the complaint process.

The Practice Advisory Service allows members to ask questions and get advice about tricky practice situations. The service is open to receiving questions about your own practice or someone else's practice. There is also the Professional Accountability Process, a process designed to help resolve relatively minor issues between professionals. In addition, we offer Alternative Complaint Resolution that can be used by members in the discipline process or by those who want to try and avoid the discipline process.

Why don't we publish

the names of all members involved in a complaint?

It simply wouldn't be fair to publish the names of every member involved in a complaint as many complaints have no grounds or are considered frivolous. We protect the identities of members involved in complaints where we find no professional misconduct and publish the names of those who have breached our Act or bylaws.

Where can I find

more information on the discipline process?

Visit our website (under Regulating the Profession) for information on the discipline process including a video, flowchart and instructions on how to lodge a complaint. If you have further questions, please e-mail me (sglover@abcfp.ca) and I'll answer them in the next issue of **BC Forest Professional** magazine. 🍷

Reflections on Ethical Requirements

In 2013 the ABCFP conducted two surveys: the first measured members' awareness of climate change and the second identified existing barriers to climate change adaptation. Among the biggest barriers to making adaptation decisions that members face in their daily work was "lack of guidance, standards, or best practices" and "lack of strategic vision or policies."

That is directly tied to Bylaw 11.3.5 (To work to improve practices and policies affecting the stewardship of forest land). There are a number of ways to improve practice with respect to climate change adaptation: "Increased flexibility for decision makers to approve innovative practices; better regional climate change information; more educational materials; and practical guidance and examples."

Council Approves Fee Increase

Members will notice a small inflationary fee increase when they pay their annual membership dues for 2015. The fee increase matches the rate of inflation, which is running at 1.5% in BC.

Get Ready to Vote in the Council Election

We are currently seeking two RPFs and two RFTs to fill vacancies on the 2015 ABCFP council. The following members are standing for election:

- Gillian Affleck, RFT
- Hans Beursekens, RFT
- Morgan Kennah, RPF
- Makenzie Leine, RPF
- Lisa Perrault, RFT
- Chris Stagg, RPF
(for vice-president)
- Trevor Swan, RPF

Please note that if Chris Stagg, RPF, is elected or acclaimed to the vice-president position, we will only elect one RPF to council (together with two RFTs).

The election takes place from December 11, 2014 to January 12, 2015. You can find more information on each of the candidates and the election process on the Council Elections page of the website.

Your Community Can Be the 2015 Forest Capital of BC!

There is still time to submit your nomination for the 2015 Forest Capital of BC. The winning community of this prestigious designation will take part in a year-long celebration of forestry by hosting a number of forest-themed events. Every community in the province is eligible to be nominated and applications are being accepted until November 30th. Visit the Forest Capital of BC web page for details and to obtain a copy of the nomination package.



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Climate Change Debate Sizzles On

BC FOREST PROFESSIONAL HAS, THROUGHOUT THE YEARS, ATTEMPTED TO TACKLE MANY timely and sometimes controversial topics, but perhaps no subject incited more passionate feedback than climate change. A book review in our September/October 2013 issue, which looked at one scientist's skepticism about the validity of global warming, resulted in months' worth of reader letters intensely debating the provocative claims. Responses reverberated beyond the book, with some taking the position that the ABCFP was irresponsible for publishing a review that touted "junk science." Whatever the motivating factor that drove feedback, and no matter what side forest professionals found themselves on in the spectrum of the debate, one thing was clear — climate change is timely, relevant and top-of-mind for many in the sector.

The topical nature of climate change was confirmed by the ABCFP's Climate Change Task Force last year through two surveys, which generated over 1,000 member responses. This issue of the magazine addresses the results and also outlines how the association will tackle climate change adaptation priorities. This issue also delves into the latest climate change research, as one article examines the findings from a national study on seven forest management strategies and two wood-use strategies vis-à-vis their potential for climate change mitigation. Climate change in the context of Biogeoclimatic Ecosystem Classification (BEC) is also examined, as we seek to understand how BEC can be used to adapt professional practice in a changing climate. And, in a change of tone, one article looks at the CO₂ Fertilization Effect and its tendency to encourage the quicker regeneration of forests.

The slate of articles here, in short, examines macro issues and serves as a primer to a second future issue (currently scheduled for March/April 2015) that will dive into articles of operational and on-the-ground significance. We recognize that despite the unknowns that are currently inherent in climate change science, there is a desire among forest professionals to do something tangible so mitigative processes can start to be incorporated into site plans. With research and new evidence flowing out in real time, forest management adaptation strategies are a fluid practice, making it an exciting and game-changing time to be a forest practitioner. 🌲

The Principles of Stewardship¹ and Climate Change

There is so much being written or spoken about climate change today. It is easy to become either overwhelmed or disconnected when we cannot identify the practical implications for our practice. So how do we, as practitioners, grapple with such an unwieldy topic? Climate change is not only the main challenge facing forest professionals in the coming years, but it is also a significant opportunity for our members to engage the principles of stewardship on what is likely the defining forest management issue of our generation. In fact, the principles themselves present an opportunity for asking questions about how we can adapt our approach.

For example, what actions are necessary at the site and landscape level to ensure the long-term diversity and resilience required to maintain the ecological integrity of our forests? What information and understanding is necessary to assess potential impacts of climate change and assist with our understanding of how forests and practices can adapt?

Are the forest management goals and objectives reasonable and achievable, given the anticipated climatic changes? If not, what amendments are necessary to make them more realistic? Beyond this, what adaptive practices are required to implement treatments, monitor the outcomes and allow for adjustments in management strategies?

Forest professionals need to set the stage for future success by recognizing possible impediments and advocating for improved management practices. This may entail changes to current legislation or management assumptions that limit the current range of practices. For example, it seems more appropriate now to monitor and treat mid-rotation stands rather than to simply assume a free growing stand will continue on a defined path to maturity.

Consider these questions and formulate some of your own. After all, it is your experience, insight and ability to 'operationalize' science that the public trusts and relies upon.

¹ The main document can be seen at http://abcfp.ca/publications_forms/publications/committee_reports.asp



How Can BC's Forest Sector Help Keep Climate Change in Check?

FOUR PROFESSIONAL ASSOCIATIONS IN BC, INCLUDING THE ABCFP, recently issued a joint statement on climate change in which they commit to taking steps to enable and encourage their members to “incorporate the best available climate-science into professional decisions.” This is an unprecedented step which requires that members have access to, and make use of, the best available climate science. BC has established a goal to reduce future greenhouse gas (GHG) emissions by 80% in 2050 relative to 2007 levels. The question we pose is, “What can forest professionals do now to help reduce BC’s long-term GHG emissions?”

Climate change has affected many aspects of BC forests and the forest sector, with changes already apparent in terms of increased areas affected by fires and insect disturbances and shifts in vegetation zones. Not all impacts of environmental changes due to climate change are expected to be negative with evidence emerging that increasing CO₂ concentrations and temperatures can, for some species and in some regions of BC, have positive effects on forest growth rates. The anticipated wide range of positive and negative impacts on BC’s forests make it essential that such changes are quantified and considered when planning future forest management and when designing regionally-specific forest-related activities to help contribute to meeting emission reduction targets.

The forest sector can contribute to meeting these targets by reducing emissions from forests (sources) and enhancing carbon storage in forests and forest products (sinks). The sector can also contribute by substituting forest-derived products for more emissions-intensive products such as steel and concrete, and emissions-intensive fossil-fuels.

A recently-published national study (Smyth et al., 2014) examined seven forest management strategies and two wood-use strategies (Figure 1) to determine their potential for climate change mitigation — in other words, their potential for reducing GHG emissions in Canada’s forest sector. Results extracted from this study for BC show the importance of carbon storage in forest ecosystems and harvested wood products derived from BC timber, as well as the avoidance of emissions by reducing slashburning and using wood in place of other products or energy sources. The analyses demonstrate that while some strategies can make a large contribution to mitigation, others would increase emissions to the atmosphere for many decades to come. In the long-term, the cumulative effect from 2015 to 2050 of the various strategies ranged from an increase in BC’s emissions of 109 MtCO₂e to a decrease in emissions by 577 MtCO₂e relative to a business-as-usual scenario. A MtCO₂e is a million metric tons of carbon dioxide equivalent, meaning that the emissions of a GHG are expressed in terms of the emissions of CO₂ that would have the same global warming effect. To put these numbers in perspective, Canada’s annual emissions from all sectors excluding land use, land use change and forestry were 699 MtCO₂e in 2012, which included 60 MtCO₂e in BC. The best combined forest management and wood-use strategies examined reduced emissions by 26 MtCO₂e annually from 2040 to 2050. For comparison, this amount is roughly equivalent to 40% of BC’s emissions in 2007. Thus our quantita-

Figure 1 Schematic describing the seven forest management strategies and two wood-use strategies. Forest simulations (pictured top right) include the dynamics of forest growth and decay, as well as impacts from wildfires and harvesting activities. Strategies to reduce GHG emissions (on the right, top to bottom) include faster growth or regrowth of forests, using harvest residues for bioenergy production and reducing harvest waste, harvesting additional wood for bioenergy production, or harvesting less wood, all relative to a base case. The two wood-use strategies shifted the wood products to either longer-lived products or bioenergy feedstock. Revised from Smyth et al., 2014.

tive analysis suggests mitigation activities can yield a meaningful long-term reduction in GHG emissions in the province, though achieving this reduction requires that implementation of such activities start now.

The design of climate-effective strategies in BC’s forest sector requires an understanding of the impacts of proposed actions on carbon storage and GHG emissions, as well as an understanding of the costs, barriers and policy options. With this in mind, the Pacific Institute for Climate Solutions (PICS) (<http://pics.uvic.ca>) recently launched a five-year research project to address the potential contributions of the BC forest sector to climate change mitigation. The project is a collaboration among climate, forestry, and socio-economic policy experts from academia, government, industry and First Nations. The project will test how various approaches to harvesting, silviculture, site preparation and stand re-establishment activities can alter GHG emissions. Maximizing forest sector contributions in reducing the effects of climate change also requires an effort to increase carbon storage in long-lived wood products. Forest managers can ensure the sustainable management of the natural resource, but to achieve forest sector mitigation objectives they will also need to work with architects, designers and the building industry to use wood in place of other emissions-intensive building products. Results from the PICS research and other investigations we and others are undertaking will inform forest professionals on what forest management activities will help keep climate change in check.

Werner Kurz is a senior research scientist with the Canadian Forest Service (Pacific Forestry Centre, Victoria, BC). With over 25 years of international expertise in forest carbon dynamics, Werner is the lead scientist in charge of Canada’s National Forest Carbon Monitoring, Accounting and Reporting System. Contact him at: werner.kurz@nrcan.gc.ca

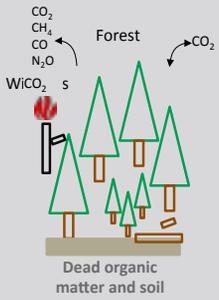
Carolyn Smyth is a research scientist with the Canadian Forest Service (Pacific Forestry Centre, Victoria, BC). Specializing in modelling of forest carbon, Carolyn has analyzed forest management mitigation strategies for Canada’s forests. Contact her at: carolyn.smyth@nrcan.gc.ca

Tony Lemprière is a senior climate change policy analyst with the Canadian Forest Service (Vancouver, BC). He has worked on issues related to forests and climate change since 1997, including extensive involvement in the international climate change negotiations and analysis of the economic cost of mitigation strategies. Contact him at: tony.lempriere@nrcan.gc.ca

References

- BC Ministry of Environment 2014. Making Progress on B.C.’s Climate Action Plan, 2012. <http://www.env.gov.bc.ca/cas/pdfs/2012-Progress-to-Targets.pdf>
- Smyth, C., G. Stinson, E. Neilson, T. Lemprière, M. Hafer, G. Rampley, W. Kurz. Quantifying the biophysical climate change mitigation potential of Canada’s forest sector, 2014 Biogeosciences, 11, 3515-3529. <http://www.biogeosciences.net/11/3515/2014/bg-11-3515-2014.pdf>

Seven FM Strategies



- 1 Better Growth
- 2 Planting



- 3 Better Utilization



- 4 Clear cut harvest
- 5 Commercial thinning
- 6 Pre-commercial thinning



- 7 Harvest Less



Two HWP Strategies

- 1 Longer-lived products



- 2 Bioenergy Harvest

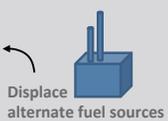


Photo: D. Erhardt



For University of British Columbia's Forest Sciences Centre, a strong emphasis was placed on innovative sustainable building strategies in which the use of wood played a dominant role.



Informing Forest Management Policy, Practice and Professionals in BC: Results from the ABCFP Survey on Barriers to Adaptation

FOREST PROFESSIONALS PLAY A KEY ROLE IN THE MANAGEMENT OF

forests in British Columbia and a changing climate with increasingly variable weather patterns adds a new dimension to their practise. Not only are professionals observing firsthand what's happening in those forests but they're also at the forefront of planning and implementing forestry activities, designing strategies and plans to achieve forest management goals, and tackling on-the-ground issues.

To support members in their professional practice, in 2013 the ABCFP through its Climate Change Task Force (CCTF), conducted two climate change-related surveys. The first survey (March 2013) looked at members' awareness, understanding and attitudes towards climate change, along with efforts to adapt. The second survey (October 2013) investigated the barriers to adaptation facing members and ways to overcome these barriers. The CCTF felt that the surveys were critical to understanding where we are in terms of adapting forest management to climate change and what members see as opportunities and barriers limiting action. The second survey is unique in that the results provide critical perspectives on what's necessary to advance both policy and practices.

The October survey, which consisted of both closed and open-ended questions, generated 1,159 responses. The diversity of the responses was similar to the diversity of membership both geographic and by employer type, and also reflected the differences in types of practice. The results showed that most respondents (59%) were somewhat or very concerned about climate change. 12% were not at all concerned. A strong majority (84%) of respondents support climate change adaptation efforts, while 16% did not. Most (87%) also have some knowledge about which forest management practices are appropriate or suitable for adapting to climate change.

This survey focused on three areas that can create barriers to adaptation: namely costs, policy and practice elements.

Practices Barriers

About two-thirds of respondents indicated that a lack of knowledge around specific practices and procedures limit their progress toward developing adaptation strategies. A similar majority also cited inadequate inventory and monitoring information, and/or contradictory or unclear scientific information as impediments to adaptation. Respondents recommended more monitoring in order to assess both climate change impacts and the effectiveness of efforts to mitigate risks and impacts.

Cost Barriers

In addition to looking at practices barriers, members were asked to weigh in on both policy and cost barriers. The top-ranked cost issues included:

- A lack of incentives for increased investment in adaptation strategies (67% say this is very or somewhat limiting);
- The cost of balancing multiple priorities (62% say this is very or somewhat limiting); and,
- Training funds either not available or not justified (58% say this is very or somewhat limiting).

Policy Barriers

In their assessment of policy barriers, a majority (62%) of respondents saw stocking standards and over-reliance on historic models as very or somewhat limiting. These two barriers outranked other policy barriers by almost 10%.

Overcoming Barriers

While the barriers pose challenges, many members have also found ways to introduce adaptation into their work. Although almost half of those who answered this question (368 of 800 members) reported taking no action, the other 432 respondents reported undertaking action and in some cases, multiple actions. These included different planting strategies and stand-level treatments as the two most commonly cited actions (30% and 20% of respondents, respectively).

Members suggested many ways to overcome the obstacles, including revision of policies (such as stocking standards), establishing incentives for adaptation and increasing flexibility and support for decision-makers to approve innovative practices. Consistently, members want more adaptation information available to practitioners (such as through research trials), particularly information that is tailored to the local context. The appendix to the full report contains members' suggestions for overcoming the top-ranked barriers.

Informing Adaptation

The October 2013 survey on barriers to adaptation identified and ranked key barriers to adaptation, and shed light on ways to overcome these barriers. It provides an excellent vantage point for the profession and professionals to move forward on adapting forest management to succeed in a changing climate. The results from the survey lend weight to initiatives underway to remove barriers and pave the way for adaptation. For example, the province is

BARRIERS TO ADAPTION continued on Page 25

¹ http://www.abcfp.ca/publications_forms/publications/documents/ABCFP_Climate_Change_Survey_2013.pdf

² http://abcfp.ca/about_us/documents/ABCFP_Climate_Change_Survey_Report_Fall_2013.pdf

³ 811 members completed the entire survey

⁴ http://www.abcfp.ca/about_us/documents/ABCFP_Climate_Change_Survey_Report_Fall_2013.pdf

⁵ <http://www.for.gov.bc.ca/HFP/silstrat/other%20docs/Timber%20Goals%20and%20Objectives%20May%2026%202014.pdf>

⁶ <http://www.for.gov.bc.ca/het/climate/knowledge/policy.htm>



**Today's Choices
Tomorrow's Forests** 2015

**Join us for the ABCFP's 67th
Annual Conference and AGM in Nanaimo**

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FEBRUARY 18, 19 & 20

The ABCFP's 67th annual conference and AGM, **Today's Choices, Tomorrow's Forests**, will examine how the decisions we make and the paths we choose today will impact future forest resources. Forestry, by its very nature, is a long-term business. This means the results of our decisions now will be felt years and even decades into the future. How can we effectively manage our forests so future generations can continue to reap their economic, aesthetic, recreational and environmental benefits? What decisions should be made to ensure the security of this valuable resource? Our lineup of sessions will look critically at a range of topics – from ecosystem-based management, reforestation, log exports, climate change, etc. – that will attempt to answer those questions. Whether it's exploring specific case studies, examining issues by geographical significance or tackling topics that every forest professional will face in his/her career, this conference will offer a practical look at how you can make a positive imprint in the long-term health of BC's forests.

MORNING EVENTS Optional. See conference website for details

8:00AM - 3:00PM **PRE-CONFERENCE TECHNICAL SESSION**

Choose one of the following sessions:

Private Forest Land Management Tour

OR

Leadership Workshop

AFTERNOON EVENT: CONFERENCE KICK-OFF

3:00PM - 4:30PM

PLENARY

Managing Today

to Meet Our Vision for Tomorrow

Bill Bourgeois, RPF, New Direction Resource Management

Dave Peterson, Provincial Chief Forester

James Gorman, Council of Forest Industries

Bill Dumont, RPF, Forest Practices Board (Moderator)

EVENING EVENT

7PM - 11PM

Icebreaker

Meet new colleagues or catch up with old friends. Get up-to-speed on the latest forest products, technologies and services by perusing the informative trade show booths. Mingle with Olympian gold medal skeleton racer, Jon Montgomery. It is sure to be an unforgettable night.



THURSDAY

February 19, 2015

FRIDAY

February 20, 2015

MORNING EVENTS

BREAKFAST

PLENARY

8:00 - 9:00AM

Opening Welcome

Opening Keynote

Jon Montgomery - 2010 Olympic Gold Medalist Skeleton Champion

PLENARY

9:15AM - 10:15AM

BREAKOUT OPTIONS

OPTION A

A Review of the EBM Agreement for the North and South Central Coast

Jonathan Armstrong, RPF, Coast Forest Conservation Initiative

Jody Holmes, Coast Forest Conservation Initiative

Domenico Iannidinaro, RPF, Timberwest (Moderator)

OR

OPTION B

The Kootenay Land Use Plan: Building a Better Mouse Trap

Jim Hackett, RPF, Interior Lumber Manufacturer's Association

Garth Wiggill, PTECH, District Manager, Nelson

Jim Girvan, RPF, MBA, MDT Management Decision and Technology Ltd.

(Moderator)

10:15AM - 11:00AM

COFFEE BREAK

11:00AM - 12:00PM

BREAKOUT OPTIONS

OPTION A

Reforestation: What Decisions Should be Made Today to Secure Forests for the Future?

Cam Brown, RPF, Forsite

John Betts, Western Silvicultural Contractors Association

Craig Wickland, RPF, Ministry of Forests, Lands and Natural Resource Operations

(Moderator)

OR

OPTION B

Log Exports, Balancing Economic and Domestic Interests

Terry Basso, RPF, Probyn Log Ltd.

Clint Parcher, Coastland Wood Industries Ltd.

Don Banasky, Truck Loggers Association (Moderator)

AFTERNOON EVENTS

12:15 - 1:45PM

INDUCTEES' RECOGNITION LUNCHEON

1:45 - 2:30PM

67th ABCFP Annual General Meeting

PLENARY

2:30 - 3:30PM

Council Hot Seat

PLENARY

3:30 - 4:00PM

COFFEE BREAK

4:00PM - 5:00PM

BREAKOUT OPTIONS

OPTION A

Playing with Fire. Should Fire be a Key Forest Management Tool and are we Ready for the Consequences?

Stayed tuned for the speaker lineup!

OR

OPTION B

Invasive Species. What's on the Horizon and How are we Preparing?

Jennifer Burleigh, RPF, Ministry of Forests, Lands and Natural Resource Operations

Brian Zak, RPF, Canada Wood Group

EVENING EVENTS

5:30PM - 6:30PM

PRESIDENT'S AWARDS RECEPTION

6:30PM - 11:00PM

PRESIDENT'S AWARDS BANQUET

MORNING EVENTS

BREAKFAST

8:15 - 9:15AM

Keynote Address: The Williams Decision

Garry Mancell and Jeff Waatainen

PLENARY

9:30 - 11:00AM

Just Who is Relying on Whom?

Is the Professional Reliance Model Working?

Mike Larock, RPF, Association of BC Forest Professionals

Bruce Blackwell, RPF, B.A. Blackwell & Associates Ltd.

Tim Ryan, RPF, Forest Practices Board (Moderator)

11:00 - 11:30AM

COFFEE BREAK

11:30AM - 12:30PM

RESOLUTIONS SESSION

AFTERNOON EVENT

12:45PM - 2:00PM

MINISTER'S LUNCH AND CLOSING REMARKS

*Keep an eye
on our website,
[www.abcfp.ca/
conference.asp](http://www.abcfp.ca/conference.asp)
for the most
up-to-date
information.*



Session summaries will
be available in November

REGISTRATION FORM



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Forestry Conference
and AGM

February
18 - 20

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ABCFP
Ph: 604.639.9186
E-mail: mmentore@abcfp.ca

Please Note

- Discounted early-bird registration is available inductees (Full Conference packages and Thursday One-Day package) and START Subscribers (all registration packages).
- You are not registered until payment is received.
- Receipts will be sent to you via e-mail.
- A \$50 administration fee will apply to all refunds. Alternate delegates may be sent without penalty if you are unable to attend. Please advise us of any substitutions by February 5, 2015 to allow time for new name tags to be generated.
- Refunds will not be granted after January 22, 2015.

Registration Packages

		FEE <i>By Jan 15</i>	FEE <i>After Jan 15</i>	PAYMENT
1 Full Conference Package (Wednesday afternoon session and Icebreaker, all sessions & meals on Thurs and Fri)	Regular	\$395.00	\$495.00	\$
	START Subscriber	\$197.50	\$247.50	\$
	Inductee	\$365.00	\$465.00	\$
2 Wednesday One-Day Package (Afternoon session, Ice Breaker & meals on Wed)	Regular	\$75.00	\$100.00	\$
	START Subscriber	\$ 37.50	\$ 50.00	\$
3 Thursday One-Day Package (All sessions & meals on Thurs)	Regular	\$285.00	\$355.00	\$
	START Subscriber	\$142.50	\$177.50	\$
	Inductee	\$255.00	\$325.00	\$
4 Friday One-Day Package (All sessions & meals on Fri)	Regular	\$170.00	\$205.00	\$
	START Subscriber	\$ 85.00	\$102.50	\$

Pre-Conference Technical Sessions — *Separate registration is required*

Check our conference website for updated times and pricing

Extra Meals

These meals are in addition to those included in the registration packages.

		# OF TICKETS	FEE	PAYMENT	
Icebreaker	Wednesday		\$40.00	\$	
Breakfast	Thursday		\$20.00	\$	
Inductees' Recognition Luncheon	Thursday		\$30.00	\$	
President's Awards Banquet & Reception	Thursday		\$60.00	\$	
Breakfast	Friday		\$20.00	\$	
Minister's Lunch	Friday		\$30.00	\$	
			ABCFP GST Registration # 130786692	Add 5% GST	\$
				TOTAL PAYMENT DUE	\$

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BC's Managed Forests and Those Bothersome Externalities:

Climate Change and Forest Pathogens



Photo: Alex Woods, RPF, MSc

CLIMATE CHANGE CHALLENGES VIRTUALLY EVERY TRADITIONAL BELIEF about how forests function, including the role that pests and pathogens play. Much of our understanding of forest dynamics for managed forests in BC has been adapted from European experience over the past 200+ years. From a pathological point of view there are at least two important differences between managed stands in BC today and the managed forests that were studied to develop those traditional theories. First, the past two centuries were a period of relative climatic stability. So to the extent that climate influences managed forests, that base understanding of managed forest dynamics is challenged. Determining how an unstable climate influences basic forest dynamics is a new and complex field of study. Predictability and stability are luxuries of the past. Second, a number of the most damaging forest pathogens in managed stands in BC including comandra and stalactiform blister rust are not found in European forests. When we combine these factors with a systemic assumption throughout traditional forest management that biotic and abiotic disturbance agents are a bothersome externality that account for little, we can arrive at a gulf between managed stand expectations and operational realities. If

recent environmental changes, such as increasing overnight minimum temperatures in late summer, favour certain pathogens over their hosts, the gulf widens. In many managed lodgepole pine (*Pinus contorta*) stands in the BC Interior we may already be looking at that widening gap.

Those bothersome externalities are increasingly difficult to ignore. Evidence of increasing incidence and severity of *Dothistroma* needle blight is building across the northern hemisphere. The same climatic trends of increasing summer precipitation and increasing overnight minimum temperatures linked to the *Dothistroma* needle blight epidemic in northwest BC appear to be at least in part responsible. Evidence of increases in hard pine rusts incidence in the central Interior of BC, both at the stand and landscape level, suggests these diseases are influenced by similar climatic trends. A comandra blister rust resistance trial established in 2004 suffered infection rates of between 70% and close to 80% in two of the three trial installations over an eight-year period. Highly detailed assessments of these sites have shown three consecutive years of high infection in 2004,



Leveraging BEC for Climate Change Adaptation

CLIMATE CHANGE INCREASES ENVIRONMENTAL STRESSES ON FORESTS, making them more susceptible to disease, insects and fire (Woods et al. 2010). Industry, government and the people of BC may increasingly look to forest professionals for solutions as these stresses impact timber supply, ecosystem services and public safety — but may also hold them accountable for management failures. The Biogeoclimatic Ecosystem Classification (BEC) was adopted by the BC Ministry of Forests 40 years ago to address reforestation failures and has since been a cornerstone of professional forestry practice in B.C. In this article, we provide our perspective on how BEC can continue to underpin forest and resource management and how forest professionals can use BEC to adapt their current professional practice in an era of changing climate.

What Does Climate Change Mean for BEC?

Forest professionals need to understand “what will grow where and how well” to properly manage the diversity of forest types and their ecosystem services within BC. With climate change, this question becomes more challenging. BEC provides a framework that integrates the essential ecosystem components required for this understanding and provides a common language that allows management knowledge gained at one location to be applied appropriately to others. These attributes will become more important with climate change. BEC has two primary spatial scales of focus: regional climate, where mapped subzone-variants delineate climate types with similar biological effect (bioclimate envelopes); and the stand scale, where the site series describes site potential types within a bioclimate envelope. The site series is a reflection of enduring site features, such as coarse or shallow soils, warm aspects and moisture shedding or receiving sites. The plant community described for any given site series is a reflection of both the bioclimate envelope, expressed by the subzone-variant, and the site and soil conditions, as described by the site series.

Recent analysis by Wang et al. (2012) suggests that the climates characteristic of existing biogeoclimatic units could change considerably in the coming decades. Although climate-vegetation patterns are driven by complex variables, such as fall rains, spring frosts, summer heat, or winter snowpack, using the ‘language of BEC’ to reflect potential future climates gives practitioners a much clearer sense of what the future may hold. Because BEC incorporates climate (subzone-variants) and sites (site series) into the same system, climate change projections can be down-scaled to the stand level. As climatic shifts occur, enduring site features will remain stable: a subxeric site in a current Biogeoclimatic Ecosystem Classification (BEC) climate will still be a subxeric site in a future climate. However, the plant community on that subxeric site will also shift, for example, from a community indicating subxeric Interior Cedar - Hemlock (ICH) conditions to one reflecting subxeric Interior Douglas-fir (IDF) conditions. Based on our understanding of the ICH and IDF, this could mean a shift in suitable tree species from, for example, western hemlock to ponderosa pine.

The fundamental relationship between site and climate within the BEC system is a key strength for adapting to climate change — forest

professionals can use BEC to determine management activities that are appropriate for both today’s climate and for potential future climates. For example, when selecting species to regenerate on a newly harvested site, it doesn’t matter that a climate change projection may suggest that western larch will be an ideal species in an area by 2080 if it isn’t suitable to regenerate on a site today. Climate change projections are also linked to broad scales and do not account for site-level variability. For example, forest professionals already use BEC to understand that hybrid spruce is only suitable on moist to wet sites in most of the IDF; this type of information can help to inform where on the landscape species may be able to persist in a changing environment.

How Can We Use BEC for Climate Change Adaptation?

Despite the trends indicated by global climate models, the details of climate change and its impacts are highly uncertain. Management regimes and the classification will need to take a risk management approach to account for many possible future climates. Forest professionals will be challenged to incorporate the variability, likelihood and consequences of projected changes to climate into their decisions. As uncertainty increases, more diverse responses will be required for management activities ranging from species selection, to silviculture systems, stand and landscape-level retention and disturbance management. For better or worse, a non-stationary climate means that ‘cookbook forestry’ will become even less viable. Government will continue to provide legislation and guidance, including data on past and projected climate trends for BEC units. However, practitioners will likely need to draw from their personal and shared experiences to interpret what this information means for management of their local ecosystems. In a context that requires continual feedbacks amongst practitioners, BEC ecologists and climate analysts, BEC’s role as a common language will be more important than ever.

Changes to BEC and the way we use it are already underway. The following are just a few of many current initiatives to leverage BEC for climate change adaptation:

- Climate change is a central consideration in recent revisions to the BEC guidebooks and subzone-variant mapping. For example, the new subzone-variant boundaries for the southern interior emphasize major topographic features since these are enduring climate drivers.
- Provincial BEC ecologists are using newly available US Forest Service ecosystem plot data to produce a draft subzone-variant classification and map for the Northwestern USA. These new BEC units will be useful for cross-border knowledge transfer about species selection, seed sources, site hazards and other management considerations.
- Climate change-related stocking standards were recently released (FLNRO 2014). This initiative is a good example of how ecological expertise and climate projections can be integrated within the BEC system into guidance for practitioners.



Photo: Colin Mahony RPF

Vegetation responses to climate change, such as the upward migration of the treeline, will be strongly mediated by enduring features of both site and climate.

BEC embodies an evolving, ground-level understanding of the relationship between climate and ecosystem function. This shared knowledge base puts forest professionals in a unique position to comprehend and respond to the impacts of climate change in BC's forests. 🍀

Deb MacKillop, RPF (Nelson), is the research ecologist for the Kootenay/ Boundary Region.

Will Mackenzie, RPBio (Smithers), is the Ministry of Forest, Lands and Natural Resource Operations' provincial BEC ecologist.

Colin Mahony, RPF (Bowen Island), is completing a PhD at the UBC Faculty of Forestry.

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The CO₂ Fertilization Effect and Considerations for BC Forestry

THE PRIMARY BUSINESS OF PLANT LIFE IS FIXING ATMOSPHERIC CARBON dioxide into the organic molecules which are the building blocks of all life. CO₂ is unique among plant nutrients in that it is the only one that comes directly from the atmosphere. Rising atmospheric CO₂ levels are of particular importance to plant productivity including that of trees. CO₂ levels have fluctuated considerably over the period in which there has been plant life on Earth and there is general agreement that CO₂ levels have been considerably higher at times in the past (Pagani, 2005). It is intuitive that lower CO₂ would be less favourable for plant growth and higher levels would favour it and, for example, one study found that the growth of modern C3 plants (Plants use either C3 or C4 cycles to fix carbon, the C4 cycle is more efficient and probably an adaptation to low CO₂ environments so C4 plants do not respond as much to rising CO₂ levels as C3 plants. Most trees are C3) is reduced by 50% at glacial (180–220 ppm CO₂) versus modern CO₂ concentrations (350–380 ppm) (Sage and Coleman, 2001). The ability of plants to grow faster with higher atmospheric CO₂, all other factors being equal, is called the CO₂ Fertilization Effect and as Allen (1997) points out, “The consensus of many studies of the effects of elevated CO₂ on plants is that the CO₂ Fertilization Effect is real.”

Keeping in mind Liebig's law of the minimum, higher CO₂ cannot increase growth if some other resource limits the ability of trees to grow. For example, if nitrogen is not sufficiently available, then trees may not be able to take advantage of higher CO₂ levels. Trying to predict growth effects with the change in supply of one nutrient quickly becomes an intractable problem. Fortunately many empirical studies looking at the effects of rising CO₂ have been conducted over the last few decades. Saxe gave a fair summary in a review conducted in 1998 in which he concluded, “The recent data on long-term effects of elevated atmospheric CO₂ on trees indicate a potential for a persistent enhancement of tree growth for several years, although the only relevant long-term datasets currently available are for juvenile trees. The current literature indicates a significantly larger average long-term biomass increment under elevated CO₂ for conifers (130%) than for deciduous trees (49%) in studies not involving stress components.”

Some studies have suggested that CO₂ growth effects level off after juvenile years, but very recent studies suggest that long-term persistent effects are also possible. McMahon (2010) looked at 55 temperate forest plots with stand ages from five to 250 years and found that in 90% of the cases (excluding losses through death) the current growth rates “greatly” exceed those predicted by historical records and the increase in biomass production was 4.15 megagrams per hectare. The sites he studied represent a broad range of temperate forest characteristics in the Eastern US. In another approach, Graven et al. (2013) looked at seasonal exchange of CO₂ north of 45° north latitude and found that there have been dramatic

increases of 32 to 59% in CO₂ exchange in northern forests. The changes are likely indicative of increases in summer uptake of carbon.

In enriched CO₂ environments trees can meet their carbon uptake requirements with less area of open stomata or with shorter open times and a predicted side effect of this is that there should be an increase in water use efficiency with CO₂ enrichment. Improvements in water use efficiency would be important wherever water is limiting to growth and a few recent studies conclude that the predicted increases in water use efficiency with higher CO₂ are occurring. Donahue et al. (2013) used satellite imagery to show that the deserts of the world are greening and they attributed this largely to the effect of CO₂ on improved water use efficiency. They conclude that CO₂ fertilization is “now a significant land surface process.” In 2013, Keenan et al. found a substantial increase in water use efficiency in temperate and boreal forests that was greater than predicted.

With such a complex subject it is impossible to fairly cover the topic in a small space. There are some points which are clear and which further reading or investigations are unlikely to change. The CO₂ Fertilization Effect is real and it does increase tree growth where growth is not limited by some other factor. Higher CO₂ levels do improve water use efficiency and this can have profound effects on growth in drier environments. There are still questions about the magnitude and duration of the effects but we are at a point in our understanding of this issue where these factors need to be taken into consideration in determining the current productive capacity of British Columbia forests. The effects of improved water use efficiency could have important ecological significance. More forest encroachment onto grassland areas might be inevitable. Productivity in lower elevation or otherwise drier forests in particular might be higher than old calculations suggest. Increased productivity in ecosystems is normally considered a good thing because greater productivity is generally associated with more abundance and diversity of life and there is generally more biomass available for human use. 🍷

Bill started work in 1973 as a fire fighter for the Ministry of Forests and that is how he paid his way (with help from mom and dad) through a degree in Plant Science at the University of Alberta (specializing in plant breeding). In 1978 he began work for S.N. McLean Forestry Services in general forestry consultation. In 1981 Bill followed the love of his love life to Calgary where he worked as an environmental consultant. With a new baby in 1985, life on the road lost its allure and Bill went back to UBC where he completed a PhD in Forest Soils under the amazing Tim Ballard with the equally amazing Shannon Berch providing guidance on all things mycorrhizal. After a short stint conducting research on tree root diseases for BC Research, Bill became the research soil scientist in the Cariboo Forest Region where he continues to work.



Are Our Forests' Genes Behind the Times?

FOREST PROFESSIONALS HAVE LONG KNOWN THAT NATURAL TREE populations are adapted to their environments — particularly to local climates. The first provenance trials were established in Europe more than two centuries ago and clearly demonstrated differences among provenances in broadleaves such as oaks, as well as conifers such as Norway spruce (*Picea abies*) and Scots pine (*Pinus sylvestris* L.). In BC, continuing in this tradition, we have long practiced a “local is best” approach to seed transfer, with “local” defined using data from comprehensive provenance trials. Forestry is well ahead of other fields, such as ecological restoration in this regard. The Chief Forester’s Standards for Seed Use continue to support the use of seed from local sources, including both class-B seed from natural stands and class-A selected seed produced in seed orchards. Most forest professionals are very comfortable with this approach.

While forestry in BC has gained from understanding and respecting local adaptation, we are now facing a huge challenge. Climate change is creating a mismatch between local populations and the environments they inhabit. Local environments are not the same as they were last century and the differences between past and new climates are increasing. As a result, local seed sources are becoming less optimal for survival, growth and health. The fossil pollen record and genetic data show that species and populations have migrated in response to past climatic changes (e.g. Since the last ice age), but the maximum rates of natural migration are far too slow to keep up with anthropogenic climate change.

Provincial seed transfer guidelines have been modified to encourage more seed transfer from warmer to colder locations, but these changes only tweak the existing policy framework. We need a new seed transfer policy framework that can be adjusted over time to climate warming, and will not require re-invention every decade. We also need a system that recommends transfers for both selectively bred class-A seed, and for wild stand class-B seed. The Ministry of Forests, Lands and Natural Resource Operations is developing such a system and various research groups have projects underway to help inform this effort.

To develop a climate-based seed transfer system, several types of data are required. First, we need climatic data for past, current, and the full range of projected future climates, and these data need to be available for every reforestation site in the province. Fortunately, these data are already available through the open access software, ClimateBC. This software allows you to estimate average climatic conditions for a large number of variables for the past 100 years for any location in the province. You can also select among general climate models and carbon dioxide scenarios to predict future conditions over time. ClimateBC is available at <http://cfcg.forestry.ubc.ca/projects/climate-data/climatebcwna/#ClimateBC>

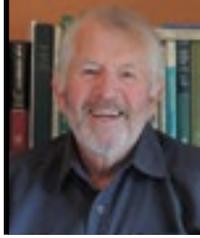
Second, we need to better understand the relationships between climate and genetics for each species. What climatic factors have had the strongest effect on natural selection? In general, we find that temperature drives patterns of variation more than precipitation for many species, but precipitation effects are still significant. Are mean tempera-

tures more important to consider, or are temperature extremes driving patterns? We find evidence of both. Do populations vary more with summer climatic conditions such as warm temperatures or precipitation, or are patterns of variation more strongly related to the length of the frost-free period and the depth of freezing events? Again, we find all of these factors are associated to some degree with local adaptation.

Provenance trials are the gold standard for assessing these patterns of adaptive variation, and BC has some of the most comprehensive provenance trials in the world. However, they take decades to complete, and we do not have large trials adequately representing all species and areas. As part of the AdapTree Project (<http://adapttree.sites.olt.ubc.ca/>), we are using short-term seedling trials in growth chambers, outdoor nursery experiments and field experiments to understand adaptation to climate in both lodgepole pine (*Pinus contorta*) and Interior spruce. In these trials, we study climate-related traits like the timing of growth and dormancy, assess cold hardiness in artificial freezing tests and test drought hardiness under controlled conditions. These traits are difficult to study in the field. Seedling studies can quickly generate information on growth and stress tolerance of provenances and we can compare these results to the performance of provenances in long-term field tests, where available. This field validation step is critical as it allows us to look at tree growth in the real world and compare results for seedlings with growth and health of more mature trees (up to 40 years of age). We are also comparing natural and selectively bred trees to determine if selection for faster growth has indirectly selected for changes in climate-related traits.

New genomic tools are available for studying genetic variation between and within provenances at the DNA level. The genomic revolution and “next-generation” sequencing technologies have provided us with the ability to study genetic variation in DNA sequence in approximately 25,000 genes simultaneously in the genomes of both lodgepole pine and Interior spruce. Within these genes, we are looking at variation in millions of DNA ‘letters’ to determine if that variation affects important climate-related traits, and if it is correlated with climatic gradients. This research has thus far revealed tremendous complexity in the genetics of adaptation, with hundreds of genes affecting most traits and tens of thousands of small changes in DNA sequence associated with climatic and geographic variables. These genetic markers also allow us to quantify the capacity of populations to adapt to new climates.

In addition to understanding genetic differences between provenances, we need to determine how much variation exists within provenances and orchard seedlots. Is the variation great enough that some trees will be able to thrive in future climates even with climate change? How many generations will it take for natural selection to adapt populations to new climates without human intervention? Should we be increasing genetic diversity in the genetic materials by planting two or more seedlots? This is one way to address uncertainties around future climate, high levels of year-to-year variation in weather and



Ecosystem-Based Management in British

The very efforts to preserve a natural system of vegetation may bring unplanned and undesired changes in it.

E.C. Stone (1965)

THE ECOSYSTEM IS A CONVENIENT WAY OF ORGANIZING THOUGHT IN the pursuit of understanding the natural world. Fundamentally, an ecosystem is developmental, with physical and biological interactions working to constrain its path through time. It is a self-organized, adaptive system with emergent properties that are more than the sum of its components. Karel Klinka (1997: 8) gives his definition as "... a segment of landscape that is relatively uniform in climate, soil, vegetation, animals and microorganisms." He interprets ecosystem management as a "... system-specific manipulation of the stands that make up a forest for a desired outcome." Vladimir J. Krajina, along with some more than 30 graduate students, developed a theoretical framework and methodology for classifying and mapping forest, grassland and alpine ecosystems of the province from 1949 to around 1970. This system, termed Biogeoclimatic Ecosystem Classification (BEC), was modified and adopted by the BC Forest Service around 1975. While far from simple, it was (and is) founded on structural characteristics of steady-state systems: BEC is based on mid-20th century notions of climax ecosystems in equilibrium with climate (Hauessler, 2011). At the same time, it is at the very foundation of BC's approach to ecosystem-based management (EBM) because it serves to identify the basic unit of management. Thus, if there are major flaws in BEC, they become interwoven into the fabric of EBM.

Two notions of EBM have developed in BC: Clayoquot Sound (CS) on the west coast of Vancouver Island and the Great Bear Rainforest (GBR) on the north and central coast. In the early 1990s environmentalists launched a large-scale campaign to protect the region. After years of campaign and conflict, BC's government announced a ban on clear-cutting in the Clayoquot rainforests and began a local planning process that incorporated First Nations of the area as well as independent scientists. CS was instituted based on recommendations made by the Clayoquot Sound Scientific Panel (CSSP) in 1995. A key feature that shaped the CS was "the recognition that ecosystems and the values with which they are imbued are dynamic, and that forest practices and policies must both anticipate and accommodate changing conditions (CSSP, 1995: xi).

The Clayoquot Sound model of environmental campaign was also used for the GBR. In May 2004, the various stakeholders agreed to recommend to the BC government that about 3,500,000 acres (14,000 km²), about 33% of the GBR, be put under some form of protection and that new forms of ecosystem-based forestry be instituted. By January 2014, the stakeholders, now termed the Joint Solutions Project, proposed further strengthening of and modifications to the rules governing the GBR. However, the GBR was not handicapped by the Clayoquot philosophy and has a heavy reliance on the premise that the future will be the same as the past. The new GBR proposal continues with the premise that old-growth is a surrogate for ecological integrity; discards monitoring and minimizes adaptive management in the process.

Actually, it has only been since the last decades of the 20th century

that concepts, experimental techniques and analytical procedures have been developed, allowing the inductive study of anything approaching something as complex as an ecological system (Botkin, 2011). The science of ecology has long been separated into two fields of study with marked differences between the approaches. For the last two or three centuries, the study of the individual and its environment (autecology) has been both experimental and inductive. On the other hand, the origins of the study of the relationship of natural communities and their environments (synecology) were philosophical and deductive.

Synecology can be traced back through to the naturalists of the 18th century. Adopting the philosophical-religious doctrine of transcendentalism, nature was perceived as benign and concerned about human beings. The world was held together by universal laws that were interpreted as evidence of the wisdom and power of a higher being¹. As the science of ecosystems ecology evolved to further explain natural phenomena, it had to shed its reliance on philosophical-religious teaching and move to a purely objective, experimental and inductive non-teleological approach. It was not all that successful.

While moving from a simple framework of structural characteristics of steady-state systems to one founded on processes and dynamic qualities, some of ecology's earlier teleological teachings were acquired by the environmental movement. A part of this thinking that includes "balance of nature" and "the future is the past" is quite evident in EBM and have not been entirely extracted from mainstream ecological thought. Still, resource practitioners using BEC had a head start in understanding and modelling whole system responses and it was an excellent beginning in identification of ecosystem characteristics to husband.

Sybille Haeussler, PhD, RPF is a research scientist who spent much of her career working with BEC. She has argued for its modification and bringing it to the standard of 21st century science². To ensure BEC remains robust and useful in an uncertain future, she suggests that it needs to embrace complex systems science to aid new generations working in a time of accelerating rates of change in climate, continued resource development, invasive species and pollution.³

BEC is becoming obsolete. Unless it updates from a static, deterministic description of climax ecosystems to a dynamic, non-equilibrium view, it will become a serious handicap to EBM. For example, while noting problems in the regeneration of redcedar in unmanaged stands in the GBR, Phil LePage and Alan Banner — working on the long-term recovery of forest structure and composition after harvesting — noted that "under the future climatic regimes, the old-growth benchmark or 'recovery target' will be different from what we are now using for comparison."⁴

Just as BEC needs to change, the rules for governing institutions in the GBR need to become more flexible and scientific. The ecosystem concept is actually evolving along with the increasing ecology's ability to make environmental predictions that involve

Columbia: Teleology or Science?

chance. GBR has confused science with mythology; entangling it in ideas more appropriate in the 19th and the 20th centuries. As BEC evolves and the understanding of ecosystems improves, the art and science of their husbandry must be emancipated from teleology.

In 1860, Henry David Thoreau (1817 – 1862) warned: “Any fool can make a rule, and any fool will mind it.” In shepherding ecosystems through this age climatic instability, better guides will work better than stronger rules. 🐿

Will Wagner, RPF, PhD, resides in Campbell River where he is continuing research initiated while with the Canadian Forest Service. He studied forestry at UC Berkeley, forest engineering at Oregon State and the economics of forest resources at the University of Victoria. He has practised forestry in three regions of the US and also in the Interior and on the coast of BC.

BARRIERS TO ADAPTION continued from Page 14

making progress on incorporating climate change considerations in policy and guidance for forest practices. Climate change is an important component in BC's new Provincial Timber Management Goals and Objectives. BC's Chief Forester's Standards for Seed Use, and other provincial level initiatives also increasingly reflect the importance of taking into account our changing climate.

The survey results point to important actions necessary to support professionals in their practices. Forest professionals are at the front line, already grappling with changing conditions, and finding ways to tackle the challenge of doing something different. The ABCFP has a strong role to play in advocating for adaptation as an essential part of forest stewardship and promoting ongoing learning. Professionals can play a key role in climate change adaptation. This opportunity comes from knowing what's happening on the ground; discerning what's working and not working; developing solutions and monitoring the effectiveness of different strategies and practices. Through this, professionals, by identifying the type of information and guidance needed to inform higher-level goals within the organizations for which they work, help link practice back to policy. Together, these actions will support effective adaptation in BC's forest management system. Above all, the survey results highlight the multi-faceted challenges and opportunities to embed climate change adaptation into management of BC's forest resources.

The ABCFP is working to address those climate change adaptation priorities identified by members and which fall within our mandate. In the summer of 2014, ABCFP staff met with government officials to discuss results of the survey and any implications for policy and prac-

References:

- Botkin, D.B. 2011. *The moon in the nautilus shell*. Oxford University Press, New York, New York 424 pages
- Clayoquot Sound Scientific Panel. 1995. "Sustainable ecosystem management in Clayoquot Sound: Planning and practices." 296 pages
- Haeussler, S. 2011. "Rethinking biogeoclimatic ecosystem classification for a changing world." *Environ. Rev.* 19: 254-277
- Klinka, K. 1997. "Foresters must understand ecosystems to manage them." *ABCFP Forum*, March/April: 8.
- Stone, E.C. 1965. "Preserving vegetation in parks and wilderness." *Science* 150: 1261-1267.

Footnotes:

- 1 A good discussion of this is in O'Neill, R.V. 2001. "Is it time to bury the ecosystem concept?" *Ecology* 82(12): 3275-3284
- 2 Haeussler, S. 2011. "Rethinking biogeoclimatic ecosystem classification for a changing world." *Environ. Rev.* 19: 254-277.
- 3 An earlier paper in this volume "Leveraging BEC for Climate Change Adaption", discusses another approach modifying BEC, bioclimatic envelopes.
- 4 LePage, P. And Banner, A. 2014. "Long-term recovery of forest structure and composition after harvesting in the coastal temperate rainforests of northern British Columbia." *For. Eco. Manage* 318:250-260

tice. The next steps for the ABCFP include: increasing awareness and knowledge among professionals through an upcoming webinar series and articles in the magazine; supporting professionals in advancing adaptation through further analysis of surveys and feedback from other meetings with stakeholders; and, ongoing efforts to promote climate change-appropriate policy development through working with the provincial government. The ABCFP will also continue to support members as they bring climate change into their practice, through creating educational opportunities and facilitating knowledge exchange. 🐿

Casey Macaulay, RPF, is the ABCFP's associate registrar. He joined the ABCFP staff in 2011 as a resource operations specialist and was part of the professional practice and forest stewardship team. He spent the previous 15 years planning forest operations.

Harry Nelson, PhD, is an assistant professor in the Faculty of Forestry at UBC specializing in forest policy and economics. One of his main areas of research in the past three years is on how climate change will potentially impact forests in Canada and ways we can adapt our management and policy framework to address those impacts. Harry also studies how current institutional arrangements (such as tenure agreements and stumpage systems) in Canada influence not only how we manage our forests but also the effect these have on the economic conditions under which firms operate and how it influences decision-making and activities.

Kathy Hopkins, RPF, is a professional forester and technical advisor on climate change with the BC Ministry of Forests, Lands and Natural Resource Operations in Victoria. She leads the Ministry's Adaptation Action Team, and contributes to a Climate Change Task Force for each the ABCFP and the Canadian Council for Forest Ministers.

Ask Mike

By Mike Larock, RPF



The ABCFP staff spends a lot of time answering tough questions from members. We thought it would be prudent to share some of the answers because the information is relevant to many members. If you have a burning question, don't hesitate to send it to Mike Larock, RPF, director of professional practice and forest stewardship.

Question: My employer would like to destroy a number of files related to previous work the company did. What is the ABCFP-directed time frame for forest professionals to archive professional documents? I realize some professional documents like site plans, forest road crossing plans, etc. have long-term implications, so is there an all-inclusive time frame (6, 10, 15 years)?

Mikes Answer: The ABCFP would not normally address the business risk associated with document retention of a variety of documents. Your employer will have to obtain advice regarding its circumstance and any requirements associated with the retention of documents. I can provide my personal professional perspective for you, as the forest professional, and on the retention of your professional work, which may be embedded in the documents of your employer.

The ABCFP has provided two situations where documents need to be retained by professionals. First, you need to keep your-self assessment records for six years for the purpose of practice assessment. Second, the professional standard of due diligence requires a professional to be able to retrieve past professional documents either in hard copy or electronic format. The direction is silent on the time requirement for this.

The profession cannot really provide a distinct time period that professional work should be maintained because there are too many variables associated with the content of those documents. There are parts of professional documents that, as you point out, contain long-term consequences and others that are relatively short but important. There are also circumstances where the professional work records someone else's responsibility (e.g. tenure holder, private land owner, lease etc.). This is important because the requirement to provide information might lie with the owner of the responsibility and it would be difficult to show that a condition exists if you, or the ABCFP, had recommended that the relevant documented evidence be destroyed.

I think you are doing the right thing by scoping out the professional circle to see what other diligence is out there in regards to document retention. I also think it would be good for the profession to share some general thoughts or encourage the discussion among members regarding document destruction and retention by professionals.

As a former consultant with file cabinets full of old documents and professional work, I can provide some more points for consideration from my own personal experience.

- As a matter of course the document destruction should not be within the liability period of your employer. An example of the liability period would be the typical free-growing period in today's legal framework. This may be longer than the actual achieved free-growing date. However, at some point there are diminishing returns on the value, such as past the free-growing period. Also, the administrative cost of maintaining a free-growing record may be far greater than re-measuring the free growing stand at a later date, if required.
- Another consideration is the future need to establish the cost and ultimately the value associated with the loss of an asset. Professional estimations and averages would prevail unless it could be shown

that the actual treatments rendered a different cost and, therefore, value.

- It is a good idea for professionals to develop a document retention and destruction policy for their employer (as you seem to be doing) that includes stripping down the file and archiving important pieces — I think this kind of process needs to be at the hand of the forest professional.
- Keep files accessible for the period of time that a management risk exists in the new stand.
- As a function of my process I would learn if the same information is stored somewhere else. For example, can I store the relevant information on RESULTS?

A few more vitally important points (in my view);

- The professional and the company/government he/she works for are different entities. Professionals are independent from their employers with respect to the practice of professional forestry and have responsibility to account for their professional work years into the future. For example, I have received calls from former clients where the professionals are trying to find documentation that no longer exists in their files (such as the sale of one company to another company).

Ultimately, reasonable care to the standard that other forest professionals are using becomes the margin of what you, as the professional, should do. The plan might belong to the client or employer; however, the professional work, judgment and advice in the plan are your own.

Given my previous statements, it may be said that the professional has some responsibility to maintain his/her own document control. Again we have no rules to cover the retention of your professional practice work for a client or employer. If you are called to account for your professional work then you may want some information that provides you with documented evidence, such as a practice diary, electronic copies of documents, an ongoing list of letters or documents that have been signed and sealed, etc. Almost any formal process that contains rigor and selection of documents is better than nothing at all.

Lastly, forest practices in higher-risk areas (streams, private properties, highways, etc.) may warrant a higher level of document retention to prove the appropriate forest practice was done. Maybe your process needs to incorporate some stratification of documents based on risk, with one risk being geographic location. 🍷

Mike Larock, RPF

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Managing Forests as Complex Adaptive Systems: Building Resilience to the Challenge of Global Change

by Christian Messier, Klaus J. Puettmann, K. David Coates.
Routledge, 2013.
368pages.

As forest professionals, we routinely influence the dynamics of forest landscapes in many different ways. We like to think we understand these complex ecosystems, but we have also learned the hard way that outcomes do not always match expectations.

Managing Forests as Complex Adaptive Systems (CAS) emphasizes the science of complex systems and how it applies to forest management through the mysterious concepts of emergence, feedback loops and non-linear dynamics (to name a few). The book is the sequel to the most excellent “A Critique of Silviculture: Managing for Complexity,” published in 2008 by the same authors, which addressed the necessary paradigm shift to truly manage for uncertainty in forest systems.

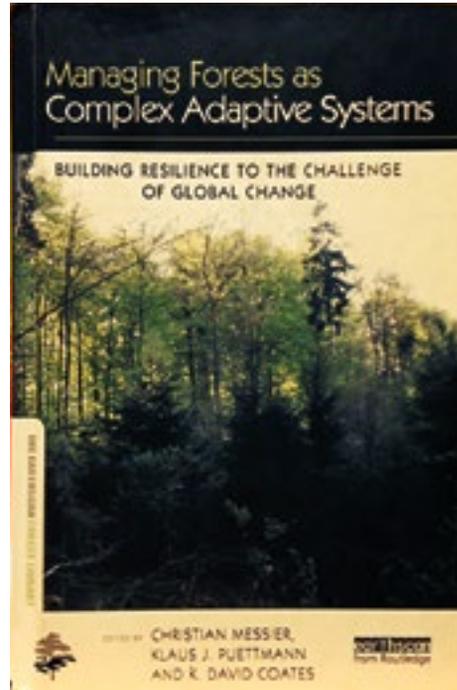
In this volume, after a mandatory initiation to the concepts of complex systems for the newcomer, the reader is taken on a fascinating tour of some of the most renowned forest ecology trials and research projects worldwide. Each chapter showcases important projects that have recently reached maturity and offers precious insight into some of the greatest minds of our discipline. The topics covered are quite diverse but come together as they are all relevant to specific aspects of our practice.

Do you think boreal forests are not very complex because of their relatively low diversity? Think again. Their multiple successional pathways, their ability to self-organize and their hierarchical dynamics make them a prime example of CAS. Another chapter on temperate forests efficiently demonstrates the need to use tools that account for emergent properties, such as the forest growth model SORTIE-ND. In chapter 7, mycorrhizal networks reveal that facilitation amongst trees is a more prominent mechanism than competition. This was observed in Douglas-fir forests but could potentially be true in many forest systems.

Management practices relevant to CAS are also addressed in following chapters, and include the conundrum

of socio-politics affecting the ecology of tropical forests (Chapter 8), lessons learned from close-to-nature forestry in Europe (Chapter 9-10) and the overwhelming benefits of the CAS framework when applied to silviculture.

The scoop on lessons learned from these projects revolves around the following concepts:



- We should do a better job of understanding the dynamics at play in the forests we manage across scales.
- We should adopt some practices directly addressing these dynamics in a less rigid, bottom-up approach, while accounting for greater uncertainty.
- Always follow up with a solid and consistent monitoring plan.

These concepts are in line with the ABCFP’s Principles of Stewardship and are not absent from forest management in BC. However, changes are needed in legislation and policy in order to further distance the practice of forestry from that of agriculture, to support professional reliance in managing for CAS and to let go of the command-and-control approach.

Despite the effort to make the book relevant to practitioners, it will suit mostly academics as a result of its scholarly style and language. This, combined with the book’s initially exorbitant cost (lower price for paperback now available), make the piece somewhat inaccessible, hence a non-perfect rating.

Nevertheless, if you are familiar with or curious about complex systems and sustainable forest management, or have an interest in international forestry, this book is an absolute must. BC forest professionals and scientists are well represented in the authorship and treat us to a series of relevant local examples that definitely warrant our attention. 🍷

Review by Marie-Lou Lefrancois, RPF, MSc

The Inherent Insecurity of Log Purchase Transactions

I HAVE PREVIOUSLY USED THIS SPACE TO DISCUSS THE POWERFUL remedies available to the provincial government's Forest Revenue Audit Program ("FRAP") under Part 11.1 of the *Forest Act* (the "Act"). By way of recap, if a "commissioner" appointed pursuant to that program considers (for any number of reasons) that stumpage was underpaid on harvested Crown timber, the commissioner may make an assessment of the underpayment on any basis that the commissioner considers "adequate and expedient" and the amount of the assessment becomes due and owing on top of any stumpage already paid on the timber at issue.

The government has other rights available under the Act to adjust the stumpage owing on harvested timber after the fact. Sections 105(5.1) and (5.2), combined with provisions of BC's stumpage appraisal manuals, require a "changed circumstances" reappraisal of the stumpage rate payable on harvested timber if the district manager concludes that the circumstances encountered in the field were sufficiently different from those contemplated in the original stumpage appraisal submission. As well, if government concludes (again, after the fact) that a stumpage rate applicable to harvested timber was appraised on the basis of "inaccurate information," the government is authorized under section 105.2 of the Act to reappraise the stumpage rate on the basis of information that government considers accurate. In either case, the difference between the stumpage paid on the basis of the original stumpage rate and the amount owing under the reappraised stumpage rate, will become due and owing.

While reasonable people would not take issue with the right of government to insist upon payment of the stumpage properly due and owing on harvested Crown timber, the translation of this right into the Act creates security issues for those who enter into agreements for the purchase and sale of Crown timber. The commissioner under FRAP may make an assessment on Crown timber harvested anytime up to six years prior to the assessment. A district manager may require a changed circumstances reappraisal for timber harvesting under any cutting permit issued prior to July 31, 2005. The government may require a reappraisal of stumpage applicable to harvested timber on account of inaccurate information "at any time." And the government can file a certificate in court under the Act with respect to any stumpage owing that, effectively, becomes a judgment of the court, anytime within seven years after the amount became owing.

The real difficulty arises on account of the fact that persons other than the party responsible for the appraisal of stumpage may be potentially liable for payment of any retroactive stumpage bills. Under the Act, anyone who acquires or deals in Crown timber is potentially responsible

for outstanding stumpage owing on that Crown timber. Consequently, even if timber is sold on the stump and the buyer assumes tenure management responsibilities — including appraisal of stumpage — the seller could still find itself on the hook for any stumpage shortfall years afterwards if stumpage was subsequently reappraised. Similarly, a purchaser of logs produced by a tenure holder could find itself liable for a retroactive stumpage reappraisal long after the conclusion of its purchase.

All of the foregoing raises the question of how a party to a log purchase agreement can protect itself from a retroactive stumpage appraisal potentially years in the future. Withholding the estimated stumpage from the purchase price pending satisfactory proof that stumpage was paid, or simply paying stumpage directly to the government, will not assist if stumpage is reappraised years afterwards.

Theoretically, if the party responsible for payment of stumpage holds substantial assets, then the exposed party could take some form of long-term charge against those assets. If not, the exposed party could insist upon a guarantor of substance. The problem is that the party responsible for stumpage payments will probably not agree to encumber its assets for a lengthy period of time, or manage to find a guarantor willing to do so. Ultimately, most timber purchases proceed without out any security against future retroactive stumpage appraisals and, presumably, this risk is accounted for in the purchase price. 🍷

Jeff Waatainen is an adjunct professor of law at UBC, has practised law in the forest sector for over 15 years, and currently works in the Forestry Law Practice Group of Davis LLP's Vancouver office.

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FOREST PATHOGENS continued from Page 19

2005 and 2006 (R. Reich pers. comm.). Comandra blister rust infections are reported to occur in wave years but three consecutive wave years of infection in this trial represent a change in disease behaviour. Earlier reports of this same pathogen in central BC in the 1980s and early 1990s suggested that the disease was uncommon. On the landscape scale, three surveys of 60 or more randomly selected juvenile lodgepole pine stands in the west central Interior show an almost three-fold increase in combined hard pine rust incidence and a six-fold increase in the proportion of stands, with rust incidence over 20% between two surveys conducted in the late 1990s and a subsequent survey of the same population in the late 2000s. The pathological landscape in BC's managed forests is not the same as it was even two decades ago.

There are other pathogens that respond to environmental extremes and it appears that the forests of central BC are also being challenged by these. A recent widespread occurrence of top dieback in lodgepole pine in the central Interior may in part be linked to an abrupt (40°C) drop in temperature in the fall of 2010, following a drier than average summer. That combination of environmental conditions is considered a trigger for *Cenangium ferruginosum* and this opportunistic pathogen is believed to be at least in part responsible for the extent of top dieback in lodgepole pine in the western portion of BC's central Interior. This example further emphasizes how environmental change can drive biotic disturbances leading to unforeseen forest conditions in what we have considered a stable predictable forest management system.

When pathogens attack the smaller, weaker trees in managed stands they have minimal impact. When they attack the dominant trees and create gaps, they expose the Achilles heel of traditional growth and yield theory. No single factor has a larger influence on managed stand productivity than unexpected mortality or loss. Managed stands in much of the Interior are experiencing losses in healthy stocking due to forest pathogens. To a degree these losses are expected. The extent to which these losses are already accounted for, though, depends on the incidence of damage agents (which evidence suggests is increasing), the size of the trees affected (which covers the entire range of tree classes and is not lim-

ited to the small and weak) and the ultimate fate of non-lethally damaged trees (which remains uncertain but is not as rosy as that of undamaged trees). Post-free-growing monitoring has provided evidence of considerable timber losses to biotic and abiotic damage agents. In the same areas data from these same monitoring programs suggest that the healthy trees are growing at least as fast as earlier predicted. Data from both Stand Development Monitoring (SDM) and Young Stand Monitoring (YSM) require dedicated analysis and a sharpened focus on understanding the implications of the findings which must then feed back and inform both policy and practice.

BC has a distinct advantage over other forest-dominated jurisdictions to conduct innovative and proactive climate change activities. Our forest land base is overseen by a single land steward. This sets BC apart from most other forested jurisdictions including our neighbours to the south, where there are many more landowners and decision makers, which make co-ordinated decisions on a landscape scale more difficult. We can actively manage our plantations for climate change mitigation more so than in much of the boreal forest where tree species options for planting are few and where large tracts of undeveloped forests are left to fend for themselves. The most effective management decision we can make to facilitate the creation of more adaptable future forests occurs at stand initiation. We can plant species that may be better adapted to future conditions. We can also plant greater densities and a greater diversity of species to lessen the threat posed by any single insect or pathogen or abiotic factor. Over 170,000 ha of forest land in BC were planted in 2012/2013. That is a significant area of land on which we can directly influence future forest conditions and the ability of those forests to both adapt to and mitigate against climate change and its associated bothersome externalities. 🍷

Alex Woods is a research forest pathologist for the BC Ministry of Forest Lands and Natural Resource Operations based in Smithers. For the past 20 years he has investigated the impacts of forest diseases on managed stand productivity with an increasing focus on the implications of climate change.

FORESTS' GENES continued from Page 23

uncertainty about what life stage we should target (e.g. seedlings or saplings) to best match trees with climate for productive rotations.

Finally, to move to a climate-based seed transfer system that aims to put climatically well-adapted seedlings in the ground, we need to gain acceptance of this approach from silviculturalists and other forest professionals. In forestry, unlike in some other fields, we have done such a good job of convincing people that "local is best" that it's hard to leave this principle behind. A climate-based seed transfer system will need to roll out changes that are initially small, and then gradually increase transfer distances as climates warm and experience and knowledge increase. Maintaining resilience and productivity will require a shift

from our local-is-best history of genetic resource management to one that uses the sophisticated tools and information at our disposal. 🍷

Sally Aitken, PhD, is a professor in the Department of Forest and Conservation Sciences at UBC. Sally is project leader for AdapTree and director of the Centre for Forest Conservation Genetics. She studies local adaptation to climate, population structure and genetic diversity in native tree species, and teaches forest biology, alpine ecology and conservation genetics.

Jack Woods, RPF, MSc, is program manager for the Forest Genetics Council of BC, a government/industry cooperative that provides a forum for collaborative business planning and policy advice to FLNRO on all forest genetic resource management activities. Jack also leads a council-owned company called SelectSeed Ltd. that produces Class-A seed for sale within BC.

A Moment in Forestry

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Always Pack Your Rain Gear By William Wagner, RPF

A painting by a member (as well as Editorial Board member and prolific contributor) depicting the area in the Elkhorn Valley between the Gold and Campbell Rivers. The painting shows the masking of roads, harvest areas and fences by a rapidly brewing storm.

Literature Cited in Viewpoint from Page 22

Allen, L. H. Jr. Baker, J. T. and Boote, K. J. 2005. The CO₂ Fertilization Effect: Higher Carbohydrate Production and Retention as Biomass and Seed Yield by in Global Climate Change and Agricultural Production Fakhri A. Bazzaz. Daya Publishing House, Jan 1, 2005 - Agriculture - 345 pages.

Donohue, Randall J. Roderick, Michael L. McVicar, Tim R. Farquhar, Graham D. 2013. Impact of CO₂ fertilization on maximum foliage cover across the globe's warm, arid environments. Geophysical Research Letters. Volume 40, Issue 12, pages 3031–3035, 28

Graven, H. D. Keeling, R. F. Piper, S. C. Patra, P. K. Stephens, B. B. Wofsy, S. C. Welp, L. R. Sweeney, C. Tans, P. P. Kelley, J. J. Daube, B. C. Kort, E. A. Santoni G. W. Bent, J. D. 2013. Enhanced Seasonal Exchange of CO₂ by Northern Ecosystems Since 1960 Published Online August 8 2013. Science 6 September 2013: Vol. 341 no. 6150 pp. 1085-1089 DOI: 10.1126/science.1239207

Keenan, Trevor F. Hollinger, David Y. Bohrer, Gil. Dragoni, Danilo. Munger, J. William. Schmid, Hans Peter. Richardson, Andrew D. 2013. Increase in forest water-use efficiency as atmospheric carbon dioxide concentrations rise. Nature. 499. 324–327 Published online. 10 July 2013

McMahon, S.M. Parker, G.G. Miller, D.R. Evidence for a recent increase in forest growth. Proc Natl Acad Sci USA. 2010;107:3611–3615.

Pagani, Mark. Zachos, James C. Freeman, Katherine H. Tipple, Brett. Bohaty, Stephen. 2005. Marked Decline in Atmospheric Carbon Dioxide Concentrations During the Paleogene. Science. Vol. 309 Issue 5734, p600-603. 4p.

Saxe, R.F. and Coleman, J.R. 2001. Effects of low atmospheric CO₂ on plants: more than a thing of the past. TRENDS in Plant Science 6: 18-24.

Saxe, Henrik; Ellsworth, David S.; Heath, James. 1998. New Phytologist Tansley Review No. 98. Tree and forest functioning in an enriched CO₂ atmosphere. Vol. 139 Issue 3, p395-436. 42p.

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