

UBC Rethink Silviculture Discussion Paper
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Context

This work grows from an ongoing dialogue between UBC Faculty of Forestry and MFLRNO, that began with the Growing Opportunities silviculture discussion paper (BC MOFR 2009a). At that time, a group of UBC Faculty of Forestry professors and students held a series of meetings and compiled a response paper. The essence of the paper was that silviculture strategies were not well linked to forest-level planning and timber supply analysis. That ecosystem services, carbon and bioenergy were not integrated into current practices or the proposed remedies, and that overall, a clearer more comprehensive vision was needed to guide silviculture planning and investment in BC.

In 2014, MFLRNO senior staff visited the Faculty and provided an update on their progress with silviculture planning, focusing on Integrated Silviculture Strategies. During this meeting, UBC was encouraged to continue the dialogue with the Ministry and with practitioners.

Through research by Faculty members, Forest Practices Board and ABCFP reports, and our routine interactions with practitioners and policy-makers, the UBC group is aware that there are continuing concerns about young stand health and climate change resilience, and the impact that stocking standards and the free-growing concept are having on silviculture decision-making.

With the support of MFLRNO, we re-launched our silviculture discussion group in the fall of 2016, under the banner *Rethink Silviculture*. This report summarizes our information sources, discussions and feedback from practitioners, organized into seven themes each of which concludes with some recommendations for policy and practice improvements.

Information Sources

In addition to our academic and professional experience in silviculture, we drew upon a number of sources to inform our discussion. These sources included the Rethink Silviculture Blog <https://blogs.ubc.ca/silviculturediscussion/> where we posed 5 leading questions:

1. What changes in regeneration and stand tending practices are needed to promote resilient, valuable forests?
2. Do current regeneration practices adequately address risks from climate change and forest health factors all the way to rotation age?
3. In your opinion, is application of the “free-to-grow” concept resulting in stands that will meet government objectives for timber and other values?
4. How could free-to-grow regulations and other silvicultural policies be changed to promote resilient and valuable forests?
5. What tools (decision-support tools, models etc.) do you use to help you make silvicultural decisions? How could they be improved?

We also reviewed the Forest Practices Board reports, in particular SR 16 *Reforesting BC’s Public Land – An Evaluation of Free-Growing Success* (BC FPB 2003), SR 25 *Achievement of Free-Growing Forests – 2004 Provincial Update* (BC FPB 2006), SIR 33 *Reporting the Results of Forestry Activities* (BC FPB 2011), and SIR 44 *Forest Stewardship Plans: Are They Meeting Expectations?* (BC FPB 2015). We also reviewed the ABCFP commissioned paper *Review and Analysis of the Effect of BC’s Current Stocking Standards on Forest Stewardship prepared by Jeff and Eleanor McWilliams* (2009), and other sources cited in the sections below.

The MFLRNO provided us with access to RESULTS shape files, from which we extracted and merged (aspatially) opening, inventory and treatment records. We conducted an exploratory analysis of these datasets with a focus on the utility of RESULTS in revealing trends in the attainment of free-growing and changes in the composition and quality of the resulting stands.

We met with practitioners at the winter SISCO and CSC meetings, the WSC Annual General Meeting, and the ABCFP Annual General Meeting. At SISCO, we lead two back-to-back structured sessions, in which we asked groups of practitioners for their feedback and commentary on the blog questions. In addition to the Blog and face-to-face discussions, we received a number of emails from practitioners with commentary and background information. We would like to thank the MFLRNO for supporting this project and all of those who contributed to the Rethink Silviculture

Blog and our subsequent discussions, with particular thanks to Eleanor McWilliams RPF, Jeff McWilliams RPF, Gary Quanstrom RPF, and Al Waters RPF. Having said that, responsibility for the conclusions and recommendations in this report rests with the UBC Rethink Silviculture group.

Integrating themes

Via examination and discussion of the various information sources, we have identified seven areas of concern for forest practitioners with respect to the health, resilience and value of BC's future forests.

1. Articulation of timber goals and the gap between stand-level prescriptions and landscape planning

In the UBC response to the 2009 Growing Opportunities silviculture discussion paper, we stated that “under the current framework for silviculture, it is assumed that a large number of knowledgeable and well intentioned individuals can undertake a vast number of variably isolated actions on the forest landscape, and the sum of all of those activities will be a desirable outcome at the landscape and larger scale. This is a very dangerous assumption.” This statement still applies today.

Practitioners feel the need for clear objectives, desired stand conditions, products and features that are linked to timber supply assumptions. There is a lack of clearly communicated goals or objectives at the landscape scale, to set the context for stand-level prescriptions. There is a lack of clarity about what ‘valuable’ stands are, and how this is determined and balanced for timber, and non-timber values.

The lack of goals and objectives has been criticized for years in BC from both a forest policy and forest management perspective. Historically, the focus of policy and management has been rooted in timber production. The Forest Act and the Forest Range and Practices Act (FRPA) are centred on timber production. The Forest Act is primarily concerned with governing the allocation of timber for harvesting. FRPA emphasizes the goal of maintaining timber harvests while ensuring delivered wood costs are cost-competitive over maintenance of other values. The Auditor General's report examining whether or not the Ministry of Forest Lands and Natural Resource operations was achieving its forest objectives for timber concluded (among other criticisms) that the Ministry had not clearly defined what those objectives were nor what kind of timber outcomes it was seeking (i.e. a targeted volume, value, and/or species diversity). In addition, the report asked how economic interests were being balanced with environmental and social opportunities for present and future generations. The report noted that while the industry had been effective in terms of regeneration, that there were concerns as to whether current silvicultural practices were leading towards less species diversity in some areas and less valuable stands (Auditor General 2012).

The Ministry responded by noting its current management frameworks and the development of new strategies (Type 4 silvicultural strategies) and standards as ways of addressing these concerns. They argued that trade-offs were best evaluated in the local context, that efforts were being made to promote forest planning at the more local level and that stewardship (balancing timber and non-timber values) was continuing to be supported through professional reliance.

While the Ministry continues working on these initiatives, subsequent reports by the Forest Practices Board have identified that the principal mechanism by which licensees identify how they will achieve their objectives, Forest Stewardship Plans, remain flawed. The Board in their audit of Forest Stewardship Plans (BC FPB 2015) concluded that FSPs contain results and strategies that are confusing to the public because they cover large and overlapping areas, contain unmeasurable or verifiable strategies that are inconsistent with objectives, and default to the government's default practices rather than innovate. Furthermore, the Board states that "Professional reliance, a cornerstone of FRPA, fails to solve the systemic FSP problems of consistency and measurability because license holders are under no obligation to accept the advice of these resource professionals" (BC FPB 2015). The Board subsequently spelled out five principles to promote stewardship, including the generation of plans that clearly lay out objectives and goals and that sustain ecological, economic and social values over time (BC FPB 2016).

The forest industry in the Interior, is facing substantial declines in harvest levels as the Allowable Annual Cut is revised downwards following the Mountain Pine Beetle epidemic. Both in beetle-affected regions and elsewhere, concerns about the trade-offs between timber harvest and other nontimber values such as maintaining visual objectives and wildlife habitat are becoming acute. Yet there is little guidance on how to prioritize those values; Morris (2015) points out that the phrasing in FRPA limiting the protection of other values where that may lead to restrictions on timber supply has weakened the ability of managers to protect wildlife and habitat values.

Clarifying the balance between protection of timber and non-timber values, and the processes by which to achieve this balance, is a responsibility of government and is key to improving outcomes. Spatial, landscape-level plans are needed to translate broad societal goals into measurable targets. Long-term, landscape-scale monitoring is needed to compare outcomes with targets.

Much of the timber harvesting in the Province takes place in Timber Supply Areas through volume-based licenses. This leads to two interrelated issues. The first issue reflects a well-acknowledged gap between strategic and operational planning. There are no assurances that regenerating stands are developing in a way that is consistent with the assumptions made in timber supply planning and the determination of current harvest levels. The second pertains to the quality of stands that revert to the crown.

Timber supply planning in BC is still oriented around volume and wood costs. Nelson et al. (2009) identified this as a predominant industrial paradigm prior to the global financial crisis. As the industry has consolidated, this paradigm appears to have become even more entrenched. A similar political dynamic exists in terms of AAC, where the emphasis is on maintaining or minimizing declines in long run harvest levels, and looking at ways to mitigate economic impacts through enhancing growth, rather than considering more value-oriented strategies, as evidenced by the midterm timber supply strategy (BC MFLNRO 2012). This volume-oriented approach serves as a disincentive to more value-oriented strategies when it comes to operational matters. Harvesting or regeneration activities viewed as more risky or costly are less likely to be adopted (Hotte et al. 2016).

Regeneration standards need to be linked explicitly to timber and non-timber objectives at the site and landscape scales. Stand value needs to be considered, in addition to volume. Appraisal allowances should promote and reward innovation in forest practices and improved outcomes.

2. Species conversion

Practitioners are concerned that we continue to over-plant lodgepole pine regionally, and that our lodgepole pine density management regimes do not adequately address the forest health risks that this species faces in the juvenile stage. RESULTS should contain the necessary data to compare pre-harvest stand composition with composition at free-growing. Our preliminary province-wide comparison of pre-harvest leading species with leading species at free-growing, using RESULTS data, indicates considerable change in leading species. For example, approximately 70% of lodgepole pine stands remained lodgepole pine-leading, while 30% of larch and 20% of spruce stands became pine leading according to the free-growing inventory label. Only 25% of stands that were originally redcedar-dominated have redcedar as the leading species at free-growing; approximately 55% of spruce-leading stands stayed spruce-leading. These

results are preliminary – the general limitations of RESULTS database have been identified by the Forest Practices Board (BC FPB 2011), and our analysis was aspatial and provincial in scope. Presuming that RESULTS data are valid, then species conversions could be evaluated by region, BEC unit and licensee.

The quality of the data in RESULTS should be verified, and data entry protocols revised as needed to improve database quality. Stocking standards should be more explicit, and more explicitly linked with desired forest conditions so that unintended or undesirable conversions are avoided. State-of-the forests reports should summarize current composition and compare it to past and desired future states.

3. Reaching free-growing status vs. desired long-term conditions

Practitioners reported that producing stands that meet free-to-grow standards is being treated as the objective of silviculture. They are not confident that stand conditions when free-growing is declared are a good predictor of stand conditions at rotation age.

There are many reasons why reaching a particular stocking standard early in stand life may not result in a predictable future stand condition. Stand development can follow multiple pathways and is influenced by growth rates and competitive interactions, and by exogenous factors such as biotic disturbances (e.g. insects and diseases), abiotic disturbances (e.g. wind and snow) and changing climate (Oliver and Larson, 1996). BEC classification allows organization and prediction of some of these factors, and is universally used to inform regeneration silviculture decisions, but it provides only a general indication of the probable stand development pathway. The BEC classification system is not well integrated into the tools used for stand projection beyond free-growing for long term planning and prediction of AAC.

Practitioners would like better tools to assess and project the condition and quality of young stands at, and beyond free-growing. The quality and utility of stocking data in RESULTS is suspect in terms of accurate characterization of growing-space occupancy and future stand trajectories at the stand level. Theoretically, RESULTS would be a valuable resource for epidemiological studies of trends by BEC unit, and effectiveness of silviculture treatments. Some practitioners do query RESULTS to inform silviculture decisions. Most do not either because they do not know how to do this, or they do not trust the accuracy of the databases. TIPSY is used by some practitioners to inform their decisions about regeneration prescription design (density, species choice). Most who do so are aware of the limitations of TIPSY for modelling mixed species stands. Few practitioners are using Prognosis or TASS, but more would if local models and training were

available. Others are using permanent sample plots, field observations and intuition/professional judgement to inform decisions. A few use financial tools. Very few use estate models to inform regeneration or stand-tending decisions. Practitioners recognize the value of growth and yield models for stand projection and scenario analysis, but want more sophisticated models and training on how to use them. The growth and yield modelers want more capacity in the FLNRO growth and yield team to improve models. There is a concern about knowledge transfer as the current cohort of modellers ages.

An integrated strategy for stand monitoring and growth and model development is needed, with appropriate financing and expertise, and this needs to incorporate timber and non-timber values and risk analysis. TASS III is widely anticipated. It should be launched as soon as possible with appropriate training. Since objectives need to be at the TSA-level multi-block standards need to be implemented to take advantage of these better predictions of final stand condition. Stocking data collected in free-growing surveys and contained in RESULTS should be useful as inputs into growth and yield models.

4. Monitoring and stand development mid-course correction

Because reaching free-to-grow standards results in the transfer of silvicultural liability to the Crown, licensees have no reason to monitor stands beyond free-growing to determine what the species composition and stand structure actually will be.

Practitioners and growth and yield modellers characterized the survey protocols, and RESULTS reporting as supporting silviculture milestone declarations, but challenged whether the characterization of stands via free-growing surveys reveals current and future dominance of growing space. They also felt that formal regeneration surveys (3-6 years post-harvest) provide no useful information for yield projection, and should be replaced with professional declarations of adequate stocking. The considerable cost and effort spent on regeneration surveys would be better spent on young-stand monitoring. Accurate characterization of young stands is fundamental for assessing ecological health and attaining timber and broader values from future forests.

The survey and reporting protocols are overly focused on silviculture milestones and should be updated to better represent current conditions and inform stand projections.

Better design of monitoring protocols will improve the quality and reducing the overall cost of data collection.

After the free-to-grow declaration is made and silviculture liability transfers from a company to the Ministry, there are no established mechanisms to systematically monitor stand conditions or prescribe intermediate treatments (mid-course corrections) to direct the stand to a desired future condition. Predictions of future condition made at the regeneration and free-growing stage are just that – predictions, and outcomes should be monitored, expectations adjusted, or additional interventions made. In addition, over the life of a stand, it is probable that social or economic circumstances will warrant a change in the desired future condition or an acceleration of stand development.

The MFLRNO has commenced young stand monitoring and other initiatives to test the assumptions of yield projection tools, but there is no routine monitoring process for post-free growing stands and no process to prioritize interventions in post-free-growing stands that depart from yield expectations. The consequences of failing to meet TSR assumptions about composition and yield will impact future British Columbians unless outcomes from continual monitoring is included in AAC determinations.

A systematic policy of mid-rotation silviculture intervention to match then strategic needs of forest management objectives should be employed. This would require the collection of data at free-growing that is useful for stand projection models. Post-free-growing monitoring data should be in a form that allows model projections to be tested and refined.

As the Ministry moves toward more integrated silviculture strategies, there will be more opportunities for the application of intermediate operations to change the trajectory (e.g. fertilization and thinning). The current concerns about midterm timber supply are an example of why there might be a desire to shift some stands to different trajectories or rotations than conceived during the original site plan formulation.

If integrated silviculture strategies incorporated post-free-growing monitoring and feedback, cost/benefit analyses could be used to evaluate strategic use of silviculture investments on a TSA by TSA basis.

5. Achieving desired future stands via timber objectives

There is a concern that costs to achieve free-growing are the primary consideration in silviculture regimes, and these costs are not linked to the potential value of the future crop, or the quality of the site. In the drive for harvesting and regeneration efficiency, opportunities to improve timber supply by protecting and releasing understory sapling and regeneration layers are being missed. Understory protection has become a standard practice in boreal and eastern Canadian mixed forests (e.g. Grover et al. 2014). There is also a concern of a general 'race-to-the-bottom' in silviculture expenditures as licensees aim to improve operational efficiency to gain competitive advantage under the existing appraisal system. The addition of an appraisal allowance for enhanced basic silviculture is welcomed by practitioners, but may not be sufficient. Development of multi-block stocking standards linked to TSR makes the connection between regeneration silviculture decisions and the assumptions of timber supply projection more explicit. It also provides practitioners more flexibility in allocating expenditures to sites where growth responses are more reliable and allows more site-site diversity in target conditions, while ensuring stocking targets are met at the forest-scale.

In addition to an allowance for enhanced regeneration silviculture, new stocking standards are needed. These include higher stocking standards for lodgepole pine in areas where juvenile health issues prevail. Multi-block standards linked to TSR yield curves for analysis units provide options to silviculturists at the site-scale. Stocking standards and the appraisal system should encourage retention and release of understory layers where they can contribute meaningfully to timber and non-timber objectives.

Many of the concerns raised by practitioners in our discussions reflect the lack of clarity from the landowner (e.g. the government) about the landscape and long term outcomes to be supported by silviculture standards and practices. The integrated silviculture strategy approach should allow better risk management via scenario analysis. Multiblock stocking standards represent a portfolio approach to stand management.

The portfolio concept could be applied more broadly to silviculture investment. Diversifying the conditions of stands across landscapes is necessary to address risks natural disturbances, climate change, changing markets and societal expectations.

BC has many strong forestry institutions, including the Forest Practices Board, FLNRO, FREP, the ABCFP, universities and colleges, however, opportunities for communication among

professionals and for professional development remain limited. The regional silviculture committees (NSC, CSC, SISCO) are important venues for discussion and information exchange between professionals. In the absence of regular continuing education offerings by extinct organizations like FMIBC, BCFCSN and FORREX, these regional silviculture workshops represent one of the few vehicles for this. Groups of practitioners have been working together in some TSAs in formalized committees to address concerns about silviculture objectives, practices and standards and the impacts on timber supply. These TSA committees are a potentially powerful institutional improvement which could be fostered by FLRNO and the ABCFP.

Formation of TSA-level communities of practice would foster communication and knowledge transfer between silviculturists, planners and analysts, and provide a venue for joint development of stocking standards and practice standards for the shared TSA landbase.

6. Ecosystem-based management and ecological health

There is a continuing tension between the sustained yield and ecosystem management paradigms in BC. The former promotes stand resistance to damage, while the latter embraces resilience - which is damage followed by recovery. There is no consensus among practitioners on how stands can be made more resilient in the face of climate change. Resilient stands and landscapes will likely not be optimized for sustained yield. In timber supply planning, losses are estimated via crude adjustment factors at the stand and landscape-scale. Silviculturists are focused on the stand-level, and the current free-growing standards require resistance to insect and disease attack, at least to the free-growing stage. In our discussions with practitioners, forest health threats were considered to be stand-specific and primarily of concern during initial establishment. Solutions include identifying optimal density. While their potential for improved resistance and resilience are recognized by practitioners, some are concerned about the timber quality and future value of mixed species stands when species stratify and higher value species are overtopped by lower value ones. There is a trend to shortening rotations in managed forests, which is one way to reduce time-dependent risks, but comes at a potential cost to volume and value. There are concerns that stands will be harvested before they reach optimal volume or value.

A portfolio approach to silviculture standards and investment is needed. Multi-block stocking standards allow for integration of stand and forest-level objectives and improve

the potential for diversification of stand-level outcomes. More versatile growth and yield models that better represent the range of stand development trajectories on a range of sites are essential for mixed species or mixed age-class management. Stand and forest-level loss rates should be linked to experienced and projected outcomes within the BEC framework, via scenario analysis that integrates climate change projections.

7. Achievement of broad societal goals and forest structures

In 2008 the Provincial Government organized a Working Roundtable on Forestry. Its goal was to identify key issues and opportunities facing the forest sector, leading to specific recommendations. One of the recommendations was that “*We should review our forest management and silviculture practices to ensure that they encourage maximum productivity, value and support forest resilience.*” (BC MOFR 2009b). Almost a decade later, this review has not occurred, and the outcomes of current minimum requirements for stand re-establishment at the landscape level and over the longer term are the subject of uncertainty and concern among practitioners and academics. In addition to the impacts on timber supply there is a concern that broad societal goals and non-timber values are insufficiently addressed.

Societal values are based on philosophical, ethical and moral principles. As Rapport and colleagues (1998) have outlined, conflicts around societal goals and values arise when aspects of values conflict. In BC, forest practices driven by short-term economic goals have led to extensive alteration of forested landscapes in ways that conflict with a number of societal goals - wildlife habitat and visual quality being of particular concern (e.g. Morris 2015), along with water quality and flow rates. These societal goals reflect an overall concern about the sustainability of industrial forestry, but also the pride British Columbians take in being the inheritors and stewards of a rich, diverse and scenic provincial forest.

Enhancing the diversity and quality of stand and forest structures has the potential to reconcile or reduce value-related conflicts. Examples include reducing the simplification in stand and forest structure and arrangement that often accompanies cutblock layout and reforestation prescriptions. Biogeoclimatic classification, stand characterization and diagnosis, and evaluation of prior disturbance regimes are routine parts of prescription development and allow foresters to recognize opportunities. However, when filtered through the lens of current and future timber extraction and minimum regeneration standards, post-harvest target conditions often become highly simplified in spite of the depth of knowledge that informs the prescriptions.

Practitioners state that having a proprietary attitude is key to making good silviculture decisions. While the volume-based tenure system is not conducive to this proprietary attitude, many practitioners, including volume-based licensees, feel a sense of pride in the regenerating stands that they establish.

Recognizing the additional costs of understory protection and high retention prescriptions and implementing an allowance for enhanced basic silviculture should promote improved diversity of outcomes at the stand level. Landscape-level assessment, target setting and monitoring is still necessary to link stand-level actions to long term landscape-level outcomes. In the absence of tenure-reform, the sense of pride in stewardship can be encouraged via establishment of communities of practice at the TSA-level.

Conclusions

There are a number of institutions that support silviculture in BC including the Chief Forester, FLRNO and its in-house practice and growth and yield experts, Forest Practices Board, a community of licensee and consulting practitioners, and the regional silviculture committees. Practitioners have considerable experience with regeneration silviculture and are proud of their accomplishments at the stand-level. As professionals they recognize that they have the opportunity to recommend innovative standards and practices, and incorporate these in FSPs and site plans, but this rarely occurs. They are concerned that the combined outcome of their efforts does not reflect the diversity of the ecosystems they manage, nor meet landscape-scale or long term objectives, in part because the latter are so poorly defined. At the stand-level, the link between condition at free-growing and at maturity is uncertain. At the landscape-scale, the match between stand-level outcomes and forest-level goals is unclear. Clarification of both should occur at the TSA level, via the emerging institution of TSA committees/communities of practice and through vehicles such as multi-block stocking standards. The improvements that we propose do not require changes in tenure or existing institutions.

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