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## Defining Forest Monitoring Business Needs for the Kamloops TSA

Prepared for

*Al Thorne, P.Eng., RPF  
Adams Lake Lumber  
Chase, BC*

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**J.S. Thrower & Associates Ltd.** Consulting Foresters  
Vancouver – Kamloops, BC



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## 1. INTRODUCTION

### 1.1 BACKGROUND

This project explores opportunities and obstacles facing a Kamloops Timber Supply Area (TSA) forest monitoring program. Forest monitoring is a key adaptive management component that aims to improve the operational and strategic processes influencing forest resource planning. For this report, forest monitoring is defined as tracking the state and condition of the forest by measuring timber and non-timber attributes over time (Appendix I).

In British Columbia, forest monitoring has been applied at the management-unit level, with many monitoring programs already established.<sup>1</sup> A common business need addressed by these monitoring programs is to check timber supply growth and yield estimates. Another motivation is to meet third party market certification requirements. These programs utilize some or all of the Change Monitoring Inventory (CMI) procedures<sup>2</sup> developed by the Ministry of Sustainable Resource Management (MSRM).

In the Kamloops TSA, forest management initiatives that a monitoring program could support include:

- Certification to meet the increasing demand by markets for certified wood products.
- Achieving sustainable forest management objectives, which include conservation of biodiversity and conservation of soil and water resources.
- Implementing the Defined Forest Area Management (DFAM) process.

### 1.2 PROBLEM STATEMENT

A forest monitoring program has not been established on the Kamloops TSA. Adams Lake Lumber is researching the feasibility of establishing a cooperative forest monitoring project that includes other TSA licensees. Before establishing a TSA-wide monitoring program, consensus from all TSA licensees on defined business needs and monitoring objectives is required.

### 1.3 PROJECT OBJECTIVES

The goal of this project was to compile a list of potential business needs for monitoring and solicit opinions of potential monitoring program stakeholders. These opinions will assist Adams Lake Lumber with building a case for the development of a Kamloops TSA monitoring program.

The purpose of this report is to:

1. Provide forest monitoring background information for all licensees (Appendix II).
2. Identify potential business needs for a Kamloops TSA monitoring program (Section 2).
3. Discuss the reaction of TSA licensees to proposed business needs (Section 3, Appendix VI)

### 1.4 TERMS OF REFERENCE

This report was prepared by A.Y. Omule, *PhD RPF* and Eleanor McWilliams, *MSc RPF* of J.S. Thrower & Associates Ltd (JST) for Al Thorne, *PEng RPF* of Adams Lake Lumber. Funding was provided through the Forest Investment Account (FIA).

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<sup>1</sup>Monitoring programs exist on Tree Farm License (TFL) 35 (Weyerhaeuser), TFL 52 (West Fraser Mills), TFL 30, 37, and 48 (Canfor), Ft. St. John TSA, and the Hope Innovative Forestry Practices Agreement (IFPA) (Interfor).

<sup>2</sup>Ministry of Sustainable Resource Management. 2002. Change monitoring inventory ground sampling procedures for the provincial change monitoring inventory program, *version 1.2*. <http://srmwww.gov.bc.ca/tib/publications.htm>.

## 2. BUSINESS NEEDS

### 2.1 THE PROCESS

The following steps were performed to define potential monitoring business needs:

1. Obtain and review important background material, including the Kamloops TSA Sustainable Forest Management Plan (SFMP)<sup>3</sup>, the Ministry of Forests (MOF) Working Paper on SFMP<sup>4</sup> Development, the Kamloops Land and Resource Management Plan (LRMP)<sup>5</sup>, the Kamloops TSA Rationale for Allowable Annual Cut (AAC) Determination<sup>6</sup>, and Forestry Plan #1 for the Adams Lake IFPA;<sup>7</sup>
2. Communicate the background information to potential stakeholders (Appendix IV);
3. Identify potential business needs applicable to the Kamloops TSA (Section 2.2); and
4. Interview stakeholders (Appendix V) and record their reaction to the list of business needs. The stakeholders' opinions are discussed in Section 3 and Appendix VI.

### 2.2 POTENTIAL BUSINESS NEEDS

Based on the above steps (Section 2.1), the list of potential monitoring business needs in the Kamloops TSA (including the Adams Lake IFPA) includes collecting information that:

1. Supports third party market certification and SFMP reporting;
2. Supports timber supply analysis and AAC determination (e.g., increases confidence in growth and yield estimates);
3. Meets monitoring requirements defined in the Adams Lake IFPA Forestry Plan;<sup>7</sup> and
4. Supports timber supply analysis and forest health obligations through the DFAM process.

Appendix II gives a more extensive presentation of potential business needs.

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<sup>3</sup> Ministry of Forests. 2002. Sustainable forest management plan for the Kamloops timber supply area. <http://www.for.gov.bc.ca/kamloops/district/kamloops/TSAcertification.htm>. 93 pages.

<sup>4</sup> Ministry of Forests. 2002. SFMP working group working paper: developing a sustainable forest management plan. <http://www.for.gov.bc.ca/hfp/pubssfmp.htm>. 20 pages.

<sup>5</sup> Ministry of Sustainable Resource Management. n.d. Kamloops LRMP. <http://srmwww.gov.bc.ca/sir/lrmp/kam/>.

<sup>6</sup> Ministry of Forests. 2003. Kamloops timber supply area rationale for allowable annual cut (AAC) determination (effective January 2003). 56 pages.

<sup>7</sup> International Forest Products Ltd., J.S. Thrower & Associates Ltd., Timberline Forest Inventory Consultants, and Keystone Wildlife Research. 2000. Forestry Plan #1 for Adams Lake Innovative Forestry Practices Agreement. <http://www.adamslake-ifpa.ca/plans.html>. 115 pages.

### 3. STAKEHOLDER'S RESPONSES

This section summarizes Kamloops TSA licensee responses to the business needs defined in Section 2.2.

1. *Market Certification.* TSA licensees have started the certification process with the Canadian Standards Association (CSA), the Sustainable Forestry Initiative (SFI), and other third parties. These programs require the monitoring of activities in the TSA, including growth and yield, watershed restoration, and water quality. However, tenure holders believe there is significant uncertainty within the CSA process, and the implications of potential changes (such as the need for a monitoring program) are unknown.
2. *SFMP.* Tenure holders have developed a SFMP that is linked to the Kamloops LRMP and CSA certification goals. The intent is to perform administrative and compliance monitoring on all 30 indicators described in the Kamloops TSA SFMP, demonstrating progress towards achieving SFMP objectives. However, this form of monitoring determines if set goals or activities are being achieved instead of measuring actual forest conditions. Furthermore, tenure holders believe the 30 indicators described in the SFMP are evolving and may change over time. An MOF paper focusing on developing a sustainable forest management plan<sup>4</sup> states, "... An indicator measures the state or condition of a goal for a defined forest area ... Indicators pertaining directly to forest conditions are preferred over those pertaining to sustainable forest management activities..." and that "... Monitoring tracks indicators over time and space."

The Kamloops SFMP was prepared before the MOF working paper; therefore, the TSA licensees may need to update its list of SFM indicators. Agreement on a set of forest conditions worthy of monitoring expenses is necessary.

3. *IFPA.* Adams Lake Lumber developed a growth and yield monitoring sampling plan for the Adams Lake IFPA, fulfilling its IFPA Forestry Plan #1 growth and yield monitoring commitment.<sup>7</sup> This plan can be used as a blue-print for establishing an IFPA monitoring program that is applicable to the rest of the TSA. The primary business needs are to meet third party certification requirements and increase confidence in the growth and yield estimates used in timber supply analysis.

Adams Lake Lumber has not implemented this growth and yield monitoring program at the operational level. Establishing an IFPA monitoring program independent from the entire TSA would be expensive, as the IFPA area is relatively small. It is more cost-effective to establish a monitoring program for the entire TSA. For this to occur, consensus on priority business needs is required.

4. *AAC Determination.* Forest management issues identified in the recent Kamloops TSA Timber Supply Review include site productivity (site index) uncertainty and potential growth underestimation in managed stands. In addition, there is a lack of confidence in the integrity of the existing inventory.

Both issues could be addressed through a monitoring program. Improved site productivity and inventory volume estimates provide supportive information to justify an increase in the AAC. However, some industry stakeholders do not have an incentive to support the development of a TSA wide growth and yield monitoring program because of ambiguity regarding potential beneficiaries of any AAC increase. Other stakeholders suppose that any increase in the AAC would benefit the industry as a whole.

5. *DFAM*. Obligations under discussion relate to timber supply analysis and forest health activities. A monitoring program could increase confidence in site productivity estimates and inventory volumes, both of which support the Chief Forester's AAC determination. The monitoring program would also support forest health aerial and ground surveys, providing a large-scale view of health issues within the TSA. Tenure holders know the DFAM requirements are under discussion and the DFAM framework is not effective until 2004.



## 4. CONCLUSIONS

### 4.1 PROJECT RESULTS

TSA licensees did not achieve consensus on priority business needs. Until stakeholders agree upon key business needs, developing a cooperative monitoring program is premature. A lack of agreement concerning the monitoring needs of licensees stems from uncertainty regarding tenure benefits, market certification requirements, and DFAM obligations. Some potential stakeholders do not believe that direct benefits from a monitoring program exist, while others believe the industry would collectively benefit. These stakeholders believe a monitoring program could build a foundation for supplying useful data towards future DFAM timber supply analyses.

### 4.2 RECOMMENDATIONS FOR ADAMS LAKE LUMBER

As a result of the findings from this project, we recommend:

1. Adams Lake Lumber, or another TSA proponent, revisit the initiative for a joint TSA monitoring program once CSA standards and indicator definitions have stabilized, the allocation of any monitoring program benefits is clarified, and the DFAM process and obligations are identified.
2. For the Adams Lake IFPA, two options are available:
  - 1) Adams Lake Lumber can consider implementing its own growth and yield monitoring program that meets the IFPA's business and monitoring objectives. This program could be spread over several fiscal years to reduce pressure on Adams Lake Lumber's annual budgets. The IFPA monitoring plan can be designed with enough flexibility to allow for integration into an overall TSA monitoring program, should one arise.
  - 2) Adams Lake Lumber defers installing the growth and yield-monitoring program until a TSA wide monitoring program is developed.

## APPENDIX I - MONITORING

The ambiguous term “monitoring” is widely used.<sup>8</sup> Under the principles of SFM planning, monitoring is defined as the periodic measurement and assessment of change of an indicator, where an indicator is a variable used to report progress towards achieving a goal. Goals are broad, general statements that describe a desired state or condition related to one or more forest values.<sup>9</sup> In this context, two broad types of monitoring can be recognized. The first type of monitoring, which may be referred to as “administrative monitoring”, checks that planned SFM activities are carried out (i.e., did we do what we said we were going to do?). An example is monitoring to ensure conformance with established Visual Quality Objectives (VQOs). Most administrative monitoring can be carried out internally by individual licensees.

The second type of monitoring, which is examined in this report, may be referred to as monitoring the state of the forest, which includes activities that measure timber and non-timber variables over time. *GY monitoring*, which is the process of checking growth and yield estimates for a defined population, is in this broad category. Some of the variables within a forest monitoring program include volume, wood quality, species composition, site productivity, and coarse woody debris. Monitoring the state of the forest requires a long-term commitment to permanent sample plots. To be cost-effective, it is best addressed as a joint venture among licensees.

Monitoring is a key process in adaptive management. It is the feedback loop that provides information for continuous improvement. The level of success in achieving objectives can be evaluated, and planning and management activities can be improved accordingly.

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<sup>8</sup> The term “monitoring” is generally used to describe the process of checking or regulating some defined activity. It is also used interchangeably with the word “measuring”. The literature is filled with numerous kinds of “monitoring”, for example: adaptive monitoring, biodiversity monitoring, change monitoring inventory, compliance monitoring, ecosystem monitoring, effectiveness monitoring, environmental monitoring, fertilizer application monitoring, fertilizer response monitoring, forest health monitoring, forest monitoring, growth and yield monitoring, habitat monitoring, herbicide application monitoring, implementation monitoring, silviculture monitoring, trend monitoring, validation monitoring, etc. So the bottom line is, don’t worry what a monitoring program is called, focus on what is being done and why. What are the objectives? Where can the results be applied? How can the results be used?

<sup>9</sup> These are the CAN/CSA-Z808/809-96 definitions.

## APPENDIX II - POTENTIAL BUSINESS NEEDS

As stated previously, monitoring involves observing vegetation changes and trends in the forest over time based on permanent sample plots (PSPs). There are several possible business reasons to track changes and trends in vegetation attributes in the Kamloops TSA. These reasons include:

1. *Check the projections of volume and site productivity in managed stands* – to provide a level-of-comfort on the accuracy of change projections in immature and mature stands used in timber supply analysis. The aim could be to check the ability of growth models to track change in timber attributes (volume and site index) from *given* initial conditions, or *independent* of the initial conditions, in the TSA. Projections of volume and site index could be checked by comparing the predicted change or yield over a period to the observed changes or yield from the monitoring points.<sup>10</sup> If there were no agreement, the source of the discrepancy would have to be identified. The disagreement could, for example, be included in the Chief Forester's TSR rationale statements as impetus for further investigation if the disagreement has a significant impact on management decisions.<sup>11</sup>
2. *Check the projections of stand dynamics in natural stands* – To provide a level-of-comfort on the accuracy of change projections of species composition and volume in natural stands. Projections of species composition and could be checked by comparing the predicted change over a period to the observed changes from the monitoring points. If there were no agreement, the source of the discrepancy would have to be identified.
3. *Periodic inventory audit of existing volumes* – To check the accuracy of standing volumes prior to timber supply analyses. These comparisons could be done in a manner similar to the past Inventory Audit program, which attempted to answer the question: "How accurate, on the average, are the yield predictions for the TSA?". This information would provide a measure of uncertainty in the inventory of existing volumes.
4. *Meet CSA certification requirements* – Demonstrate that the indicators and objectives in the SFMP are met. This could be achieved by observing and interpreting the trends over time in forest indicators.
5. *Wood quality* – to provide data to estimate wood quality in managed stands. This could involve, for example, measuring branch diameters over time.
6. *Track non-timber vegetation cover* – To detect changes in presence or proportion of plant species as an early warning indicator of climate or other changes and impacts (e.g. associated insect infestations), and to quantify rare plants (potentially needed for certification and Pesticide Management Plans).
7. *Forest health database* - To be queried to provide an overall picture of forest dynamics, such as incidence of mountain pine beetle and root disease infestations over time. The monitoring data could be used to help quantify the mountain pine beetle and root rot losses over time.

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<sup>10</sup> J.S. Thrower & Associates Ltd. 2000. Graphical & statistical analysis for monitoring estimates of change at the management-unit level. March 2000. Contract report prepared for the Ministry of Forests, Victoria, BC. <http://srmwww.gov.bc.ca/tib/g&y/reports/mgmtmon.pdf>. 14 pages.

<sup>11</sup> J.S. Thrower & Associates Ltd. 1999. Conceptual Methods for Change Estimation and Monitoring of Vegetation Resources Version 2.0. Contract report prepared for the Ministry of Forests, Victoria, BC. <http://srmwww.gov.bc.ca/tib/g&y/reports/change.pdf>. 23 pages.

8. *Other purposes* – Given the expense of plot establishment, it is prudent that the data collected is used for as many purposes as possible. Thus, the monitoring data could be used for other purposes, such as VRI statistical adjustment, site index adjustment, and development of growth models. These linkages and other uses are discussed further in Appendix III.

The most common business needs in management units where monitoring programs have been established in BC are points 1 and 4.

## APPENDIX III - OTHER APPLICATIONS OF MONITORING DATA

### VRI Statistical Adjustment

A portion of PSPs established for monitoring purposes could be used towards plots established for VRI phase II. Data from fixed area PSPs and variable radius temporary sample plots (TSPs) currently established for VRI Phase II can be combined. Single fixed area PSPs are less efficient<sup>12</sup> for estimating current volume than the VRI Phase II prism plot cluster, but if the plots are already established, they could be used to reduce the number of required Phase II plots. Theoretically, inventory and monitoring plots should be kept separate so that the monitoring plots provide an independent check of the inventory and inventory projections. Practically, the implications of using plots for both inventory and monitoring should be minimal if the monitoring plots make up a small portion of the inventory plots and the cost savings offsets these minimal implications.

### Developing Growth Models

BC has a long history of establishing and re-measuring PSPs<sup>13</sup> to develop and maintain GY models. Most of these PSPs were subjectively<sup>14</sup> located in natural and treated stands, or established as part of designed experiments. Monitoring plots could be used to augment the data sets used for model development. There is risk to doing this as it could result in incorrect conclusions from monitoring. This risk is a function of the degree to which the monitoring data has influenced the model. For example, the risk would be highest where most of the same data used to develop a model (e.g., VDYP) were also used to check the estimates from the model. Ideally, completely independent PSPs would be used to develop and check models, however, the costs of maintaining two independent sets of plots is likely prohibitively expensive and unnecessary.

In BC, most GY models (e.g., TASS, VDYP7, and PrognosisBC) are developed using data from a wide range of areas and stand conditions. Consequently, the risk of a model projection being largely influenced by the data from any given management unit is low. It should be noted that other types of modeling data (e.g., experimental plots to determine treatment responses) will still be needed in addition to plots established for monitoring and model development.

### Site Index Adjustment

Many TFLs and most Innovative Forestry Practices Agreement (IFPA) areas in the province have chosen a statistical approach to provide unbiased estimates of potential site index (PSI) for yield projection in post-harvest regenerated (PHR) stands in timber supply analysis. The data are collected from randomly selected plots across the management unit and used to adjust preliminary estimates attached to each polygon for the entire management unit. This approach has been widely used by industry (on more than 20 landbases) and is accepted for generating managed stand yield tables for application in timber supply projections.

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<sup>12</sup> Empirical evidence from TFL 37 suggests that the single CMI plot is approximately 30% less efficient for estimating current volume than the VRI Phase II prism plot cluster. That is, sampling for net volume using the single CMI plot would require 30% more plots than would the five-point VRI cluster, to attain the same target sampling error.

<sup>13</sup> For example, the Growth Natural Program.

<sup>14</sup> Plots purposely established in fully stocked portions of stands. Monitoring plots will be randomly or systematically located.

A monitoring program does not provide enough samples in suitable stand types to complete an SIA project. However, data from monitoring plots can be used for this purpose. Using data from the monitoring plots to develop the SIA theoretically compromises the independence to monitor the site index estimates over time. However, this potential problem is probably not of practical significance if the proportion of monitoring plots in the overall sample used for SIA is low.

**SIBEC Estimation**

Data from all suitable PSPs should be used to contribute to the provincial SIBEC database. Data from monitoring PSPs are probably more suitable for the SIBEC database as they will be from randomly or systematically located plots as opposed to the current policy of subjectively locating SIBEC plots.

**PEM Mapping Accuracy Assessment**

Monitoring plots could be used to provide point estimates of site series to check PEM estimates of site series. However, again the observations from this program should be supplemented with many more samples to achieve the objective.

## APPENDIX IV - PRESENTATION TO THE KAMLOOPS TSA COMMITTEE

Eleanor McWilliams of J.S. Thrower & Associates made a presentation on December 5, 2002 to the Kamloops TSA Committee titled "Defining business needs for monitoring – Kamloops TSA". Following is a synopsis of this presentation:

- Definition and role of monitoring. Monitoring describes the process of checking or regulating some defined activity. It is a feedback loop, used to learn and improve management practices.
- Review of the different types of monitoring – effectiveness monitoring, implementation monitoring, compliance monitoring, growth and yield monitoring, change monitoring inventory and validation monitoring.
- Review of the monitoring needs for results based code, sustainable forest management, AAC, etc.
- Description of monitoring for sustainable forest management, which is the periodic assessment and measurement of change of an indicator. This monitoring may be administrative monitoring, monitoring the state and condition of the forest, effectiveness monitoring, or knowledge monitoring.
- Description of growth and yield monitoring, which is the process of checking growth and yield estimates and predictions for a defined population. Critical elements in this type of monitoring are clear definition of the target population and monitoring objectives, and probability sampling. This monitoring does not include controls and cannot be used to estimate or check treatment response directly.
- Discussion of examples of monitoring programs established or being considered in TFL 35 (Weyerhaeuser), Ft St John TSA, and TFLs 30 and 37 (Canfor).
- Discussion of potential current and future monitoring business needs for the Kamloops TSA. These include checking growth and yield projections, supporting market certification, supporting DFAM or IFPA requirements, tracking wood quality in managed stands, links to adaptive forest management, and data to support other activities such as site index adjustment, timber inventories, and model development.
- Potential costs of monitoring plots – establishment cost \$400,000 over a period of 2-3 years, and remeasurement cost \$150,000 every 5 years.

**APPENDIX V - POTENTIAL STAKEHOLDERS WHO RESPONDED**

Following is the list of potential stakeholders contacted to discuss the proposed potential monitoring business needs outlined in section 2.2.

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Member	Licensee
Carman Smith	Gilbert Smith Forest Products Ltd.
Al Thorne	Adams Lake Lumber
Mike Bragg	Tolko Industries Ltd.
Dave Dobi	Slocan Forest Products Ltd.
Lennart Holm	West Fraser Timber Co. Ltd. (100 Mile House)
Pat Salm	Weyerhaeuser Company (Kamloops)
Jeff Stone	Ministry of Forests (Kamloops Region)
Tony Buckley	Ministry of Forests (Kamloops District)
Jon Vivian	Ministry of Sustainable Resource Management
Bob Macdonald	Ministry of Sustainable Resource Management

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## APPENDIX VI - POTENTIAL STAKEHOLDER COMMENTS

Following is a summary of the main points raised by the stakeholders interviewed.

### *General*

- Monitoring program would be good for the TSA; MSRM willing to participate by contributing technical staff to assist with the implementation the program.
- No need for an elaborate monitoring plan at this time as we already have a reasonable streamlined monitoring format for the SFM plan that we have all committed to update; and the Kamloops LRMP is also, on some basis, doing monitoring.
- Maybe some stuff out of TSR obligations but this is probably too early.
- SIGY is considering establishing growth and yield permanent plots; are we better off supporting this program or a monitoring program?
- What is the value of temporary plots for monitoring?
- Before deciding on monitoring it is important to note that it is a long-term commitment that requires sustained support.
- If the project is FIA-funded that would be okay, however, it would be a low priority if corporate funds were needed.

### *Certification*

- Current SFMP indicators do not need a monitoring program as defined in this project.
- The SFM indicators are new, not quite sure what they mean and how they will evolve over time.
- CSA certification process is undergoing changes; hence future monitoring requirements uncertain.
- Do not see the need for a monitoring program at present; need to go slow.

### *AAC determination*

- It would provide improved growth and yield estimates that can be used by the Chief Forester in AAC determination
- Do not disagree that a monitoring program may provide improved growth and yield estimates.
- However, there is no incentive to support the program now since it is uncertain who will benefit from the program.

### *Adams Lake IFPA*

- IFPAs need to monitor innovative forest practices outlined in their forestry plans.
- Need to monitor such activities as growth and yield estimates and watershed restoration.
- Developed a growth and yield monitoring plan and done some watershed restoration monitoring.

### *DFAM*

- Monitoring program would build foundation to provide data to support DFAM timber supply obligations.
- Forest companies may not benefit individually, but they would collectively benefit from monitoring data.
- However, whose operating area would benefits accrue?
- DFAM obligations will not come into effect for another year or two.