

Resource Analysis Group

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MODEL II - OBJECTIVE-DRIVEN PERFORMANCE STANDARDS PHASE 1 - STRATEGY DEVELOPMENT

Prepared for Canadian Forest Products Ltd. Grande Prairie Operations

Background

In 1999, a committee consisting of representatives from the Land and Forest Service, Alberta Environment and Alberta's forest industry met to develop recommendations on amendments to policies related to reforestation. This group's work concluded in March 2000 when the Land and Forest Service (LFS) made recommendations to the Minister. These recommendations were not the consensus of the committee, due to differences in opinion between coniferous and deciduous timber operators.

There has been considerable interest in the new reforestation policies announced on March 10, 2000. Of specific interest is the impact on existing and future deciduous, coniferous, and mixedwood reforestation in the province. Extensive discussions on this matter between the Crown and the forest industry resulted in the decision to undertake a review by an independent council, the Alberta Reforestation Standards Science Council (Government of Alberta 2000).

The reforestation policies announced by the LFS in March 2000 include the beginnings of an expanding monitoring framework. The companion paper entitled "Implementation Framework for Enhanced Forest Management (EFM) in Alberta" indicates that the government expects licensees to substantially increase their monitoring efforts in exchange for claiming allowable cut effects (ACE) under the EFM program.

Canfor manages towards compliance with these various standards, policies and initiatives in its proactive effort to maintain both its "regulatory" and "social" licenses to cut.

The key differences from the 1991 regeneration standards include:

- Different stocking standards for all four broad cover groups (C/CD/DC/D);
- Minimum deciduous stocking in mixedwood strata;
- Minimum height requirements by drainage class and natural subregion;
- Re-classification of cutblocks (block swapping); and
- Mechanism to allocate ACE.

Introduction

The desire to implement enhanced forest management requires adaptable standards, as stated in the Alberta Forest Legacy (2000).

Canadian Forest Products Grande Prairie Operations (Canfor), is interested in developing objective-driven performance standards (the Standards) for their future regenerated stands. Canfor believes that these unique standards will:

- provide the means for monitoring the results of EFM;
- enable innovative solutions to forest management problems; and

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- better reflect the objectives of the newly developed Detailed Forest Management Plan (DFMP 2001).

The Standards will be developed in four Phases:

Table 1. Project Phases

PHASE 1:	STRATEGY DEVELOPMENT
Objectives:	Develop guiding principles and strategy Get buy-in from all stakeholders Gain preliminary approval of strategy by LFS
PHASE 2:	WORK PLAN
Objectives:	Define sampling design Define plot layout Specify measurements to be taken Develop data collection protocols Develop field manual and tally cards Develop schedule
PHASE 3:	PILOT FIELD DATA COLLECTION
Objectives:	Carry out pilot project
PHASE 4:	DATA ANALYSIS
Objectives:	Develop data compilation and analysis protocols

The purpose of this document is twofold:

1. to address the guiding principles that will direct Phase 1: STRATEGY DEVELOPMENT; and
2. To present a preliminary implementation framework that will ensure the long-term success of the Standards.

Once all stakeholders' buy-in is achieved, Canfor will seek preliminary approval from the LFS to further develop the Standards, survey design, field data collection, analysis and reporting procedures.

For further discussion on the role of operational silviculture surveys in Canfor's Growth and Yield Monitoring Program (the Monitoring Program), the reader should refer to the draft "Growth and Yield Monitoring Program" document that is being developed as part of the DFMP 2001.

Guiding Principles

This section outlines the principles that guide the development of the Standards.

[The Standards shall ensure the long-term maintenance of both conifer and deciduous profiles in the mixedwood landbase.](#)

The proportions of conifer and deciduous species are to be maintained without significant impact on both species' annual allowable cut.

[The Standards shall be based on ecosystem management principles.](#)

Ecosystem management is a cornerstone of Canfor's Forestry Principles. Canfor will use the best available science to develop an understanding of ecological responses to natural and human-caused disturbances (Canfor's Forestry Principles)

[The Standards shall be linked to current practices and DFMP objectives.](#)

The linkage between the Standards and the allowable annual cut must be transparent, defensible and scientifically validated. Reporting and spatially explicit auditing and tracking systems will be required to monitor performance as well as conformance with planned activities.

[The Standards shall be an integral part of Canfor's Growth and Yield Monitoring Program.](#)

Operationally, and from the regulatory standpoint, operational silviculture surveys are the first steps in benchmarking and validating expectations for regenerated stands. Canfor's "Growth and Yield Monitoring Program" document outlines the role of the Standards in the early growth phase of stand development.

[The Standards shall be compatible with Alberta's basic regeneration standards](#)

Every reasonable effort will be made to make the sampling design and base data collection protocols compatible with the basic provincial regeneration standards. This will help Canfor and other licensees to share data and to provide information to government reporting systems (e.g., ARIS).

[The Standards shall provide for statistically defensible data analysis](#)

Surveys will be designed to allow for objective analysis and hypothesis testing as part of the Monitoring Program. Sample precision, data collection protocols and clear

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and consistent definition of variables will be developed.

Data collected at various stages of stand development will also be used for stratum and forest-level statistical analyses as part of the Monitoring Program.

Proper procedures for organization and summarization of data are a must. Systems will allow for automated silviculture survey data compilation.

The Standards shall provide for operationally feasible and cost-effective field data collection

Survey scheduling, sampling and data collection protocols will be designed to allow for the combining of surveys, logistics, survey planning.

The Standards shall be subject to on-going review and validation

New results from research and data analysis may require the revision of standards from time to time. Continuous planning and adaptive management will provide the basis for incorporating new information. The grid-based sampling design and plot layout should enable easy incorporation of future changes (e.g., the inclusion of competition indices, height-diameter ratios etc.).

Outline of Strategy

This section provides a broad outline of Canfor's proposed strategy for the Standards. Differences between the provincial standards and Canfor's proposed regeneration standards strategy are discussed.

Administration

Compatibility with the provincial standards requires that Canfor's 17 yield groups be 'mapped' to the four strata standards (C/CD/DC/D). Table 2 presents the suggested preliminary grouping.

The Standards will utilize two independent surveys:

1. Establishment survey and
2. Performance survey.

The timing of the surveys (Figure 1) will be determined based on survival rates, expected regeneration delay, silvics of tree species, and applied treatments. It is expected that timelines will differ for lodgepole pine and white spruce.

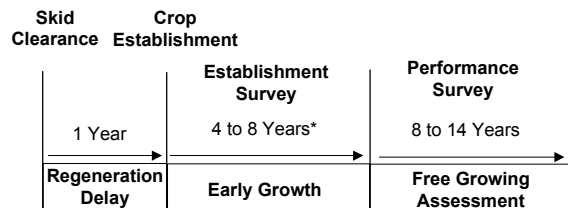
Table 2. Preliminary Mapping of Yield Groups to Provincial Strata Standards

Yield Group	Description	Original Stratum	Regen. Stratum
1	AW+(S)-AB	D	D
2	AW+(S)-CD	D	D
3	AWSW/PBSW/BWSW	DC	DC
4	BW/BWAW+(S)	D	D
5	FB+OTH	C	C
6	H+(S)/S	CD	CD
7	PB+(S)	D	D
8	PL/PLFB+(H)	C	C
9	PLAW/AWPL*	CD, DC	CD,DC,C**
10	PLSB+OTH	C	C
11	PLSW/SWPL+(H)	C	C
12	SBLT/LTSB(G,M,F)	C	C
13	SBLT/LTSB(U)	C	C
14	SBPL/SBSW/SBFB	C	C
15	SW/SWFB+(H)-AB	C	C
16	SW/SWFB+(H)-CD	C	C
17	SWAW/SWAWPL	CD	CD

Note: *CD: PL leading; DC: Aw leading stands
** in the UFH, SAL natural subregions

Large cutblocks may have smaller areas of different strata. Where applicable, surveys of those strata may be combined to allow for cost-effective assessment of the cutblock.

Figure 1. Timing of Provincial Surveys



*Note: All years are given from skid clearance

Silviculture update procedures will be developed to ensure timely update of the inventory polygons.

Sampling Design

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Canfor proposes the modification of the provincial survey sampling protocols.

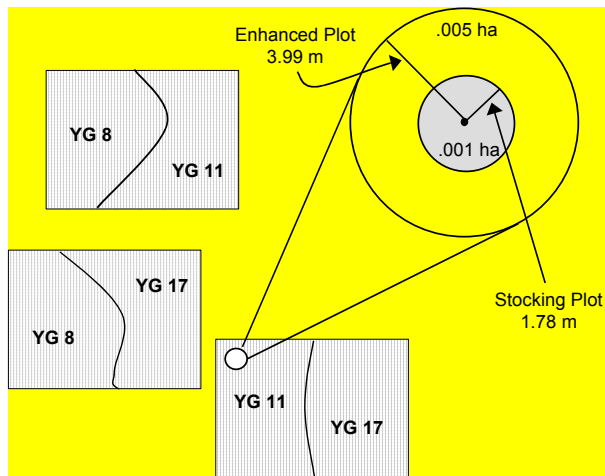
Basic regeneration standards would be examined at the block-level (e.g. stocking proportion), while information on years to breast height, site index and density would be collected at the yield group level with less intensive sampling of larger plots.

At the **Block-Level**, the mil-hectare (1.78-m radius) “stocking” plots on a sample grid will be utilized to identify crop trees, stocking percentage, crop tree height and diameter. Sampling intensity will be determined according to the provincial standards.

At the **Yield Group Level**, larger, 0.005 ha (3.99-m radius) “enhanced” plots will be measured. The enhanced plots will be concentric with the stocking plots. Density and juvenile site index (growth intercept) will be measured in these less intensive plots. The area of the blocks surveyed in the Monitoring Program reporting period, the yield group areas and the sample precision requirements (e.g., $\pm 10\%$ at the 95 % probability level) will determine the sample size of the enhanced plots. A minimum of 30 plots per yield group will be collected.

The suggested sample layout is shown in Figure 2.

Figure 2. Sampling Design and Plot Layout



Data

Density and the distribution of crop trees play a very important role in growth and yield monitoring. It is felt that the mil-hectare plots do not provide sufficient information on average densities. Stocking percentage may also not capture overstocked stands very well.

Minimum, maximum and target densities will be determined for both conifer and deciduous species. The target density standards will be based on mortality models in various growth and yield tools (GYPSY, MGM, TIPSY, TASS). Canfor's PSP program in regenerated stands will help future calibration of these models to local conditions. Canfor's participation in various growth and yield associations (NIVMA, FGYA, WESBOGY) will ensure that research results on the impact of silviculture practices (treatment response) and site will be incorporated in future models. These associations are collecting information in yield groups and ecoregions similar to the Canfor FMA. Management regimes being examined are those Canfor is currently using or planning to use in the near future.

Enhanced plot centres and trees within the plot will be marked at the time of the establishment survey. This will provide some insight into mortality of juvenile stands (3-14 years as a minimum) and it might provide reliable data for adjusting planting densities.

Growth intercept data will be collected in the less intensive enhanced plots. It is proposed, that three trees per conifer and deciduous leading species will be measured in every enhanced plot.

Root collar diameter (RCD) and diameter at 15 cm height will also be collected for the three sample trees in the enhanced plots. Diameter growth and sheath volume will be calculated. Marking the enhanced plots would enable the analysis of performance over time by looking at the trajectories defined by the slope coefficient of the sheath volume progression curve and/or by examining the change in the height to RCD (HRCD) ratio.

In addition to minimum height requirements, target crop tree heights will also be determined based on the yield tables and

regeneration assumptions used in the DFMP (Table 3).

Table 3. Sample Height Performance Standards

	Yield Group	Definition	Species	Site Index	Years To BH*	Default NSR**	
Regenerated	8	PL/PLFB + (H)	Primary	PL	15.77	6	UFH
Pre-Harvest	8	PL/PLFB + (H)	Secondary	AW	18.85	10	
Natural Subregion	CMW PRP	DMW LFH					

Primary Species	YEARS FROM HARVEST								
PL	1	2	3	4	5	6	7	8	9
	BREAST HEIGHT AGE								
	0	1	2	3					
RD	0.26	0.52	0.78	1.04	1.30	1.85	2.05	2.27	

* includes 1 year regeneration delay (RD)
 ** Natural subregion for height modeling

However, the height standards will be carefully evaluated. Minimum acceptable height requirements will be based on assumed site index seed values as defined for each regenerated yield group in the DFMP. It is anticipated that target site index seed values will be 'split' by site class and minima will be determined as 25 % above the observed minimum site index values for the range. This will ensure that height requirements are in line with DFMP assumptions while maintaining the natural range of variability.

Average target height and site index requirements will have to be met at the yield group level analysis of the data. Growth intercept models will be used at the early age (10-12 years) and the height-age models used in the DFMP will also be utilized. The impact of 'switching' from one model to another will also be evaluated.

Once data becomes available from research trials, the numbers can be refined based on site and treatment type.

Competing vegetation has long been understood to limit conifer establishment, survival and growth (Comeau 1992). What has been less well understood is the impact of competition on mid-tolerant conifer species (Cole *et al.* 1987, 1999). There has been a tendency to over estimate the capabilities of mid-tolerant species to perform in the face of minimal competition

when growing mid-tolerant conifer species. This acceptance of competition has contributed to the misconception that mixedwood reforestation comes at little cost to mid-tolerant conifer species. Monitoring of conifer plantations tended promptly in conjunction with on going research will provide better understanding of the roles of competition in stand establishment and early growth; and of the cost (to mid-tolerant conifers) of mixedwood reforestation. Monitoring will help assess if thresholds used to trigger and treatments used to attain competition control are adequately achieving conifer management objectives.

Free-to-Grow (FTG) status will be monitored in performance surveys as well as the effectiveness of vegetation management treatments.

For the establishment period Canfor proposes to use Comeau's competition index (Comeau 1992, Comeau 1993, Comeau *et al.* 1993).

For performance surveys Canfor proposes to use two criteria:

- Basal area of woody competition versus basal area of the crop tree:** if the basal area of woody competition was greater than 60 % of the crop tree basal area Canfor would prescribe a treatment
- Height to RCD ratio:** spruce would have to have a ratio of less than 60:1 and lodgepole pine a ratio of less than 50:1.

So if the first criterion was met but the trees exceeded the HRCD ratio a treatment would also be prescribed.

If these criteria were not met on more than 25% of the blocks in an ecoregion and yield group stratum, changes to stand tending protocols would be initiated to ensure competition control occurs earlier in the stand renewal process.

These criteria are subject to on-going research and operational validation. New findings will be incorporated as soon as they become available.

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Stocking percentages, SR and NSR areas (> 4 ha) will be reported for blocks >20 ha at both the block and yield group levels. For blocks <20 ha voids exceeding 20% of the area will be reported.

A block must pass the 2000 regeneration standards for both stocking and minimum height requirements according to the C/CD/DC or D standard established for the block.

For every reporting period, stocking and enhanced plot data will be aggregated for growth and yield monitoring purposes.

Stocking percentages by yield group will be calculated (Table 4) to ensure satisfactory overall stocking.

Density, site index and years to BH values, as well as information on regeneration delay will be assessed based on the enhanced plots. Values will be compared and validated against DFMP growth and yield objectives.

Sheath volume and HRCD ratios will also be calculated during the analysis. This information will be used in the evaluation of competition and overall silvicultural performance.

Table 4. Sample Stocking Proportion Template

Stocking Plot	Yield Group					
Plot Size: 1.78 m	1	2	3	4	5	6
Stocked Plots						
Conifer						
Deciduous						
Both						
Total Stocked						
Unstocked Plots						
Total Plots						
Stocking Percent						
Conifer						
Deciduous						
Total						

Table 5. Sample Summary Template for Monitoring Purposes

Enhanced Plot	Yield Group					
Plot Size: 3.99 m	1	2	3	4	5	6
Density						
Conifer						
Deciduous						
Total Density						
Site Index						
Conifer Species						
Conifer Site Index						
Deciduous Species						
Deciduous Site Index						
Years to Breast Height						
Conifer						
Deciduous						

Conclusion

The Model II objective-driven regeneration standards will tie juvenile stand development directly to management practices, the DFMP and other higher-level plans.

Canfor is committed to responsible forest stewardship and will ensure that activities are conducted according to the principles of sustainable forest management on public lands in their care.

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