
Dawson Creek TSA

Silviculture Strategy (Type 1)

March 2000



funded by
FOREST
RENEWAL BC



Dawson Creek TSA Silviculture Strategy (Type 1)

Acknowledgements

This interim silviculture strategy was developed through a workshop conducted at the offices of the Dawson Creek Forest District, on December 6-7, 1999. The workshop and this report were prepared and presented by Jordan Tanz of Cortex Consultants Inc. and Bryce Bancroft of Symmetree Consulting Group Ltd. Forest Renewal BC provided funding through a contract between Prince George Forest Region and Cortex Consultants Inc.

The consultants are grateful to Les Herring of Prince George Forest Region for administering this project and coordinating the six workshops undertaken in the Region, and to Winn Hays-Byl of Dawson Creek Forest District for acting as liaison and providing needed information to the consultants. The consultants are also grateful to the Dawson Creek Forest District for providing the presentation facility, and to Victoria Stevens of the Ministry of Environment, Lands and Parks for providing background information on habitat issues in the TSA. The consultants also wish to thank the workshop participants, listed below. Their contributions are the basis of this strategy.

	Name	Organization
1	Andrew Carveth	Chetwynd Forest Industries, (West Fraser Mills)
2	Mark Schoenberger	Chetwynd Forest Industries, (West Fraser Mills)
3	Don Scott	Chetwynd Forest Industries, (West Fraser Mills)
4	Mike Byl	Louisiana Pacific Corp.
5	Doug Russell	Louisiana Pacific Corp.
6	Rod Brooks	Louisiana Pacific Corp.
7	Don Rosen	Canadian Forest Products
8	Wes Neumeier	Canadian Forest Products
9	Les Herring	Prince George Forest Region
10	Frank McAllister	Dawson Creek Forest District
11	Elaine Armagost	Dawson Creek Forest District
12	Frances Hall	Dawson Creek Forest District
13	Carl Jahn	Dawson Creek Forest District
14	Regan Dickinson	Dawson Creek Forest District
15	Wojciech Szczesniak	Dawson Creek Forest District
16	Rod Kronlachner	Dawson Creek Forest District
17	Jacek Bankowski	Dawson Creek Forest District
18	Henry Hartmann	Dawson Creek Forest District
19	Danny Way	Dawson Creek Forest District
20	Paul Gevatkoff	Dawson Creek Forest District
21	Winn Hays-Byl	Dawson Creek Forest District
22	John Stevenson	Dawson Creek Forest District
23	Rod Backmeyer	Ministry of Environment, Lands and Parks



Preface

The development of silviculture strategies for TSAs and TFLs is motivated by the desire to clarify the relationship between investments in silviculture and the critical forest-level issues specific to the management unit.

The Type 1 analysis is workshop-based. It draws on the expert knowledge of the participants to identify the critical issues, derive objectives with respect to those issues, specify regimes to meet those issues, and identify the regime activities that can be implemented in the next five years. After consideration of the benefits and costs of each of the activities on each of the forest-level objectives, the participants rank the silviculture activities by priority. The result is a prioritized list of silviculture activities that are explicitly linked to the critical issues of the management unit.

Type 2 analyses are model-based, but the analysis process is fundamentally identical to the Type 1 analysis. A forest-level model is used to evaluate the impacts of regimes on the forest-level objectives, to identify the silviculture activities constituting the "preferred management scenario", and to rank those activities.

The Type 2 (model-based) analysis will result in a silviculture strategy that is considerably more appropriate and robust than the Type 1 approach, but it is more expensive and demanding of scarce modelling expertise. Hence the Type 1 (workshop-based) approach has been designed to produce an interim silviculture strategy that will serve until a Type 2 analysis can be completed. A Type 2 analysis will eventually be undertaken in the Dawson Creek TSA, possibly in 2001.

In the absence of a silviculture strategy for a management unit, the Ministry of Forests' provincial level strategy *Incremental Silviculture Strategy For British Columbia (Interim)* has provided interim guidance. A summary of this document is included as an appendix to this report.

Strategy Summary

Issues Addressed by the Strategy

While many issues were proposed and discussed in the workshop, the participants developed a silviculture strategy that addressed four issues: addressing important management uncertainties (e.g., site index estimates on backlog areas); maintaining or expanding the size of the timber harvesting land base (THLB), and in particular the balance of area in the coniferous and deciduous THLBs; addressing the pending reduction (falldown) of the deciduous timber supply forecast; security of the coniferous timber supply.

1. Uncertainties

There are presently no satisfactory estimates of future productivity from residual balsam in spruce-overstorey removal shelterwoods. This uncertainty hinders projection of future yields, and makes it difficult to evaluate the suitability of the advance regeneration balsam on these sites. It was estimated that about 13% of the district harvest was being done with this silviculture system, yet there are currently no suitable yield projection models for these stand types in British Columbia.



Concern was expressed at the workshop about the reliability of estimates of site productivity on backlog and other regenerating sites.

An issue that seems important simply because it seems to interfere with good management, is that of the land base being split into coniferous and deciduous components for determination of allowable annual cut (AAC) and regulating harvesting and other management practices.

2 Expand or maintain the timber harvesting land base

Objectives and strategies aimed at addressing this issue were related to either reclassifying or rehabilitating NSR, or converting NC Br to bring it into the THLB. Activities involve surveying, reclassifying, and various afforestation regimes.

3 Mitigate the expected reduction in deciduous timber supply and harvest levels

The harvest forecast for the deciduous landbase in Dawson Creek TSA declines after the first decade. The one strategy aimed at this issue was related to protecting regenerating aspen stands from damage by grazing cattle. Where there is insufficient coniferous stocking in backlog NSR areas (from harvesting or fire disturbance origin) deciduous stocking of acceptable species and quality is counted and retained.

4 Improve the security of the coniferous timber supply

While the coniferous harvest forecast was non-declining, and seemed not to present a problem for the district, two objectives were set for ensuring that the coniferous timber supply is secure. These were to improve the availability of regenerating stands by treating them so that they reach FG earlier than at present, and ensuring cutblocks are restocked promptly after harvest.



Tactical Priorities

The tactical priorities set by the participants represent a balance between the participant's strategic objectives for the management unit and the silvicultural opportunities available on the TSA in the next 5 years. Three activities were ranked highest by the workshop participants: retiring NSR, using the growth intercept method to improve estimates of site productivity, and developing methods for pre-harvest assessment of risk to problems with *Calamagrostis canadensis*. Table 1 lists activities identified by the participants and the rank (priority) assigned to each activity.

Table 1. Silviculture activities and areas selected by the workshop participants

Activities/Treatments	Opportunity (ha/yr)	Workshop Rank
Surveys		1
Surveys (NSR backlog), incorporating growth intercept estimates of S.I.	2500	
Surveys (current FG blocks), incorporating growth intercept estimates of S.I.	2500	
Treating deciduous and coniferous backlog NSR (not meeting minimum stocking requirements)		1
Brushing existing stems	1700	
Site preparation	1700	
Fill-planting	1700	
Brushing	1700	
Develop method for pre-harvest assessment of risk from <i>C. canadensis</i>—field test	1500	1
Convert NC Br to grazing land—survey	500	2
Protect regenerating aspen stands from grazing – grazing plan, move cattle	1000	2
Address uncertainty about development of BI understory in shelterwood systems in ESSF—survey		3
Convert NC Br to THLB		3
cut and pile	500	
mound	500	
plant	500	
herbicide (aerial application)	500	
survey	500	
fill-plant	500	
Convert NC Br to grazing land—mechanical site preparation and seeding	100	3



Table of Contents

Acknowledgements	i
Preface	ii
Strategy Summary.....	ii
Issues Addressed by the Strategy	ii
Tactical Priorities	iv
Table of Contents	v
1. Introduction	1
2. Analysis of Issues and Strategies	2
Issue 1: Uncertainty about critical inventory and growth and yield information	2
Issue 2: Maintaining or expanding the timber harvesting land base	3
Issue 3: Mitigate deciduous timber supply falldown	4
Issue 4: Security of coniferous timber supply	5
Issues Requiring Investigation ("To Do List")	5
3. Silviculture Impacts and Priorities	7
4. Silviculture Program.....	9
4.1 Tactical Priorities	9
4.2 Program Costs and Benefits	9
Appendix 1 Timber Supply Context.....	11
Coniferous Timber Supply Dynamics	11
Deciduous Timber Supply Dynamics.....	17
Appendix 2 Executive Summary, Incremental Silviculture Strategy for BC (Interim).....	24



1. Introduction

The Silviculture Strategy (Type 1) workshop draws on the expert knowledge of the participants to identify the key issues that should guide silvicultural planning on the TSA, derive objectives with respect to those issues, specify regimes to meet those issues, and identify the regime activities that can be implemented in the next five years. The key idea is that this line of logic from issues to silvicultural activities can be retraced when evaluating funding levels, ensuring that activities are funded that address critical TSA issues.

The first step in developing this line of logic is to identify the key issues that should guide silvicultural planning on the TSA. Next, the participants' objectives with respect to these issues are clearly stated. Strategies for meeting these objectives are identified, together with the silvicultural target (stand types) to which these strategies are to be applied. A plan of action, most often a silvicultural regime, is then developed to implement each strategy. This sequence constitutes the "strategic analysis" part of the workshop and the resulting compilation of issues, objectives, strategies and regimes is the silviculture strategy.

After developing the strategy, the workshop identifies opportunities to implement the regimes in the next five years and develops a program of silvicultural activities that is consistent with the strategy and is feasible with respect to the operational realities of the TSA. The impacts of these silvicultural activities on selected objectives are estimated by the workshop participants, and in a final step, the activities are ranked as to their importance with respect to the TSA issues. Development of the 5-year plan of silvicultural activity and estimating impacts and evaluating ranks of the activities constitutes the tactical analysis part of the workshop.

This report documents the results of a workshop to develop a strategy and a 5-year plan for the Dawson Creek TSA. Following this introduction, section 2 summarizes the results of the strategic analysis and section 3 presents the analysis of the 5-year plan. Issues that influence silviculture planning on the TSA were obtained from a questionnaire sent to the District, the most recent Resource Management Plan, and other documents identified by the District. Appendix 1 contains a detailed examination of the timber supply situation on the TSA, also prepared prior to the workshop, as some aspect of timber supply is often a guiding issue for silviculture planning. Appendix 2 includes the executive summary of the interim provincial incremental silviculture strategy.



2. Analysis of Issues and Strategies

This section identifies the critical issues that guide silviculture planning on the TSA and strategies developed in the workshop for addressing those issues. These strategies were assessed by the workshop participants as to their appropriateness and efficacy. Some of these strategies were selected by the participants as feasible and desirable for the TSA and are listed in Table 1. This set of strategies constitutes the silviculture strategy for the Dawson Creek TSA, as determined by the workshop participants.

While many issues were proposed and discussed in the workshop, the participants developed a silviculture strategy that addressed four issues: addressing important management uncertainties (e.g., site index estimates on backlog areas); maintaining or expanding the size of the timber harvesting land base (THLB), and in particular the balance of area in the coniferous and deciduous THLBs; addressing the pending reduction (falldown) of the deciduous timber supply forecast; security of the coniferous timber supply.

Issue 1: Uncertainty about critical inventory and growth and yield information

Strategies

1-1 Improve site index estimates for backlog areas

target: backlog NSR areas that are not FG (add growth intercept to FG surveys)

1-2 Improve site index estimates for free-growing stands

target: backlog NSR in BWBS BEC zone (add growth intercept to FG surveys)

Increase confidence of site productivity by obtaining more accurate Site Index (SI) information on backlog and free-growing stands. If as thought, the site index values are underestimates, this would allow for additional volume in the mid and long term.

The intent is to survey 2500 ha per year of NSR backlog and 2500 ha of current free-growing blocks, using the growth intercept method to obtain more accurate SI information. This updated information could then be used to update productivity potential of analysis units for future timber supply reviews.

1-3 Add deciduous species to coniferous stocking assessments

target: newly regenerated areas (expand surveys to include deciduous species, update ledger)

Utilize deciduous stocking where it exists, rather than investing effort to convert it to conifer stocking. This change implies that stocking surveys be modified to recognize deciduous species. The way the land base is split into separate components supporting coniferous and deciduous AAC makes this more complicated than it would otherwise be since shifting hectares after harvest from one component to the other (e.g., coniferous to deciduous) would change the land base size, and therefore would affect future AACs.

The LRMP recommends maintaining the areas of deciduous and coniferous species at or near their present levels. Where stocking has changed from one to the other, it was suggested that some form of land base accounting (e.g., a ledger system) should be used. The recommendation



was for equal areas presently deciduous to be changed to conifer where suited, e.g., a nurse tree shelterwood where the aspen is removed leaving a stocked spruce stand. This is a large issue that goes beyond maintaining deciduous vs. conifer stocking. It encompasses mixedwood management and the numerous pathways that it provides. Prior to implementing this approach, consultation with those responsible for mixedwood management policy is required.

It should be noted that currently where there is insufficient coniferous stocking in backlog NSR areas (from harvesting or fire disturbance origin) deciduous stocking of acceptable species and quality is counted and retained. These areas are then managed for deciduous species, and should be added to the deciduous land base.

1-4 Monitoring operational vegetation management treatments (install NIVMA plots)

target: all pre-FG areas

In TSR1 the Chief Forester indicated that vegetation management issues could ultimately affect the mid-and long-term coniferous timber supply. Installation of NIVMA plots (6 – 8 plots per year) will track success of various operational treatment regimes, aiding in future yield projections and timber supply determinations.

Issue 2: Maintaining or expanding the timber harvesting land base

There is potential in Dawson Creek TSA to expand the timber harvesting land base by rehabilitating or reclassifying hectares currently classified as NSR, NC Br, and NP Br. In addition, making unproductive area suitable for grazing might permit grazing to be shifted away from hectares that are productive or potentially productive for timber.

Strategies

2-1 Retire NSR

target: NSR backlog across District

A two-phased approach was suggested for retiring NSR. The first step is to survey to determine NSR status and treatment opportunities. Past practices, which were oriented to maintaining the coniferous land base, used conifer-dominated stocking standards. With recent harvesting of deciduous species there has been pressure to maintain the deciduous land bases and a re-examination of stocking standards. There is a need for improvement in the mixedwood stocking standards to allow for varying combinations of species given that many backlog areas have regenerated to mixtures of coniferous and deciduous species.

Draft mixed-wood stocking standards are available and may suffice for the time being. Recommendations for treatment options should be made for blocks not meeting the minimum stocking. The stands to be assessed are from the NSR backlog. A total of about 2500 ha per year has been suggested for assessment.

The second step is to implement regimes to address deficiencies in coniferous stocking:

Conifer regime options include brushing existing stems, site prep, fill planting and additional brushing. An estimated 800 ha per year may be treatable.



Deciduous regime– if deemed stocked with deciduous accept as is and record in a ledger accordingly. An estimated 800 ha per year may be treatable.

Mixed-wood regime options include brushing existing stems, site prep, fill planting and additional brushing. An estimated 900 ha per year may be treatable.

TSR1 assumes all of this land to be restocked to conifers. Some form of ledger is needed to account for deciduous-leading blocks.

2-2 Convert non-commercial brush (NC Br) hectares to make them operable (THLB)

target: areas of NC Br across the District

Increase the THLB by afforesting areas of NC Br. Target areas of NC Br that have been roaded since FRDA-funded conversions in the late 1980's. A rigorous treatment regime is required to successfully convert NCBR to make it operable. A regime of six treatments was defined, including: cut and pile, mound, plant, brush with herbicide, survey, and fill-plant. An estimated 500 ha per year may be treatable.

Depending upon the site productivity this strategy could increase the mid- and short-term harvest levels incrementally, possibly offsetting reductions from sub-optimal stocking elsewhere.

2-3 Shift grazing from THLB hectares to non-productive forest land by converting NC Br to grazing land

target: NC Br in BWBS that can be converted to grazing land

To reduce grazing pressure on newly restocked aspen cutblocks, the intent is to convert suitably located NC BR areas to grazing land. The first step is to determine the opportunities and feasibility for this to occur (with 500 ha to be assessed in the first year). Once areas have been identified and surveyed, site preparation and seeding would follow (with 100 ha estimated for the first year).

Issue 3: Mitigate deciduous timber supply falldown

Damage to regenerating aspen by grazing cattle was identified as a problem affecting deciduous timber supply. The strategy identified to address this issue was to create a grazing plan that keeps cattle out of susceptible stands during the establishment period.

Strategies

3-1 Protect regenerating young aspen stands from grazing

target: recently harvested aspen cutblocks in the BWBS BEC zone

The first activity needed to protect regenerating aspen stands from grazing is to create a grazing plan that enables successful establishment of deciduous harvest blocks (1000 ha might be appropriate in year one). The intent is to allow aspen stands to become fully stocked so as to provide medium-and long-term fibre. The grazing plan may require fencing or other forms of cattle management to limit access to recently harvested aspen cutblocks.



Issue 4: Security of coniferous timber supply

Two issues were identified related to the issue of coniferous timber supply. Reaching free-growing was identified as a problem, especially where a balsam understory remains after harvesting the spruce overstorey in shelterwood systems in the ESSF BEC zone. The second issue was the impact of *Calamagrostis canadensis* on regenerating conifers.

Strategies

4-1 Assure achievement of free-growing status

target: residual balsam remaining after removal of spruce overstorey in ESSF shelterwood harvests

In blocks where spruce has been harvested leaving a balsam understory, the performance of the residual balsam is uncertain. To provide greater certainty for future predictions some form of analysis is required to provide better estimates of future growth and yield in these types. Discussion with the Regional Research Section should occur prior to any further work on this subject. Experience at the Eliza Lake Research facility and other partial-cutting initiatives and literature may help define the problem and provide guidance.

4-2 Mitigate impact of *Calamagrostis canadensis*

target: harvested areas in BWBS BEC zone

Calamagrostis canadensis can significantly reduce stocking and growth potential in regenerating harvested blocks. To ensure adequate basic reforestation is accomplished promptly, a procedure to help rate blocks for their potential for grassing-in is needed. It was estimated that field-testing could occur on 1500 ha per year. The Regional Research Section should be contacted to determine what if any tools are presently available for grass prediction, and what treatment options have been used successfully.

Issues Requiring Investigation (“To Do List”)

As various issues, objectives and strategies were discussed in the workshop, there were inevitably some that were clouded by lack of information. Either the lack of information itself was the issue (e.g., uncertainty about site productivity), or the issue could not be resolved until further investigation provided some clarification (e.g., the impact of *C. canadensis* on yield projections in the BWBS BEC zone). These items were added to a running “To Do List” throughout the workshop. At the end of the workshop participants ranked these items by urgency (Table 2).



Table 2. Issues identified in the workshop that require investigation

Rank	Issue
1	Developing silviculture systems for mixedwood stand types.
2	Developing appropriate strategies to resolve conflicts between uses of coniferous and deciduous timber.
3	Explore concept of ledger to track the balance of the coniferous and deciduous land bases.
4	Reach agreement on mixedwood stocking standards.
5	Forest cover re-inventory (VRI and other inventories).
6	Develop aspen planting stock, identify superior aspen clones.
7	Develop methodology for pre-harvest assessment of risk of problems with <i>Calamagrostis</i> . The Regional Research Section should be contacted to determine what if any tools are presently available for grass (<i>C. canadensis</i>) prediction, and what treatment options have been used successfully.
	* Improve estimates of OAF 1 and OAF 2 in regenerating stands.
	* Improve methods for projecting growth and yield of deciduous species, (e.g., through development of MGM), particularly mortality functions in pure, deciduous leading, and mixed stands.

* these items were added to the table after the workshop

3. Silviculture Impacts and Priorities

The following worksheet, defining the elements of the interim silviculture strategy, was produced in the workshop in the Dawson Creek Forest District offices, December 6-7, 1999.

Table 3. Showing the workshop issues, objectives, strategies, targets, activities, and impacts, Dawson Creek TSA

Issues	Objectives	Strategies	Activities	Target	Opportunity Area (ha)	Supply Effects Short	Supply Effects Mid	Supply Effects Long	Qual	Habitat Effects	Jobs Days/sha	Cost \$/ha	Rank
Uncertainty about critical issues	gather information	1a improve SI estimates on backlog improve SI estimates on FG stands	add growth intercept to FG surveys (re backlog NSR)	backlog NSR	2500	0	+/-	+/-	?	0		10 to 30	1
			add growth intercept to FG surveys (re FG)	backlog NSR (in BWBS)	2500	0	+/-	+/-	?	0		10 to 30	1
		1b add deciduous to conifer stocking assessment	expand survey to include deciduous—update ledger	newly regenerated areas	2500	0	+/-	+/-	0	0		2	1
			install NIVMA plots		6 - 8 plots/yr	0	+	+	0	+/-		1100/plot	
Expand or maintain THLB	rehab or reclassify NSR (incl. NC Br, NP Br)	1c monitoring for vegetation management											
		2a retire all NSR	survey to determine opportunities	NSR backlog	2500/yr	0	+/-	+/-	0	0		40	1
			conifer treatment regime		800/yr	0	+/-	+/-	0	0		1800	1
			deciduous treatment regime		800/yr	0	+/-	+/-	0	0		0	1
			mixedwood treatment regime		900/yr	0	+/-	+/-	0	0		2600	1
			cut and pile	NC Br	500/yr		+	+		0		350	3
			mound		500/yr		+	+		0		550	3
			plant		500/yr		+	+		0		1000	3
			herbicide		500/yr		+	+		0		450	3
			survey		500/yr		+	+		0		80	3
			fill-plant		500/yr		+	+		0		500	3
	shift grazing to non-productive land	2f convert NCbr to grazing land	survey and grazing plan	NC Br	500/yr		+	+		-		25	2
			MSP and seeding		100/yr		+	+		-		500	3
Deciduous timber supply -- falldown	improve yields of regenerating aspen	3a protect regenerating aspen stands from grazing	grazing plan to move cattle out of susceptible young stands	BWBS	1000/yr		+	+				25	2
			implement grazing plan		1000/yr		+	+				50	3
Security of coniferous timber supply	improve availability of regenerating stands	4a reach FG earlier	survey (pre-early FG)	shelterwood stands in ESSF	500/yr	+/-	+/-	+/-				50	3
			develop methodology for assessing risk pre-harvest	BWBS	1500/yr	0	0	0	0	0		10	1

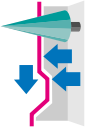


Table 4. Summary of silvicultural activities, Dawson Creek TSA

Strategies		Activities	Target	Opportunity Area (ha)	Rank
1a	improve SI estimates on backlog	add growth intercept to FG surveys (re backlog NSR)	backlog NSR	2500	1
1a	improve SI estimates on FG stands	add growth intercept to FG surveys (re FG)	backlog NSR (in BWBS)	2500	1
1b	add deciduous species to coniferous stocking assessments	expand survey to include deciduous—update ledger	newly regenerated areas	2500	1
1c	monitoring for vegetation management	install NIVMA plots		6 - 8 plots/yr	
2a	retire all NSR	survey to determine opportunities	NSR backlog	2500/yr	1
2a	retire all NSR	conifer treatment regime (brushing, fill-planting, brushing)		800/yr	1
2a	retire all NSR	deciduous treatment regime (retain deciduous stems)		800/yr	1
2a	retire all NSR	mixedwood treatment regime (brushing, fill-planting, brushing)		900/yr	1
4c	mitigate impact of <i>C. canadensis</i>	develop methodology for assessing risk pre-harvest	BWBS	1500/yr	1
2f	convert NCbr to grazing land	survey and grazing plan	NC Br	500/yr	2
3a	protect regenerating aspen stands from grazing	grazing plan to move cattle out of susceptible young stands	BWBS	1000/yr	2
3a	protect regenerating aspen stands from grazing	implement grazing plan		1000/yr	3
4a	reach FG earlier	survey (pre-early FG)	shelterwood stands in ESSF	500/yr	3
2e	convert NCbr to THLB	cut and pile	NC Br	500/yr	3
2e	convert NCbr to THLB	mound		500/yr	3
2e	convert NCbr to THLB	plant		500/yr	3
2e	convert NCbr to THLB	herbicide		500/yr	3
2e	convert NCbr to THLB	survey		500/yr	3
2e	convert NCbr to THLB	fill-plant		500/yr	3
2f	convert NCbr to grazing land	MSP and seeding		100/yr	3



4. Silviculture Program

4.1 Tactical Priorities

Tactical priorities for Dawson Creek TSA were defined in the workshop by having participants ranking strategies and activities for implementation in the next five years. Priorities were assigned through discussion and consensus among the participants, and produced a reasonably clear sense of the most important activities from the participants' perspectives. Given the currently benign timber supply forecast for the TSA, participants focused on dealing with NSR promptly, and addressing uncertainties that might affect future forecasts. Three activities were ranked highest by the workshop participants: retiring NSR, using the growth intercept method to improve estimates of site productivity, and developing methods for pre-harvest assessment of risk to problems with *Calamagrostis canadensis*.

4.2 Program Costs and Benefits

The costs and benefits of the program devised in the workshop are summarized in tables 5 - 8 (below). Table 5 shows the assumed unit costs (\$/ha, or \$/plot) and employment (person-days) associated with each activity. Tables 6-8 show the area treated, expenditures, and employment respectively by program year.

Table 5. Unit Cost (\$/ha or plot) and Employment (person-days/ha or plot) assumptions

Improve backlog surveys		NIVMA plots (per plot)	NSR Treatment regimes			Protect Aspen		Convert NCbr to THLB						Convert NCbr to grazing	
			Survey	conifer regime	mixedwood regime	survey & plan	implement	cut, pile	mound	plant	herbicide	survey	fill-plant	survey & plan	MSP, seed
\$/ha or plot	20	1100	40	1800	2600	25	50	900	550	1000	450	80	25	25	500
PD / ha or plot *	0.05	3.5	0.1	3	4	0.05	0.1	2	2	2	0.1	0.05	1	0.05	1

* these productivity figures were estimated by the consultant, and should be reviewed by the District

Table 6. Area (ha) treated by activity and year

Year	Improve backlog surveys	NIVMA plots (# plots)	NSR Treatment regimes			Protect Aspen		Convert NCbr to THLB						Convert NCbr to grazing		TOTAL
			Survey	conifer regime	mixedwood regime	survey & plan	implement	cut, pile	mound	plant	herbicide	survey	fill-plant	survey & plan	MSP, seed	
1	500	7	2500	800	900	1000	1000	500	500	500	500	500	500	500	500	10700
2	500	7	2500	800	900	1000	1000	500	500	500	500	500	500	500	500	10700
3	500	7	2500	800	900	1000	1000	500	500	500	500	500	500	500	500	10700
4	500	7	2500	800	900	1000	1000	500	500	500	500	500	500	500	500	10700
5	500	7	2500	800	900	1000	1000	500	500	500	500	500	500	500	500	10700
Yr 1 - 5	2500	35	12500	4000	4500	5000	5000	2500	2500	2500	2500	2500	2500	2500	2500	53500
Yr 6 - 10	2500	35	12500	4000	4500	5000	5000	2500	2500	2500	2500	2500	2500	2500	2500	53500
Total Yr 1 - 10	5000	70	25000	8000	9000	10000	10000	5000	5000	5000	5000	5000	5000	5000	5000	107000

* Includes prescription and layout

Table 7. Expenditure ('000 \$) by activity and year

Year	Improve backlog surveys	NIVMA plots	NSR Treatment regimes			Protect Aspen		Convert NCbr to THLB					Convert NCbr to grazing		TOTAL	
			Survey	conifer regime	mixedwood regime	survey & plan	implement	cut, pile	mound	plant	herbicide	survey	fill-plant	survey & plan		MSP, seed
1	10	7.7	100	1440	2340	25	50	450	275	500	225	40	12.5	12.5	250	5737.7
2	10	7.7	100	1440	2340	25	50	450	275	500	225	40	12.5	12.5	250	5737.7
3	10	7.7	100	1440	2340	25	50	450	275	500	225	40	12.5	12.5	250	5737.7
4	10	7.7	100	1440	2340	25	50	450	275	500	225	40	12.5	12.5	250	5737.7
5	10	7.7	100	1440	2340	25	50	450	275	500	225	40	12.5	12.5	250	5737.7
Yr 1 - 5	50	38.5	500	7200	11700	125	250	2250	1375	2500	1125	200	62.5	62.5	1250	28688.5
Yr 6 - 10	50	38.5	500	7200	11700	125	250	2250	1375	2500	1125	200	62.5	62.5	1250	28688.5
Total Yr 1 - 10	100	77	1000	14400	23400	250	500	4500	2750	5000	2250	400	125	125	2500	57377

Table 8. B14Short term employment benefits (person-years) of the silviculture program, by year and activity

Year	Improve backlog surveys	NIVMA plots	NSR Treatment regimes			Protect Aspen		Convert NCbr to THLB					Convert NCbr to grazing		TOTAL	
			Survey	conifer regime	mixedwood regime	survey & plan	implement	cut, pile	mound	plant	herbicide	survey	fill-plant	survey & plan		MSP, seed
1	0.125	0.123	1.25	12	18	0.25	0.5	5	5	5	0.25	0.125	2.5	0.125	2.5	53
2	0.125	0.123	1.25	12	18	0.25	0.5	5	5	5	0.25	0.125	2.5	0.125	2.5	53
3	0.125	0.123	1.25	12	18	0.25	0.5	5	5	5	0.25	0.125	2.5	0.125	2.5	53
4	0.125	0.123	1.25	12	18	0.25	0.5	5	5	5	0.25	0.125	2.5	0.125	2.5	53
5	0.125	0.123	1.25	12	18	0.25	0.5	5	5	5	0.25	0.125	2.5	0.125	2.5	53
Yr 1 - 5	0.625	0.6	6.25	60	90	1.25	2.5	25	25	25	1.25	0.63	12.5	0.63	12.5	264
Yr 6 - 10	0.63	0.61	6.25	60	90	1.25	2.5	25	25	25	1.25	0.63	12.5	0.63	12.5	264
Total Yr 1 - 10	1.25	1.2	12.5	120	180	2.5	5	50	50	50	2.5	1.25	25	1.25	25	527

Note: Assumes 200 days of harvesting, silviculture work, and timber processing = 1 job



Appendix 1 Timber Supply Context

Timber supply is the rate at which timber is made available for harvesting, and it is “made available” through natural, administrative, and economic processes. The forest economy draws timber from the land base in response to consumer demand, and this flow of timber is limited by the rate at which the forest can physically grow trees, and by a variety of administrative constraints. The combined effect of these administrative constraints is incorporated in the Annual Allowable Cut (AAC).

The base case of the timber supply review (TSR) forecasts future timber supply subject to current administrative constraints and assuming present market conditions. The purpose of this section is to identify the “pinch points” and constraining mechanisms that shape the timber supply forecast for the unit. Observations drawn from the TSR base case and selected sensitivity analyses are used to describe the timber supply dynamics of the management unit and to suggest how silviculture treatments might enhance timber supply.

The Dawson Creek TSA timber supply analysis (1994) separates the timber supply forecast into coniferous and deciduous components and so this section is presented in two parts:

- Coniferous Timber Supply Dynamics, which deals only with the coniferous harvest forecast and sensitivity analysis;
- Deciduous Timber Supply Dynamics, which deals only with the deciduous harvest forecast and sensitivity analysis.

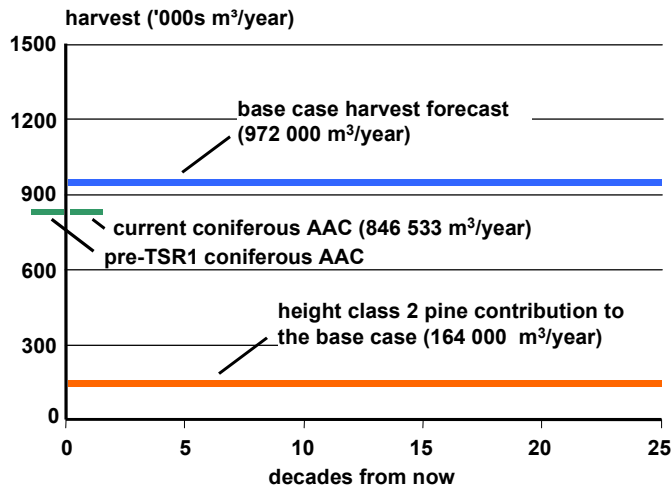
Coniferous Timber Supply Dynamics

Timber Supply and the AAC

The 1994 TSR, upon which the current AAC determination was based, shows forecasts an even-flow harvest of 972,000 m³ maintained throughout the entire planning horizon (Figure A1-1). This harvest level is approximately 13% higher than the current AAC. Mature pine stands less than 19.5 metres will contribute 164,000 m³ per year, or 15% to the total annual harvest from coniferous stands.

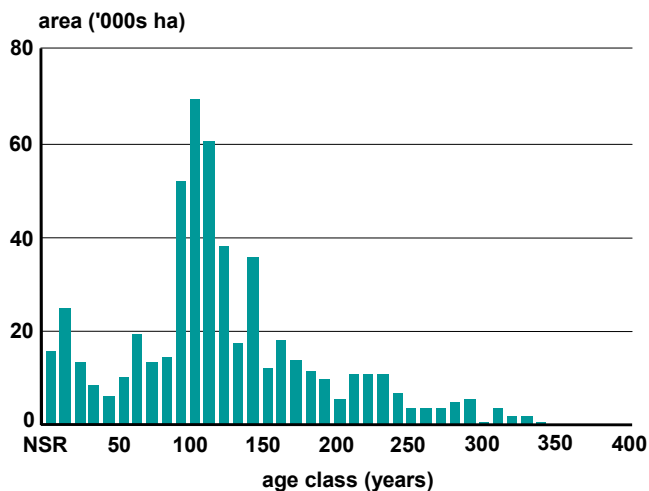


Figure A1-1. Coniferous base case harvest forecast, Dawson Creek TSA, 1994.



This even-flow harvest level for coniferous stands can be attributed to a low rate of harvest that is close to the productive capacity of the management unit and the age class structure of the coniferous timber harvesting land base (Figure A1-2). Extensive stands of mature timber allow the heavily concentrated younger stands (ages 80 to 110 years) to be preserved until later periods. These younger age classes can mature and be gradually harvested, while the regenerating stands mature. The age class distribution at 150 years (not shown) suggests a “normal” forest.

Figure A1-2. Current coniferous age class distribution-timber harvesting land base, Dawson Creek TSA 1994.



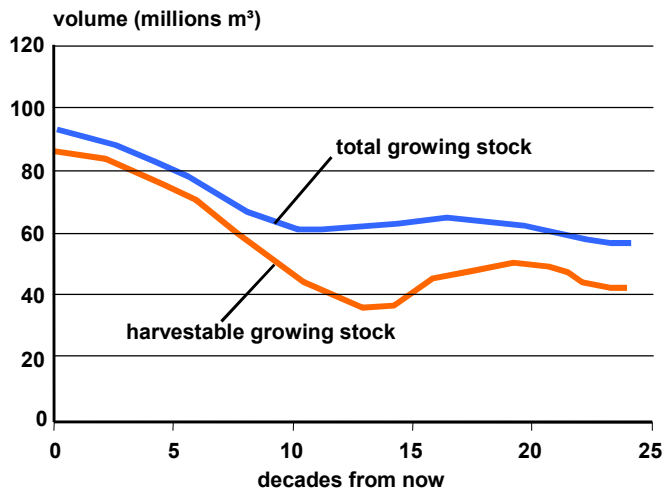
Even-Flow Harvest Level Effects

The even-flow harvest level rations mature merchantable stands until later periods allowing younger stands to reach merchantable ages without a decline in the harvest level. This drawing down of the mature stock is demonstrated in Figure A1-3, which forecasts a steady decline in



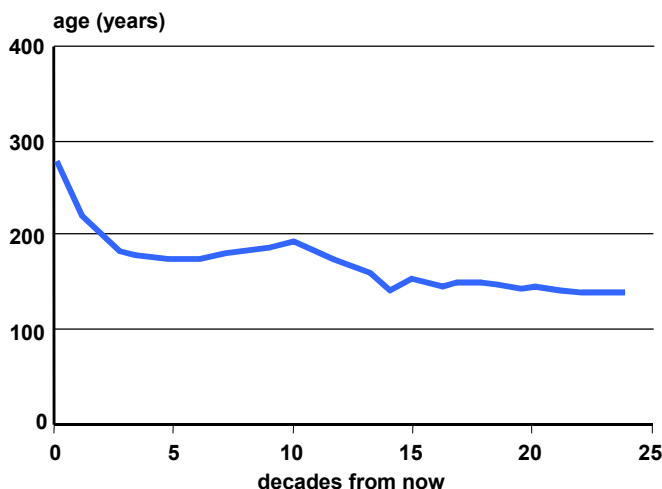
total and harvestable growing stock for the first 100 to 150 years. After this time, both measures of stock increase and reach a steady long-term level.

Figure A1-3. Total and harvestable growing stock, coniferous base case, Dawson Creek TSA, 1994



The average volume per hectare of timber harvested over time (not shown) remains steady until 150 years when there is a decline in the average volume. The average age of harvested stands (Figure A1-4) declines quickly over the first 4 decades of the planing period from 280 years to 180 years, and then more slowly to the long-term level of 130 years. This decline can be attributed to older stands ranging in ages 130-340 years being harvested for the first 40 years. Once these stands are harvested, the average age declines as the heavy concentration of younger stands become merchantable.

Figure A1-4. Average age of harvested stands over time, coniferous base case, Dawson Creek TSA, 1994

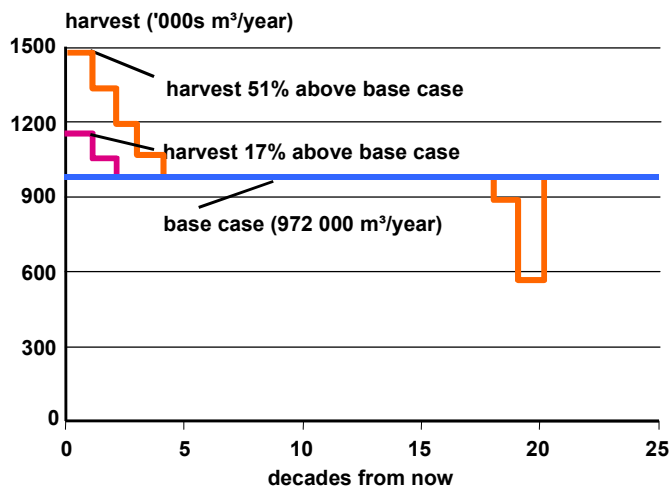




Robustness of the Base Case Harvest Forecast

Figure A1-5 demonstrates the robustness of the base case harvest forecast. The initial harvest level can be increased by 17% above the base case forecast, and reduced gradually over 2 decades (<10% per decade) down to the LTHL. If the initial harvest level is increased by 51%, the reduction to LTHL occurs over 4 decades and a shortfall is forecast to occur at 180-200 years.

Figure A1-5. Alternative harvest flows using the coniferous base case, Dawson Creek TSA, 1994



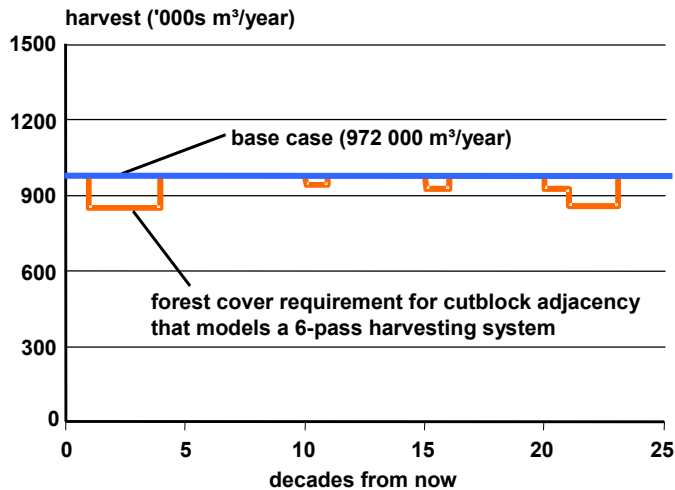
Green-up and Cutblock Adjacency

A 5-year decrease in green-up age results in a small benefit of about 1.5% of the even flow rate across the entire planning horizon (Figure not shown). This increase can be attributed to increased harvesting in visually sensitive areas, which were previously set aside until the age when a required height was reached.

In the coniferous base case forecast the forest cover requirement used to model cutblock adjacency is based on the assumption that a maximum of 33% of the area can be less than 3 metres tall at any given time – a 3-pass harvesting system. Increasing the constraint to a 5-pass system does not change the base case forecast. Figure A1-6 illustrates the effects of harvesting on a 6-pass system -- modest shortfalls occur periodically across the planning horizon. This result reinforces the earlier observation that the base case harvest forecast is quite robust.



Figure A1-6. Coniferous harvest forecast with a more stringent cutblock adjacency requirement, Dawson Creek TSA, 1994



Changing Stand Yields

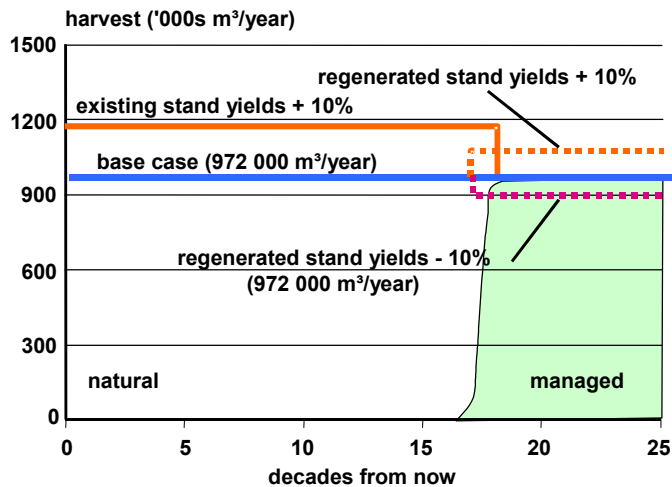
Increasing existing stand yields causes a 16% increase in the initial rate of harvest (Figure A1-7). This long-term level is maintained until period 160 when there is a step down to the long term harvest level.

Figure A1-7 also shows the implications of increasing and decreasing the regenerated stand volumes by 20%. Note that the effects of changing yields of existing and regenerated timber were determined independently.

Also plotted on Figure A1-7 is the transition (estimated) from natural to managed stands. This transition at 180 years marks the end of the mid-term of the timber supply forecast and the beginning of the long term. The short term is arbitrarily defined as the first two decades.



Figure A1-7. Coniferous harvest forecasts with changes in estimated stand yields



Coniferous Timber supply Dynamics -- Summary

The base case harvest forecast for coniferous stands is even-flow due to two features: the low rate of harvest (pre-TSR and current) that is close to the productive capacity of the management unit, and an age class structure that is heavily weighted to mature timber.

This timber supply forecast is robust with respect to management modelling parameters such as green-up age and adjacency. Increasing existing and regenerated stand yields results in significant increases in timber supply.



Deciduous Timber Supply Dynamics

Timber Supply and the AAC

The 1994 TSR, upon which the current AAC determination was based, shows the deciduous allowable annual cut can be maintained for 10 years without causing a reduction in future harvest levels (Figure A1-8). Starting from the current deciduous AAC of 886 500 m³/yr, the harvest declines steeply at 22% each decade until the long term harvest level of 480 000 m³/yr is reached in the fourth decade. The LTHL is 46% lower than the current AAC. Cottonwood stands are expected to contribute 92 000 m³ per year, or 11% to the total harvest from deciduous stands over the long term.

Figure A1-8. Deciduous base case harvest forecast, Dawson Creek TSA

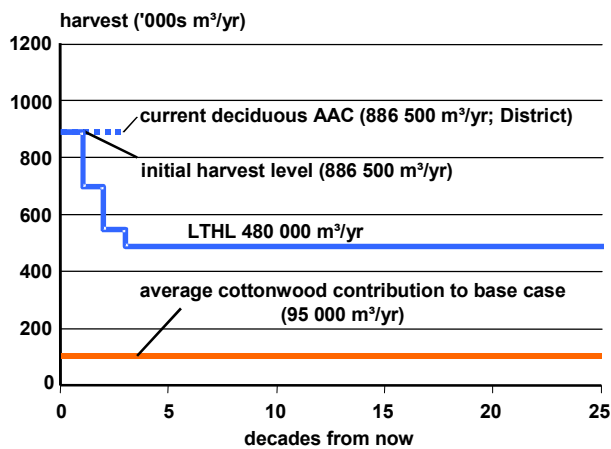
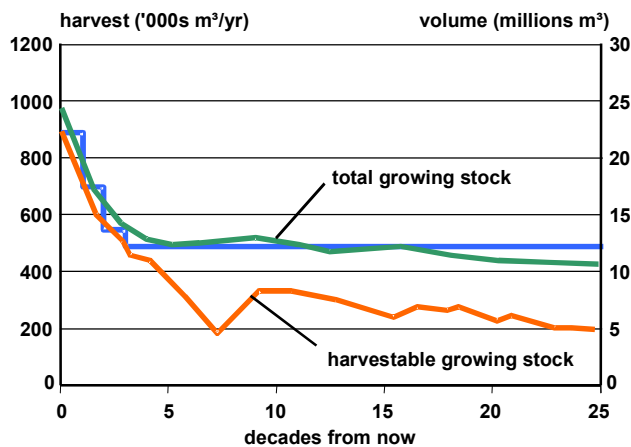


Figure A1-9. Deciduous base case harvest forecast and growing stock inventory, Dawson Creek TSA





Impending Scarcity of Harvestable Timber

Figure A1-9 overlays total and harvestable growing stock on the projected harvest for the base case forecast, showing how the timing of the depletion of the growing stock coincides with the reduction in harvest level or falldown. The harvestable growing stock is at its minimum level in decade 7, indicating a scarcity of timber in decades 6-8.

Figure A1-10 displays the deciduous age class distribution of the timber harvesting land base currently, and in 50 and 100 years. Much of the area in the current age class distribution is between 70 and 120 years old, with little timber in the younger age classes. An important management consideration in this TSA is the increased risk of decay in aspen and cottonwood older than 120 years, suggesting that a high rate of harvest might be desirable in the first few decades. Another important factor affecting the choice of short-term harvest level in the base case forecast is the need to ration the stock of existing mature timber until enough regenerating stands reach minimum harvestable age to support the long-term harvest level .



Rationing Existing Mature Timber

The rate at which the stock of existing mature timber can be depleted depends partly on the rate at which existing immature and regenerated timber becomes large enough to harvest. Since there is a shortage of young stands in the existing forest, the harvest level must be reduced rapidly after the first decade to conserve existing mature timber for harvesting in later decades. The LTHL of 480 000 m³/yr is reached in decade 4.

Figure A1-10. Stand age class distribution over time, deciduous base case Dawson Creek TSA

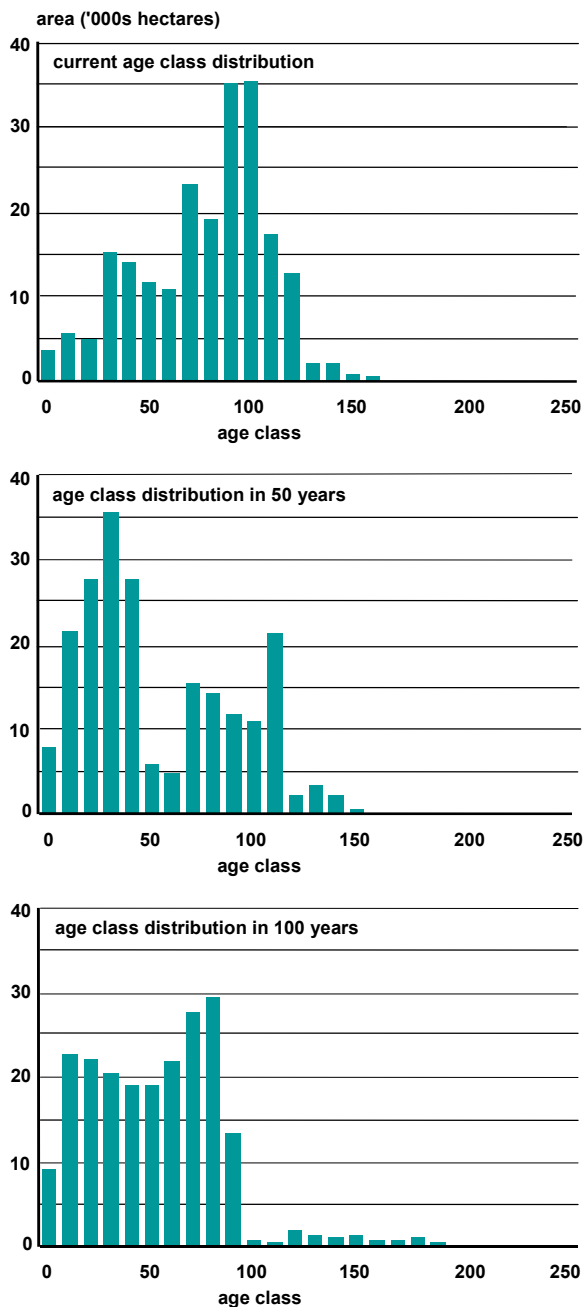
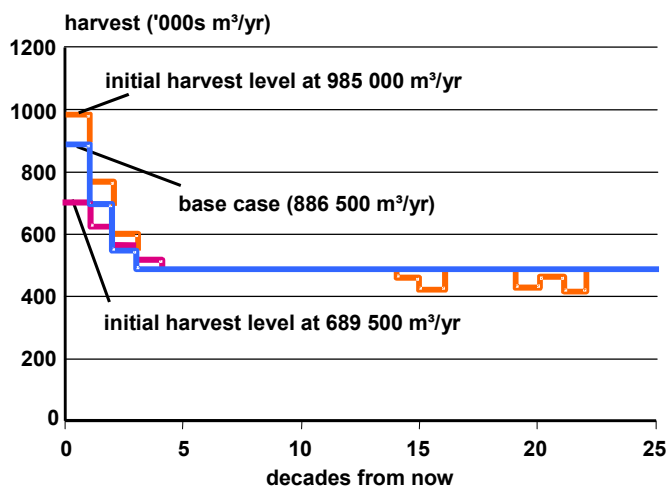




Figure A1-11 shows alternative forecasts for comparison with the base case. If the initial harvest level is set at 985 000 m³/yr, the LTHL must be reduced to below that of the base case. In other words, the rate of harvest must be constrained to ensure that the inventory is not drawn down too quickly. It is this mechanism shaping timber supply – constraints on the rate of change of the harvest level – that provides a means of capturing silvicultural benefits in the short term. Note that the efficacy of this effect is determined by the shape of the timber supply forecast and hence is specific to a management unit.

Figure A1-11. Alternative harvest flows using the deciduous base case, Dawson Creek TSA Addendum, 1996



Minimum Harvest Ages

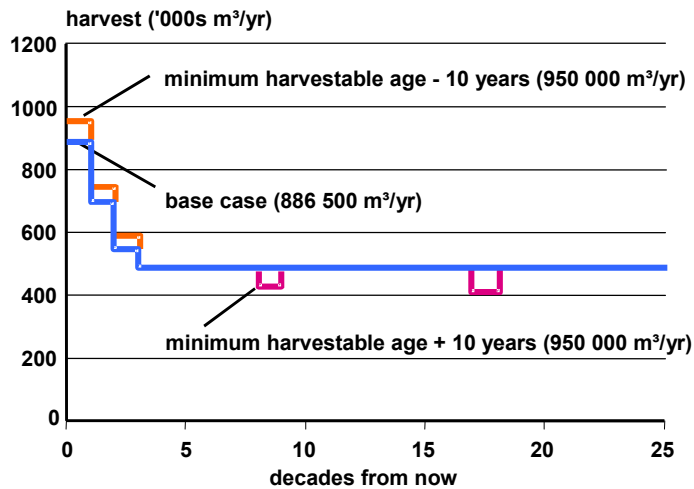
Minimum harvest ages were set by District staff based on the age at which the average annual volume growth of a stand is within 5% of its maximum or “culmination” age. Minimum harvestable ages might be reduced further through silviculture, and Figure A1-12 illustrates how much and when timber supply might be affected by doing so.

In the short term, reducing minimum harvest ages results in a significant increase in timber supply. Reducing minimum harvestable ages makes young and regenerating stands available for harvest sooner, and increases the amount of timber that is currently above the minimum harvestable age. The combination of volume available from both the young and older age classes increases the harvest level.

Increasing the minimum harvestable age has no short-term effect, and a small long-term effect on harvest levels because the minimum harvestable ages are just slightly less than the culmination ages. Since the majority of stands have reached culmination increasing the minimum harvestable age has no effect on the harvest level. If there were no surplus of mature stands, increasing the minimum harvestable age would mean regenerating stands could not be harvested as early in the planning horizon, therefore harvest levels would have to decrease as mature stands are depleted.



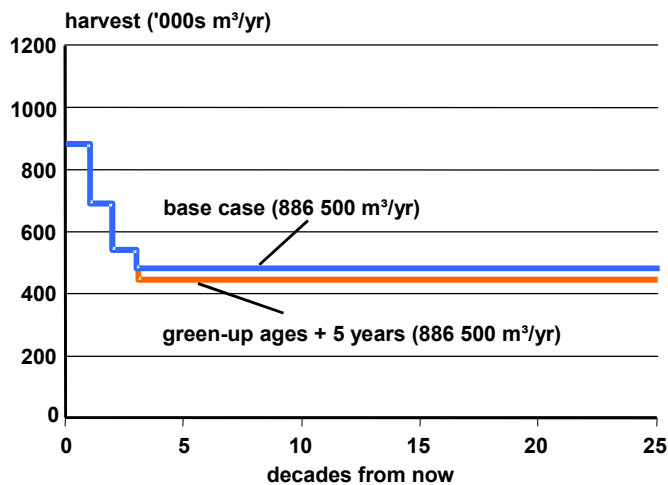
Figure A1-12. Deciduous harvest forecast with minimum harvestable ages +/- 10 years



Green-up

As illustrated in Figure A1-13, a 5-year decrease in green-up results in benefits across the entire planning horizon. The even-flow rate of harvest can be increased to approximately 4% above the base case. Again this increase can be attributed to increased harvesting in visually sensitive areas. Increasing the green-up ages means that harvestable area is constrained until certain height requirements are met.

Figure A1-13. Deciduous harvest forecast with green-up periods + 5 years, Dawson Creek TSA
Addendum, 1996



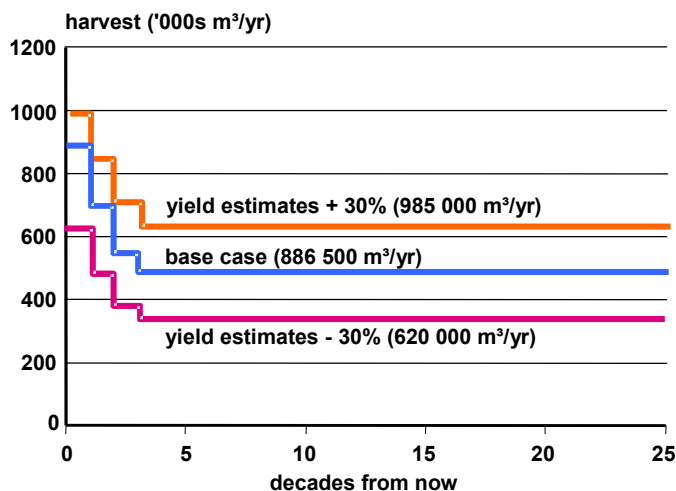


Increasing Stand Yields

Increasing stand yields has a significant effect on the short and long harvest levels (Figure A1-14). Since there is a majority of stands over the minimum harvestable age, increasing yield estimates will mean that increased volume will be obtained from these stands. As the older stand are used up, there will be a decline in the harvest, as seen with the base case, but the harvest level will be greater than the base case because regenerating stands will have greater volumes contributing the harvest level.

Decreasing the stand yields causes a drastic decline in the harvest level. This can be attributed to the fact that the potential volume from the mature stands is lessened due to the decreased yield estimates. As these mature stands are harvested there is a steady decline in the harvest level. Once the regenerating stands reach minimum harvestable age the long term harvest level is reached, but is below the base case because of decreased yield estimates.

Figure A1-14. Deciduous harvest forecast with adjusted yield estimates

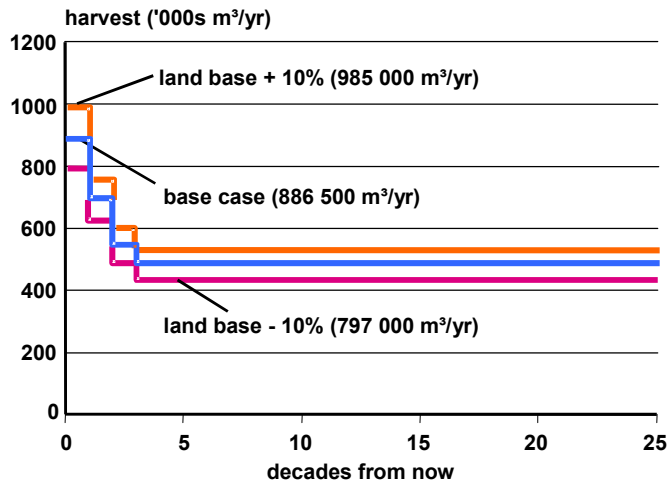




Increasing the Timber Harvesting Land Base

Various silvicultural activities can be interpreted as bringing land into the timber harvesting land base and so the TSR sensitivity analyses of the effect of increasing the timber harvesting land base (Figure A1-15) will provide information on the magnitude and timing of the benefits. Increasing the timber harvesting land base increases timber supply across the whole planning horizon.

Figure A1-15. Changes to the timber harvesting land base



Deciduous Timber supply Dynamics -- Summary

The supply of deciduous timber in the Dawson Creek TSA is shaped by the interaction of the productivity of the unit, the current rate of harvest, and administrative constraints on harvest flow. Specifically, the age class structure of the TSA is characterized by a physical shortage of younger stands approaching minimum harvesting age and the current and scheduled rates of harvest substantially exceed the growth rate and the long term harvest level. This physical shortage of supply is brought forward to decades 2 and 3 by the constraints on the rate of change of the harvest level, which ration the remaining mature timber to sustain the harvest through the periods of scarcity.



Appendix 2 Executive Summary, Incremental Silviculture Strategy for BC (Interim)

Purpose

This strategy provides guidance to the application of available funds for incremental silviculture activities. It is not tied to a specified funding level.

Government's Goals

- Sustainable Use
- Community Stability
- A Strong Forest Sector

Key Principles

- Because the distant future cannot be foretold, the best and only course of action in managing the timber resource is that which minimizes risk and maintains options.
- British Columbia's forests are important locally, provincially, nationally and globally and should be managed in this context.
- Each generation of British Columbians becomes the steward of the province's forest resources and has a moral obligation to preserve this heritage for future generations.

Working Targets

Within the context of the guiding principles:

- Minimize the anticipated interim reduction in timber supply so that provincial annual harvests of at least 65 million m³ can be achieved.
- Create a long-term timber supply capable of supporting a steady long-term provincial harvest level of at least 75 million m³.
- Over the long term, maintain the production of premium quality logs at or above 10% of total harvest.

Major Silvicultural Strategies

- Increase the use of alternative silvicultural systems and commercial thinning.
- Achieve earlier green-up of harvested areas.
- Increase regenerated stand volumes 20%.
- Eliminate all pre-1982 good- and medium-site-backlog NSR and all 1982 to 1987 backlog NSR.
- Initiate a long-rotation quality management program for stands where harvesting must be delayed.

Other silvicultural and non-silvicultural strategies must also be implemented to achieve the working targets.

Strategy Implementation

Regional and management unit strategies must be developed, followed by programs and plans to implement them