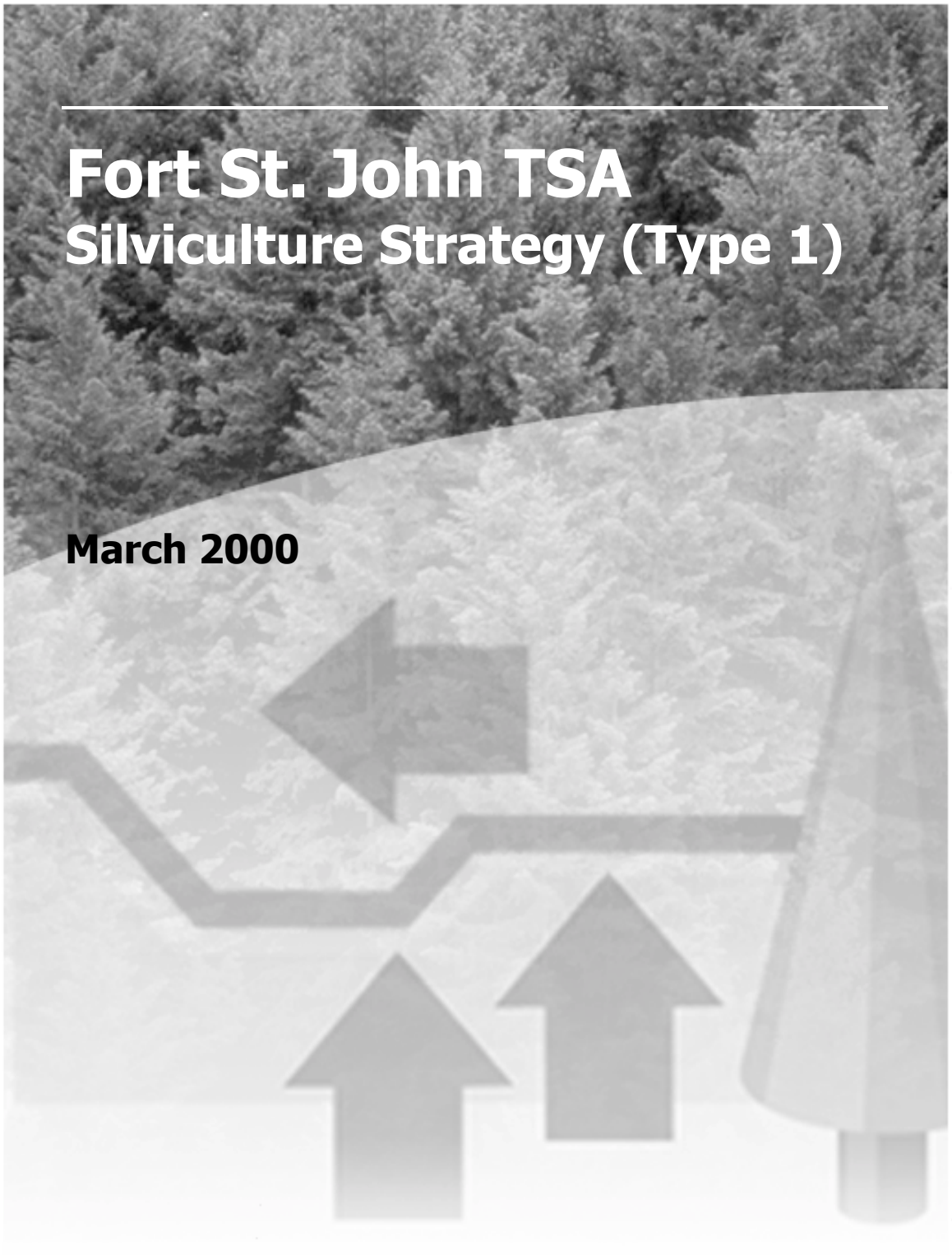
Fort St. John TSA
Silviculture Strategy (Type 1)

March 2000



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Fort St. John TSA Silviculture Strategy (Type 1)

Acknowledgements

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Name	Organization
John Dymond	Slocan Group, Fort Nelson Woodlands
Mike Byl	Louisiana-Pacific Canada Ltd.
Greg Taylor	Canfor
Paul Perkins	Forest Renewal BC
Bill Jensen	Forest Renewal BC
Bill Williams	Industrial Forestry Services
Brian Farwell	MoF Fort St. John Forest District
Richard Kabzems	MoF Fort St. John Forest District
Janice Edwards	MoF Fort St. John Forest District

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 modeling 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 be undertaken in the Fort St. John TSA in 2000.

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 three key issues: addressing backlog NSR, increasing the size of the timber harvesting land base (THLB), and mitigating the projected falldown in the harvest forecast for the deciduous land base.

Workshop participants ranked the treatment of backlog NSR as the highest priority item. Next most important was the conversion of "low" site stands, non-merchantable stands, and abandoned agricultural lands and oil patch roads and well sites.

Elements of the Strategy

1. Retiring backlog NSR

The strategy for addressing backlog NSR involves surveying, preparing prescriptions, and treating. The first task identified was reclassification using false-colour infra-red aerial photography, and then ground surveys. Prescriptions will usually involve site preparation, planting, manual and/or herbicide brushing, and surveying.

2. Increasing the size of the timber harvesting land base

Workshop participants considered options for expanding the timber harvesting land base, including reforesting or afforesting old agricultural lands and oil industry roads and well sites. Also considered were surveying, reclassifying, and where appropriate, treating "low" productivity sites, NC Br, and other non-merchantable stands.

3. Mitigating the falldown in the deciduous harvest forecast

Several strategies were identified to mitigate the projected reduction in the deciduous species harvest forecast. These strategies focused on:

- developing and using decision aids to help assess individual aspen stands and to recognize superior clones
- developing and using techniques for artificial regeneration of aspen including development of stock types, nursery procedures, and site-specific prescriptions for deciduous species.

Tactical Priorities

Tactical priorities for Fort St. John 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 clear sense of the most important activities from the participants' perspectives. In Fort St. John TSA, workshop participants felt that the most important issues were those of maintaining or increasing the area of the timber harvesting land base, and mitigating the projected falldown in deciduous harvest levels. The corresponding objectives for the first issue included retiring backlog NSR, afforesting abandoned agricultural land and old oil and gas access roads, well-sites and facilities, and utilizing low productivity lands.

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

Activities/Treatments	Opportunity Area (ha/yr)	Workshop Rank*
NSR Reclassification		
photo interpretation	10 000	1
ground surveys	2000	1
NSR Reforestation		
site preparation	200	1
planting	400	1
manual brushing	900	1
herbicide brushing	400	1
surveying	1600	1
Surveys		
low productivity sites	?	2
non-merchantable stand types	?	2
NC Br (recce survey)	200	3
old oil and gas industry roads and well sites	400	4
Aspen management		
fill-plant, or herbicide and plant to establish improved aspen genotypes on site	250	5

*** KEY TO RANK**

1 NSR is highest priority because base case depends on it

2 items that contribute to land base immediately were given high priority

3 bringing non-contributing lands into THLB

4 dispersed, high cost, questionable return on investment

5 long-term benefits

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1. 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. The issues, with objectives and strategies for each, area listed in Table 1. Regimes were developed to implement each strategy, and 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 (Table 1). This set of strategies constitutes the silviculture strategy for the Fort St. John TSA, as determined by the workshop participants.

The issues identified for the Fort St. John TSA that were identified by workshop participants were:

1. Maintaining or increasing the timber harvesting land base
2. Falldown in the deciduous harvest forecast.
3. Lack of confidence in yield projections
4. Uncertainty about the accuracy of the forest inventory
5. Concerns about the availability of grizzly bear habitat and ungulate winter range, and about poor understanding of habitat requirements for red-listed species and fur -bearers.

The first two issues were addressed directly in the workshop, while the last three issues were placed on the list of issues requiring further investigation (the "To Do List"). These are described with corresponding strategies in the following section.

Issue 1: Maintain or expand the THLB

Strategy 1-1: Retire NSR backlog

- Identify NSR versus non-NSR, using photo interpretation in concert with ground-truthing.
- Classify NSR that is deciduous leading.
- Reforest stands that require it. Check stocking of deciduous-leading stands–where adequately stocked, consider shifting the block to a deciduous polygon for future timber supply analyses.

Target area:

- area currently classified as NSR in ISIS, both harvested and otherwise.

Benefit:

More productive landbase, thereby increasing timber supply. Assumptions in the TSR are being met. (base case depends upon it).

Presently there is no falldown indicated for the coniferous timber supply, one is indicated for the deciduous timber supply (assuming the cut is achieved in the short-term). Accepting NSR stands stocked with deciduous species would increase the deciduous supply and decrease coniferous supply in the mid-term and long-term.

Strategy 1-2: Increase the timber harvest landbase through conversion of old agricultural land

To implement this strategy there needs to be an agreement with Crown Lands over jurisdiction. A paper describing the benefits of afforestation or range use is needed. The justification of including the land in the THLB could be in the form of jobs or animal unit months (AUMs).

Target areas:

Crown lands within the TSA.

Benefit:

Bring more land into the THLB to increase harvest levels in the long term, and potentially in the short- and mid-term, depending upon the status of the land–some hectares may be presently stocked with merchantable or nearly merchantable deciduous stems.

Strategy 1-3: Afforestation of oil and gas industry access roads, facilities and well sites that are no longer in use

Create treatment regimes based on present status (cover and history). Identify potential areas, survey to determine total treatable area and treat accordingly.

Target areas:

Suitable lands from Oil and Gas Commission database.

Benefit:

Bring more land into the THLB to increase harvest levels in the long and potentially short and mid term, depending upon the status of the land (some may be stocked with merchantable or nearly merchantable deciduous).

Strategy 1-4: Classify "low productivity" lands as treatable, non-treatable and not "low"

Bring not-low hectares back into the THLB, treat treatable lands where appropriate, update the inventory with accurate figures for "low-productivity" and non-treatable "low productivity" lands.

Identify potential areas, survey to determine total treatable area and treat accordingly. This will require a comprehensive sampling methodology (some 275,000 ha to assess), a set of criteria for "low productivity", a set of criteria for "treatable", a set of regimes appropriate for "treatable" sites and a mechanism to update the database with the revised values.

Once the treatable area and the regimes have been identified, the impact of treatment and desirability of implementing the plan can be determined based on the forest-level effects.

Target areas:

Areas classified presently as "low productivity". Identify areas in FC1. Use most recent TSR to check for criteria for "low productivity".

Benefit:

Bring more land into the THLB to increase harvest levels in the short-, mid- and long-term.

Strategy 1-5: Classify non-merchantable stands as to their status – merchantable presently, marginally merchantable, non-merchantable

Create classes to better define merchantability, i.e., volume categories (e.g., > 140 m^3/ha, 100 to 140 m^3/ha, 70 to 100 m^3/ha, < 70 m^3/ha or some sliding scale organized by distance to processing locations - less volumes closer to center).

Identify non-merchantable polygons in the inventory. Sampling will require a comprehensive sampling methodology (some 306,000 ha to assess), a set of criteria for non-merchantable (or categories as described above needs to be created) along with a mechanism to update the database with the revised values.

Target areas:

Areas classified as non-merchantable. Identify areas in FC1. Use most recent TSR to check for criteria for "non-merchantable".

Benefit:

Bring more land into the THLB to increase harvest levels in the short-, mid- and long-term.

Strategy 1-6: Classify and treat suitable NC brush (NC Br)

Identify potential areas, survey to determine total treatable area and treat accordingly.

Target areas:

Areas of NC Brush in newly roaded (last 5 years) areas. Target areas not available during FRDA period (e.g., Tommy Lakes).

Benefit:

Bring more land into the THLB to increase harvest levels in the long term.

Issue 2: Falldown in deciduous harvest forecast

Strategy 2-1: Improve deciduous inventory and productivity

The present accuracy of the deciduous inventory is uncertain. Audit investigations for TSR 1 were based on too small a sample size to be statistically valid. Therefore a larger sample size is needed to provide accurate deciduous volume estimates.

While TSR 1 did not indicate a problem with site index estimates, there is uncertainty regarding deciduous productivity estimates. It is suggested that productivity be estimated at the time of

field sampling. An example methodology is described by Chen et al (1998[1]) to assess aspen productivity based on ecological factors.

Target area:

Within 150 km of Ft. St. John.

Benefit:

More accurate volume estimates and growth potential for aspen leading stands. Better forecasting for deciduous timber harvest.

Strategy 2-2: Explore mixedwood management

Follow-up with present strategies and research initiatives such as those being explored in the Fort Nelson TSA and elsewhere (e.g., Alberta). Beware of the limitations of present information when modeling mixedwood treatments. Additional field study, operational trials, and adaptive experimental management are needed to determine suitable options for mixed wood management[2].

Propose and implement suitable mixedwood harvesting strategies in the TSA, monitor results. Work with modelers to help assess timber supply implications.

Target area:

Within 150 km of Ft. St. John.

Benefits:

Use of existing mixedwood structures to utilize both deciduous and conifer volumes. Studies have shown significant spruce release after aspen overstorey removal[3]. Possible increase to deciduous long term harvest level, depending upon implementation.

Strategy 2-3: Design management strategies based on clone productivity. Examine the suitability of the minimum harvest age as being used in the TSR.

Through updated inventory information identify "underachieving" clones. Where clones are not well suited to the site (i.e., early rot), harvest prior to the minimum harvest age (MHA) to capture present volume. To increase the productivity of these sites artificial reforestation (either aspen or conifers) should be considered.

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[1] Chen, H.Y.H., K. Klinka and R. Kabzems. 1998. Site index, site quality, and foliar nutrients of trembling aspen: relationships and predictions. Can. J. For. Res. 28: 1743-1755.

[2] Barrie Phillips memo to the Chief Forester Regarding: Slocan FRBC Project Report "Forest Estate Planning in the Boreal Mixedwood:. October 8, 1999.

[3] Yang, R.C. 1991. Growth of white spruce following release from aspen competition: 35 year results. For. Chron. Vol. 67. No. 6, 706-711.

Man, R. and V. J. Lieffers. 1999. Are mixtures of aspen and white spruce more productive than single species stands? Forestry Chronicle, Vol. 75, No. 3, 505-513.

Target area:

Within 150 km of Ft. St. John (decaying stands that are below the MHA).

Benefit:

Utilize present volumes before additional decay reduces their volume and value further. Reforest with suitable stock to promote better site utilization.

Strategy 2-4: Refine artificial regeneration techniques for aspen

Further development of stock types and nursery procedures is required. Development of site-specific regeneration prescriptions (e.g., density, microsite location) is also needed.

Explore aspen fertilization (watching for understory effects versus aspen response).

Target area:

Within 150 km of Ft. St. John (decaying stands that are below the MHA).

Benefit:

Reforest aspen in areas of poor quality clones. Allow more flexibility in reforestation of aspen and increase future aspen quantity and quality.

2. Silviculture Impacts and Priorities

The following worksheet, defining the elements of the interim strategy, was produced in the workshop in the Fort St. John Forest District offices.

Table 1. Showing the workshop issues, objectives, strategies, targets, activities, and impacts, Fort St. John TSA

	Issues	Objectives	Strategies	Target	Activities	Opportunity Area (Ha/Yr)	------ Timber Supply Effects ------ Short	Mid	Long	Qual	Habitat Effects	Jobs Days/ha	Cost $/ha	Rank
1	Maintain or increase timber harvesting land base	Retire backlog NSR	identify NSR/non-NSR	Area currently classified NSR on FC1	Photo interpretation reclassification - false color IR	10000		+	+	0				1
			classify NSR (decid-leading, conifer-leading, productivity)	NSR in ISIS database	- ground surveys	2000		+	+				36	1
			reforest backlog NSR	harvested NSR in ISIS	site prep	200		+	+		+/-		1000	1
					plant	400		+	+		+/-		900	1
					manual brushing	900		+	+		+/-		850	1
					herbicide brushing	400					+/-		400	1
					survey	1600		+	+		+/-		36	1
2		Manage abandoned agricultural land	afforest old agricultural land - substitute lands for range use	Crown lands in TSA: - ALR lands that have reverted to Crown	- pursue agreement with Crown Lands - identify old agricultural land suitable for afforestation or range use	250		+	+		+/-		4	3
3		Afforest oil and gas lands	afforest oil and gas access roads, facilities, and well sites that are no longer used	oil industry roads and well sites	- identify lands from Oil and Gas Commission database - survey, determine total treatable area	800		+	+		+		4	4
					prep and plant	400		+	+		+		3500	
4		Utilize "low productivity" lands	Classify "low productivity" lands as treatable, non-treatable, not "low"; utilize productive sites	area classified as "Low Productivity"	identify area in FC1 (check TSR criteria) - survey - classify	?		+	+					2
			Classify non-merchantable stands	area classified as "non-merchantable"	identify area in FC1 (check TSR criteria) - survey - classify	?		+	+					2
					treat	0, 300, 300...		+	+		+/-		3186	2
5		Utilize "low productivity" lands	Assess and treat NC Br	areas of NC Br accessed since FRDA conversions (e.g., Tommy Lakes)	- recce survey - landscape-level plans -select areas for treatment	200		+	+		+/-		4	3
6	Falldown in deciduous harvest forecast	Mitigate deciduous harvest falldown	Classification of deciduous stands recognizing differences btwn aspen clones	aspen-leading stands across TSA within 150 km of Fort St. John	- tools/decision tree to assess individual stand - aging and assessing - design management regimes for different classes of aspen clone - assess timber supply implications	within 150 km of Fort St. John	+	+	+				10	3
					harvest stands that are decaying and below present MHA	<250 ha	+				+/-			
			Use artificial regeneration techniques for aspen	harvested areas with inadequate aspen re-stocking	- further development of stock types, nursery procedures - developing site-specific prescriptions for establishment	<250 ha		+	+	+	+/-			5
				areas harvested in 6, above	fill-plant, or herbicide and plant to establish improved genotype on site	<250 ha		+	+	+	+/-		1800	5

KEY TO RANKS

1 NSR is highest priority because base case depends on it
2 items that contribute to land base immediately were given high priority
3 bringing non-contributing lands into THLB
4 dispersed, high cost, questionable return on investment
5 long-term benefits

Table 2. Summary of silvicultural activities, Fort St. John TSA

Objectives/Strategies	Activities	Target	Opportunity Area (ha/yr)	Rank
Retire backlog NSR				
identify NSR/non-NSR	photo interpretation re-classification	area currently classified NSR on FC1	10 000	1
classify NSR (as deciduous-leading, coniferous-leading, productivity)	ground surveys	NSR in ISIS database	2000	1
treat backlog NSR	site preparation	harvested NSR in ISIS	200	1
	planting		400	1
	brushing (manual)		900	1
	brushing (herbicide)		400	1
	surveys		1600	1
Expand timber harvesting land base	Survey lands outside THLB	“low” site, non-merchantable stands, NCbr	?	2
	afforest old agricultural lands in TSA	ALR lands that have reverted to Crown	250	3
	afforest old oil industry sites	old oil patch roads and well sites in TSA	800	4
Mitigate falldown in deciduous harvest forecast	fill-plant, or herbicide and plant aspen to establish improved genotype	aspen-leading stands areas harvested across TSA within 150 km of Fort St. John	< 250	5

3. Silviculture Program

3.1 Tactical Priorities

Tactical priorities for Fort St. John 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 clear sense of the most important activities from the participants' perspectives.

In Fort St. John TSA, workshop participants felt that the most important issues were those of maintaining or increasing the area of the timber harvesting land base, and mitigating the projected falldown in deciduous harvest levels. The corresponding objectives for the first issue included retiring backlog NSR, afforesting abandoned agricultural land and old oil and gas access roads, well-sites and facilities, and utilizing low productivity lands. Objectives and strategies related to the deciduous falldown issue focused on identifying and defining management regimes for productive aspen clones, and developing regeneration techniques for aspen.

Table 3. Silviculture activities and areas selected by the workshop participants

Activities/Treatments	Opportunity Area (ha/yr)	Workshop Rank
NSR Reclassification		
photo interpretation	10 000	1
ground surveys	2000	1
NSR Reforestation		
site preparation	200	1
planting	400	1
manual brushing	900	1
herbicide brushing	400	1
surveying	1600	1
Surveys		
low productivity sites	?	2
non-merchantable stand types	?	2
NC Br (recce survey)	200	3
old oil and gas industry roads and well sites	400	4
Aspen management		
fill-plant, or herbicide and plant to establish improved aspen genotypes on site	250	5

3.2 Program Costs and Benefits

The costs and benefits of the program developed in the workshop are summarized in Tables 4-7 (below). Table 4 shows the assumed unit costs and employment associated with each activity. Cost and employment figures for NSR photo-interpretation were estimated by the consultant and should be verified by the District. Tables 5-7 show the area treated, expenditures, and employment respectively by program year. No treatment of old oil and gas industry roads and well sites was included because it was ranked "4 dispersed, high cost, questionable return on investment" (Table 1).

Table 4. Unit cost ($/ha) and employment(person-days/ha) assumptions**

	NSR Reclassification		NSR Reforestation					
	Photo Interpretation**	Ground Surveys	Site Preparation	Planting	Brushing*	Survey	NC br survey	Establish superior aspen
$/ha	1.00	36	1000	900	625	36	4	1800
P-D /ha**	0.001	0.05	0.5	2.0	2.0	0.05	0.05	4

* includes manual and herbicide brushing

** cost and employment multipliers for photo interpretation were estimated by the consultant and should be reviewed

Table 5. Area (ha) treated by activity and year

	NSR Reclassification		NSR Reforestation						
Year	Photo Interpretation**	Ground Surveys	Site Preparation	Planting	Brushing*	Survey	NC br survey	Establish superior aspen	Total
1	10,000	2,000	200	400	1,300	1,600	200	250	15,950
2	10,000	2,000	200	400	1,300	1,600	200	250	15,950
3	10,000	2,000	200	400	1,300	1,600	200	250	15,950
4	10,000	2,000	200	400	1,300	1,600	200	250	15,950
5	10,000	2,000	200	400	1,300	1,600	200	250	15,950
Yr 1-5	50,000	10,000	1,000	2,000	6,500	8,000	1,000	1,250	79,750
6 - 10	50,000	10,000	1,000	2,000	6,500	8,000	1,000	1,250	79,750
Total Yr 1-10	100,000	20,000	2,000	4,000	13,000	16,000	2,000	2,500	159,500

* Includes manual and herbicide brushing

Table 6. Expenditure ('000 $) by activity and year

	NSR Reclassification		NSR Reforestation						
Year	Photo Interpretation**	Ground Surveys	Site Preparation	Planting	Brushing*	Survey	NC br survey	Establish superior aspen	Total
1	10	72	200	360	813	58	1	450	1,963
2	10	72	200	360	813	58	1	450	1,963
3	10	72	200	360	813	58	1	450	1,963
4	10	72	200	360	813	58	1	450	1,963
5	10	72	200	360	813	58	1	450	1,963
Yr 1-5	50	360	1,000	1,800	4,063	288	4	2,250	9,815
6 - 10	50	360	1,000	1,800	4,063	288	4	2,250	9,815
Total Yr 1-10	100	720	2,000	3,600	8,125	576	8	4,500	19,629

* Includes manual and herbicide brushing

Table 7. Short-term employment benefits (person-years), by activity and year**

Year	NSR Reclassification		NSR Reforestation						
	Photo Interpretation**	Ground Surveys	Site Preparation	Planting	Brushing*	Survey	NC br survey	Establish superior aspen	Total
1	0.1	1	1	4	13	0.4	0.1	5	24
2	0.1	1	1	4	13	0.4	0.1	5	24
3	0.1	1	1	4	13	0.4	0.1	5	24
4	0.1	1	1	4	13	0.4	0.1	5	24
5	0.1	1	1	4	13	0.4	0.1	5	24
Yr 1-5	0.3	3	3	20	65	2	0.3	25	118
6 - 10	0.25	2.5	2.5	20	65	2	0.25	25	118
Total Yr 1-10	1	5	5	40	130	4	1	50	235

* Includes manual and herbicide brushing

** based on 200 person-days per person-year

4. 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 index estimates for existing regenerated stands), or the issue could not be resolved until further investigation provided some clarification (e.g., the impact of silvicultural systems on wildlife habitat). 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 8).

The items on the to do list were related to three general topics: managing timber, range-timber conflicts, and wildlife-forestry conflicts. About half the items were related to timber management, and four of these ranked highest on the to do list (Pre-Inventory Analysis and upgrading forest inventories; regeneration delay; restocking backlog; and improving yield predictions, including decay, waste and breakage factors). Three items were related to wildlife habitat: requirements for red-listed species; impacts of silvicultural systems on wildlife habitat; and the findings of the 1999 grizzly bear habitat study. Four items were related to range and management of range-timber conflicts (impact of range use on THLB and timber supply; improving range/cattle management; .minimizing tree-grass-cattle conflicts; and integrating aspen regeneration with agronomic seeding for range use). Some of these topics are explained briefly following Table 8.

Table 8. Issues identified in the workshop that require investigation, Fort St. John TSA

Item	Issue requiring further investigation	Rank
1	Upgrade forest inventories (investment strategy depends on it, as do future timber supply analyses); begin with Pre-Inventory Analysis	1
2	Explore regeneration delay	1
3	Reforest and maintain stocking of backlog	2
4	Improve prediction of future yields	3
5	Improve decay, waste and breakage factors	4
6	Understand habitat requirements for: red-listed species (e.g., warblers), furbearers,	4
7	Develop strategies about impacts of silvicultural systems on wildlife habitat	5
8	Develop mixedwood management strategy	6
9	Quantify the impact of range use on THLB and timber supply	7
10	Improve range/cattle management	7
11	Minimize tree-grass-cattle conflicts through IRM	7
12	Integrated aspen regeneration and agronomic seeding—include input from licensees and MELP	7
13	Look into findings of 1999 grizzly bear study	8
14	Develop artificial regeneration techniques for aspen	9
15	Explore effect of fertilizing aspen	10

Upgrade forest inventories

Concerns were raised in the district about the accuracy of the forest inventory, and in particular about the estimates of deciduous volumes. Audit investigations for TSR1 were based on a small sample (not statistically valid). Timber supply forecasts are dependent on the quality of the inventory. Undertaking a pre-inventory analysis (PIA) to assess the current inventory is recommended as a first step.

Explore regeneration delay

Some empirical data is needed to validate or correct current estimates of regeneration delay used in timber supply analysis.

Reforest and maintain stocking of backlog

There is some uncertainty, or lack of confidence that reforested backlog hectares will remain adequately stocked. Survey evidence is needed.

Prediction of future yields

There is a noticeable lack of information about the productivity of deciduous stands, and about estimates of site productivity for deciduous species. It may be possible to estimate site productivity for aspen using an approach based on ecological factors (e.g., Chen *et al*, 1998[4]).

[4] Chen, H.Y.H., K. Klinka and R. Kabzems. 1998. Site index, site quality, and foliar nutrients of trembling aspen: relationships and predictions. Can. J. For. Res. 28: 1743-1755.

Wildlife habitat

Discussion in the workshop identified the need for better information about at least three aspects of wildlife management and wildlife habitat:

- habitat requirements for red-listed species, furbearers
- the impacts of silvicultural systems on wildlife habitat
- maintenance of critical grizzly bear habitat

Workshop participants felt that management activities should be devised to be consistent with the habitat needs of wildlife, and in particular with those of red-listed species, and fur-bearing animals. However, it was felt that some work needed to be done to identify species of concern, specify their habitat requirements, and investigate the impacts of different silvicultural systems on habitat.

Reference was made in the workshop to strategies for maintaining grizzly bear habitat that were defined in the Fort St. John Land and Resource Management Plant. Example strategies include mapping high quality grizzly habitat, consider creating designating critical grizzly bear habitat as wildlife habitat areas (WHAs), providing corridors at a landscape level where ecologically appropriate and creating plans to minimize any negative effects of resource developments on key grizzly habitat. The findings of a 1999 grizzly habitat study were also mentioned during the workshop, and should be reviewed.

Develop mixedwood management strategy

While there is little harvesting in mixedwoods today, some "coniferous" sites are developing as mixedwoods. Issues include appropriate management for these sites, and developing yield projections for the deciduous and coniferous components of the stands. Follow-up with present strategies and research initiatives such as those being explored in the Fort Nelson TSA and elsewhere (e.g., Alberta). Additional field study, operational trials, and adaptive management experiments are needed to determine suitable options for mixed wood management[5]. Some studies have shown significant spruce release after aspen overstorey removal (e.g., Yang, R.C. 1991, Man and Lieffers, 1999[6]).

Conflicts between timber and range management

A number of issues related to conflicts between timber management and range management were identified as needing investigation. These include quantifying the impact of range use on the THLB and the browsing effect on stocking density and potential yield in deciduous-leading stands; possible opportunities for reducing grazing damage to trees by improving the coordination of cattle management; and integrating aspen regeneration and grass-seeding.

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[5] Barrie Phillips memo to the Chief Forester Regarding: Slocan FRBC Project Report "Forest Estate Planning in the Boreal Mixedwood:. October 8, 1999.

[6] Yang, R.C. 1991. Growth of white spruce following release from aspen competition: 35 year results. For. Chron. Vol. 67. No. 6, 706-711.

Man, R. and V. J. Lieffers. 1999. Are mixtures of aspen and white spruce more productive than single species stands? Forestry Chronicle, Vol. 75, No. 3, 505-513.

Appendices

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 Allowable Annual 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 TSA. 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 timber supply analysis for Fort St. John TSA (1995) separated the timber supply forecast into coniferous and deciduous components, and so this section is presented in two parts:

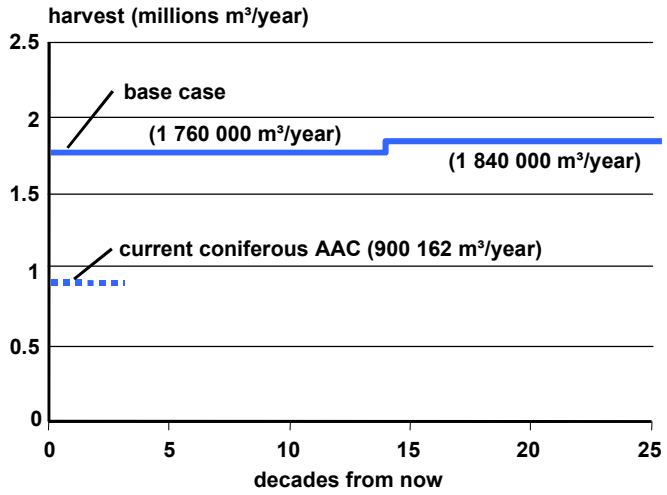
- Coniferous Timber Supply Dynamics, which deals only with the coniferous harvest forecast and sensitivity analysis
- Deciduous Timber Supply Dynamics, which deals only with the deciduous harvest forecast and sensitivity analysis.

A. Coniferous Timber Supply Dynamics

Base Case Harvest Forecast

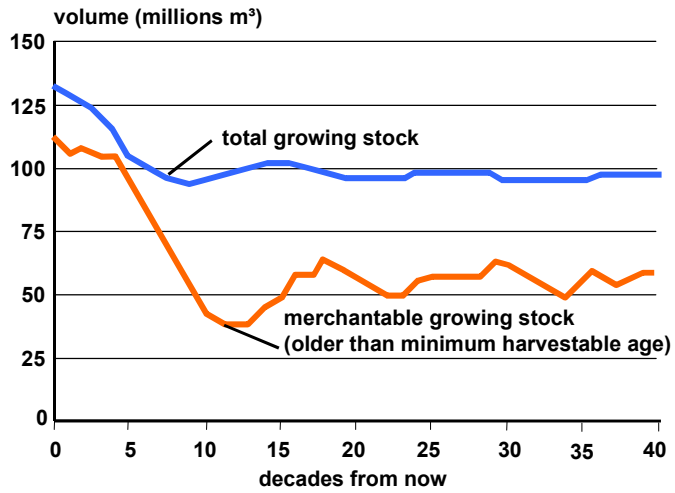
The 1995 TSR, upon which the current AAC was based, suggests that the coniferous timber supply in Fort St. John TSA is capable of supporting a non-declining harvest level of 1.76 million m^3/yr (Figure A-1). This harvest level is 95% higher than the current AAC of 900 162 m^3/yr. The projected increase in the coniferous timber supply relative to the current AAC is due primarily to the inclusion of marginal pine stands previously not contributing to the timber supply.

Figure A-1. Coniferous base case harvest forecast, Fort St. John TSA 1995



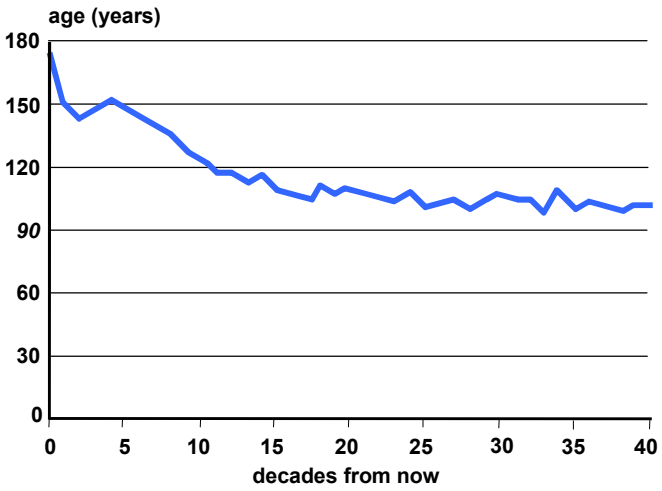
A significant portion of the existing coniferous forest is older than minimum harvestable age (Figure A-2). There is currently a total of about 131 million m^3 of coniferous volume on the THLB, and of that, about 110 million m^3 (84%) is older than minimum harvestable age. Both the total and harvestable components of the timber inventory decline over the first 100 years before stabilizing. A stable growing-stock level signifies that timber is being harvested at the productive capacity of the forest.

Figure A-2. Growing stock inventories, coniferous base case, Fort St. John TSA 1995



The average age of stands harvested in the base case forecast declines from about 175 years in the short term to about 100 years in the very long-term (Figure A-3). Over the first 150 years, the harvest is taken almost exclusively from existing older stands of timber. Regenerated stands are harvested near the minimum harvestable ages.

Figure A-3. Average age of harvested stands, coniferous base case, Fort St. John TSA



Transition from Natural to Managed Stands

Figures A-4a, -b, and -c display the age class distributions of the THLB today, in 50 years, and in 100 years. The majority of the current age class distribution ranges from 90 to 130 years. As this mature timber is harvested, younger age classes can mature, and regenerating harvested mature stands can develop until they reach or exceed minimum harvestable ages.

Figure A-4a. Age class distribution, coniferous base case Fort St. John TSA

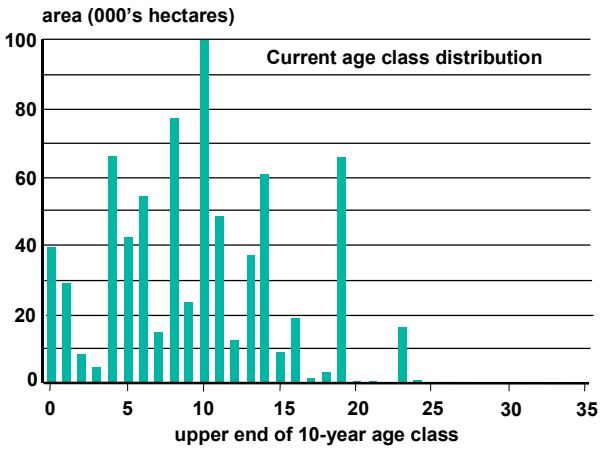


Figure A-4b. Age class distribution in 50 yr, coniferous base case Fort St. John TSA

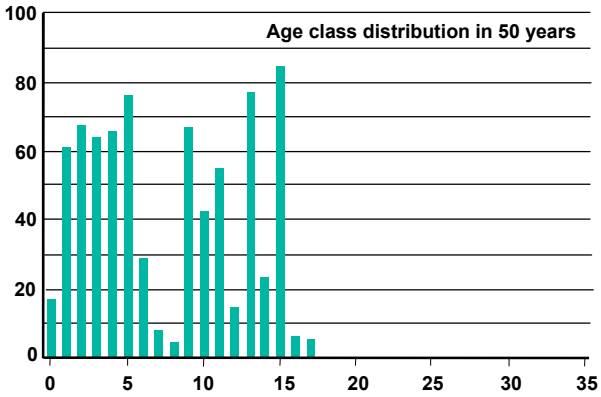
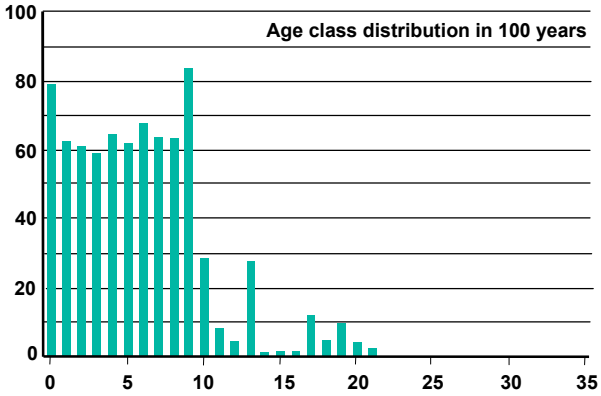


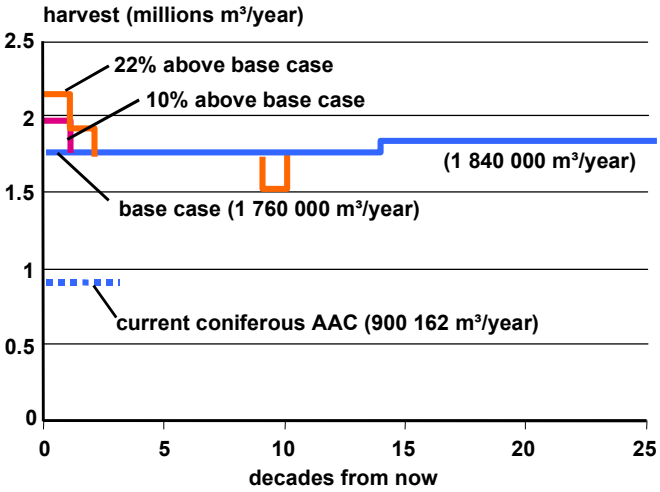
Figure A-4c. Age class distribution in 100 yr, coniferous base case Fort St. John TSA



Non-declining Harvest Level Effects

With the addition of land base area (marginal pine stands) to the THLB, the harvest forecast can begin well above the pre-TSR1 AAC and still be non-declining. Without the non-declining harvest flow constraint, a higher harvest could be maintained in the short-term, with the long-term harvest level reached in about 140 years (Figure A-5). This higher rate of harvest in the short term is achieved by harvesting the existing inventory of mature coniferous timber more rapidly than in the base case. The alternative harvest flow shows that a harvest of 2.15 million m^3/yr, approximately 22% higher than the base case harvest forecast, can be maintained for one decade. The dip below the base case harvest forecast in decade 10 is a result of the adjacency or old-growth forest cover requirements limiting the availability of stands for harvest.

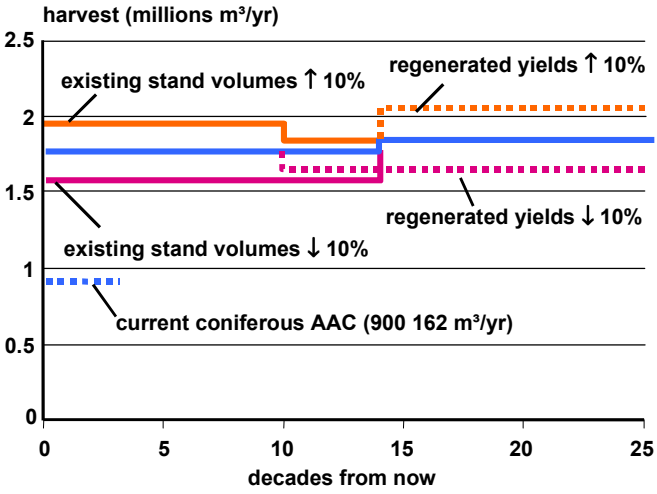
Figure A-5. Alternative harvest flows using the coniferous base case, Fort St. John TSA



Increasing Stand Yields

Changing existing-stand yields causes significant change in the initial harvest level (Figure A-6). Changing the yields for regenerated stands has no effect on the initial harvest level.

Figure A-6. Coniferous harvest forecasts with stand yields changed by 10%, Fort St. John TSA



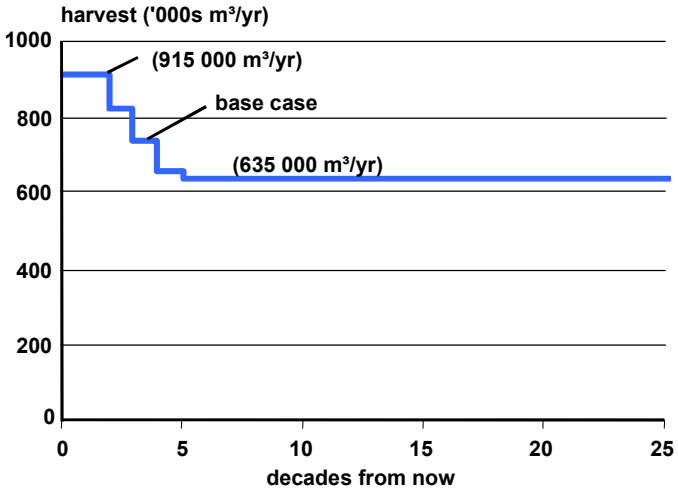
B. Deciduous Timber Supply Dynamics

Timber Supply and the AAC

The deciduous harvest forecast based on current forest management assumptions for the Fort St. John TSA indicates that the current AAC of 915 000 m³/yr from deciduous stands can be

maintained for 20 years, after which the volume harvested must be reduced by 10% per decade to avoid severe drops below the long-term level (Figure B-1).

Figure B-1. Deciduous base case harvest forecast, Fort St. John TSA



Transition from Natural to Mature Stands

Figures B-2a, -b, and -c display the deciduous age class distribution of the THLB currently, in 50 years, and in 100 years. Most of the area of deciduous forest is between 80 and 140 years old. Aspen and cottonwood reach culmination of mean annual increment (MAI) at these ages, and the incidence of decay increases significantly after about 120 years. Therefore, an important consideration in managing deciduous stands is to harvest older stands before significant volumes are lost to decay.

Figure B-2a. Current age class distribution, deciduous base case, Fort St. John TSA 1995

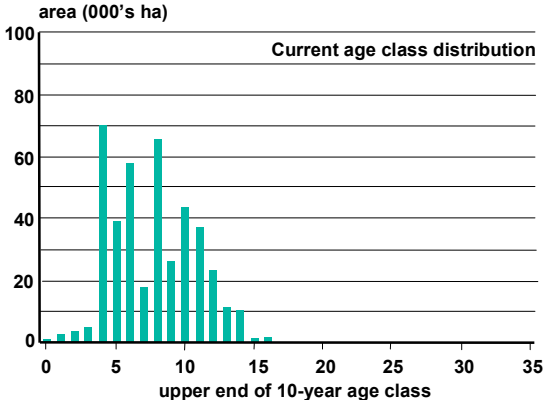


Figure B-2b. Age class distribution in 50 years, deciduous base case, Fort St. John TSA 1995

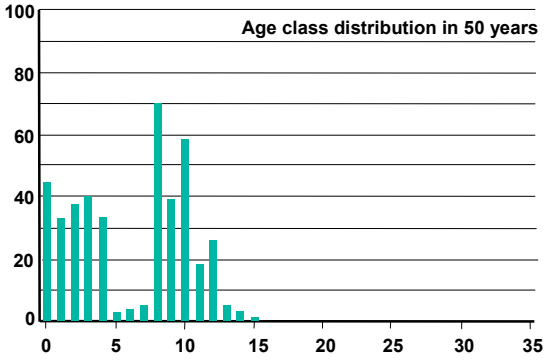
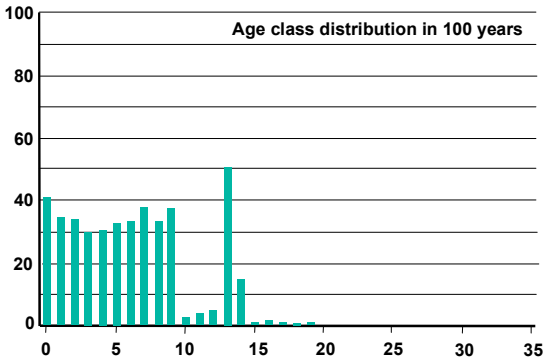


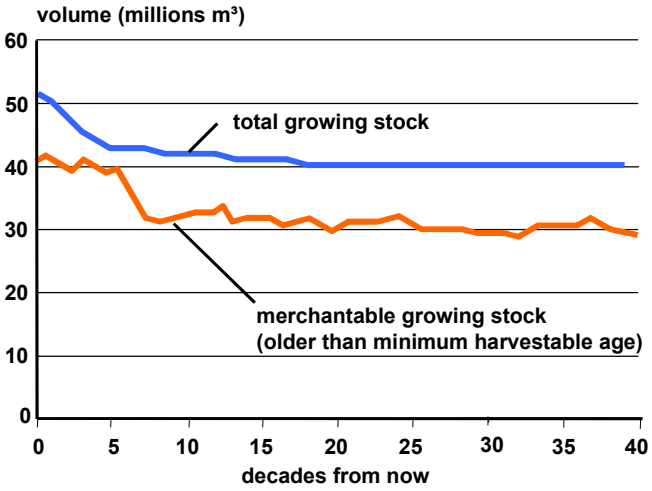
Figure B-2c. Age class distribution in 100 years, deciduous base case, Fort St. John TSA 1995



Scarcity of Harvestable Timber in Late Mid-Term

Figure B-3 illustrates the gradual decline in the available growing stock for the first 50 years.

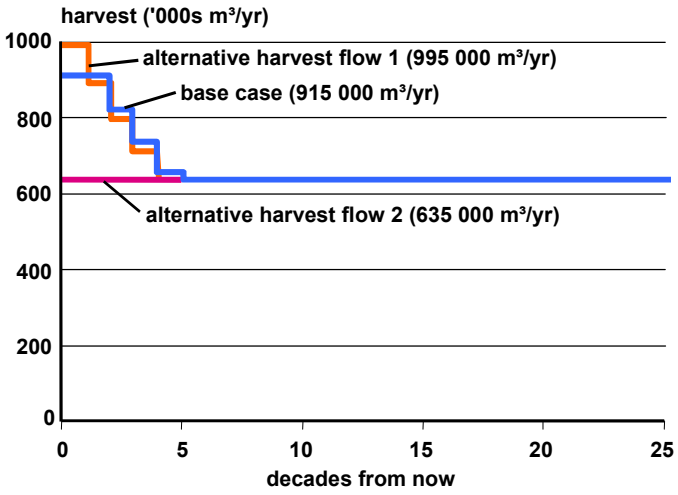
Figure B-3 Total and available growing stock, deciduous base case, Fort St. John TSA 1995



Rationing of Current Mature Timber

Figure B-4 shows alternative harvest flows that ration out the stock of existing mature timber at different rates than in the base case. In the first alternative harvest flow, the initial harvest is 9% higher than in the base case forecast, but declines slightly more steeply. The reason for this decline is the depletion of mature harvestable stands before regenerating stands have reached the minimum harvestable age. The harvest level evens out as the balance between regenerating and mature stands is reached.

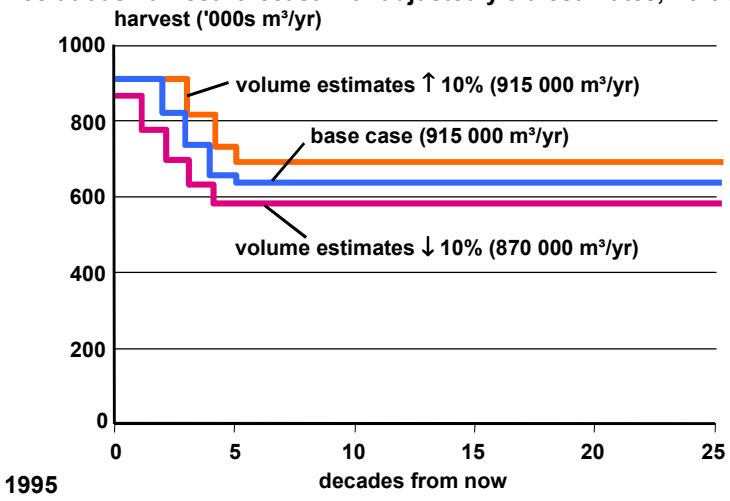
Figure B-4. Alternative harvest flows using the deciduous base case, Fort St. John TSA 1995



Increasing Stand Yields

Figure B-5 shows the effect on the deciduous harvest forecast of increasing stand volumes for existing and regenerated stands by 10% (the same yield tables were used for existing and regenerated stands). The current allowable harvest level can be maintained for 30 years then declines by 10% per decade to the long term harvest level. If the stand volumes are decreased by 10%, the initial harvest level is decreased and declines after the first decade by 10% per decade to the long term harvest level.

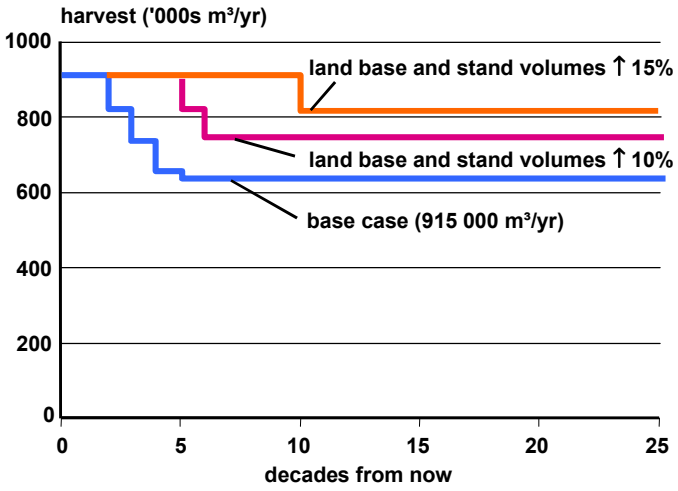
Figure B-5. Deciduous harvest forecast with adjusted yield estimates, Fort St. John TSA



Increasing the Timber Harvesting Land Base

A review of 280 sample plots used to calibrate Variable Density Yield Prediction (VDYP) revealed that deciduous stand volumes may be underestimated by an average of 15% due to decay, waste and breakage factors. If volumes are underestimated, the THLB would be larger because fewer stands would be netted out for low site productivity or volume. Figure B-6 examines the effects of increasing both stand volumes and land base area.

Figure B-6. Deciduous harvest forecast with yield estimates and land base increased, Fort St. John TSA 1995



C. Timber Supply Dynamics Summary

The Fort St. John TSA is separated into coniferous and deciduous components for timber supply analysis and AAC determination. The harvest forecast for the coniferous forest is flat, indicating that there is little harvesting pressure on the unit in the short term, and that the abundance of existing mature timber buffers the harvest forecast against changes in data or assumptions. This means that there aren't many opportunities for manipulating timber supply by applying silvicultural activities. Neither changing minimum harvestable age (MHA) nor increasing yields for regenerated stands has any short-term effect on timber supply.

Timber supply on the coniferous forest is sensitive to changes in the THLB, about which there are two sources of uncertainty. First is the inclusion of a large area of marginal (small) pine stands. There is some question about how much of these pine stands are truly merchantable. Secondly, there is a significant amount of backlog NSR that was scheduled for rehabilitation in TSR1. There is uncertainty about how much of this backlog can be successfully rehabilitated on the one hand, and how much might be incorrectly classified on the other hand. If the use of herbicides is curtailed, rehabilitation of NSR will be more challenging, and regenerating high site index coniferous stands to pure conifer may be difficult or impossible.

The base case forecast for the deciduous forest shows that the current AAC can be maintained for only two decades, after which it must decline by 30% over four decades to the long-term harvest level. The short-term deciduous harvest was slightly sensitive to two factors: yields for existing and regenerated stands, and regeneration delay. It may be possible to define some silvicultural strategies to utilize this sensitivity to affect short-term harvest levels. However it is only recently that the actual level of harvesting in the TSA is approaching the supply forecast levels.

Appendix 2: Executive Summary, Incremental Silviculture Strategy for British Columbia

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

1 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.

2 British Columbia's forests are import locally, provincially, nationally and globally and should be managed in this context.

3 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:

1 Minimize the anticipated interim reduction in timber supply so that provincial annual harvests of at least 65 million m^3 can be achieved.

2 Create a long-term timber supply capable of supporting a steady long-term provincial harvest level of at least 75 million m^3.

3 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