
Fort Nelson TSA Silviculture Strategy (Type 1)

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The consultants also wish to thank the participants in the workshop, listed below, whose contributions are the basis of this strategy.

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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.

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.

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Strategy Summary

While many issues were proposed and discussed in the workshop, the participants focused on 4 issues, and subsequently developed 5 strategies to address them.

Elements of the Strategy

Restock Backlog NSR

ISIS currently lists 11,000 ha of backlog NSR. Of this, approximately 2,500 are deemed untreatable due to regeneration problems or other constraints, and a further 2,500 ha are known or estimated to be stocked. There remains approximately 6,000 ha to be treated, spread out in a mosaic pattern over the entire THLB. It is estimated that 30% will be mechanically site prepared and planted, and 70% will be chemically site prepared and planted. Assuming an average cost of \$1600/ha to site prepare and plant these areas, the total budget to complete this work is estimated at \$9.6 million.

Restock Riparian Backlog NSR

A small portion of the backlog NSR area consists of riparian areas. A strategy is required to deal with these areas, probably including altered stocking standards, in order to protect or enhance their value as habitat. It was estimated that only a very small area (10 ha) would be treated each year.

Tend Impeded Backlog

For the entire area of backlog (41,000 ha) including NSR areas, it is estimated that 25% needs no treatment, 60% need one brushing treatment, and 15% needs two brushing treatments. It is also assumed that 70% of brushing treatments will use herbicides, while the other 30% will be manual. Given two treatments on some areas, it is estimated that 25,800 ha of treatment is required for full achievement of free growing on all backlog sites. Assuming \$400/ha for chemical treatments and \$1400/ha for manual treatments, the total budget required for brushing backlog areas is anticipated to be \$25.8 million.

Convert NCB

In the timber supply analysis for TSR II it was assumed that 2500 ha would be converted over the next 10 years. Assuming average productivity for the TSA, this is sufficient to increase the LTHL by 6900 m³/yr. Each additional 2500 ha treated would have a similar effect. Currently, achievement of this assumed treatment is questionable, as funding is insufficient to treat all backlog sites which are considered high priority by the District.

Treat Budworm

The largest pest problem in the TSA currently is the spruce budworm, which has experienced dramatically increased population levels in recent years.



A widespread population control program is not anticipated, but localized protection of threatened plantations using spray programs may be of value.

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. Table S-1 lists activities identified by the participants and the rank (priority) assigned to each activity.

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

Activities/Treatments	Opportunity (ha/year)	Workshop Rank
Budworm		
BT spray	560	2
Backlog		
Surveys: backlog all stages	6000	1
Site prep, plant, brush - NSR	600	
Brushing chemical - impeded	900	1
Brushing manual - impeded	670	
Conversion NCB		3
Surveys	1000	
Site preparation	250	
Plant	250	
Brush chemical	250	
Brush manual	250	
Riparian zone rehabilitation		4
Manual brushing	10	
none (stratify for habitat)		



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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 Fort Nelson 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. These issues were compiled prior to the workshop and are described in Appendix 1. Appendix 2 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. Subsequent to the Type 1 workshop (February 28-28, 2000) a review copy of the TSR2 Fort Nelson Timber Supply Area Report was made available to the consultant. The document's salient points with implications for silviculture planning are discussed in Appendix 3.



2 Analysis of Issues and Strategies

This section identifies the critical issues that guide silviculture planning in the Fort Nelson TSA and the strategies developed in the workshop for addressing them. The issues prepared prior to the workshop (Appendix 1) were reviewed by the participants and categorized as

- not an issue or not addressable with silviculture actions,
- addressable with silviculture activities, or
- requiring investigation prior to undertaking silviculture actions.

The participants analyzed issues that could be addressed with silvicultural actions, by identifying objectives with respect to each issue, strategies for meeting the objectives, the target stand types, and a list of activities to implement each strategy. These elements are tabulated in Table 2-1 for the issues analyzed by the workshop, and are examined in more detail in sections 2.1 –2.3 below.

Issues that were identified as requiring investigation prior to silvicultural action are discussed in section 2.4.

2.1 Issue: Backlog

The Fort Nelson TSA has a larger than average proportion of backlog stands requiring treatment to reach free growing. TSR II assumed that all backlog areas would be treated over a period of 10 years. Current funding levels, however, are sufficient to treat this area at only approximately half the assumed rate, requiring a 20-year period for completion. This in turn will result in a delay in areas again being available for harvest 10-14 decades from now, around the time of the transition from primarily old growth harvesting to primarily second growth harvesting. Delayed availability of some second growth stands may result in a small fibre supply deficit at that time. This is particularly critical given that backlog sites tend to be some of the most productive in the TSA.

Strategy: Restock Backlog NSR

ISIS currently lists 11,000 ha of backlog NSR. Of this, approximately 2,500 are deemed untreatable due to regeneration problems or other constraints, and a further 2,500 ha are known or estimated to be stocked. There remains approximately 6,000 ha to be treated, spread out in a mosaic pattern over the entire THLB. It is estimated that 30% will be mechanically site prepared and planted, and 70% will be chemically site prepared and planted. Assuming an average cost of \$1600/ha to site prepare and plant these areas, the total budget to complete this work is estimated at \$9.6 million.

Strategy: Restock Riparian Backlog NSR

A small portion of the backlog NSR area consists of riparian areas. A strategy is required to deal with these areas, probably including altered stocking standards, in order to protect or enhance their value as habitat. It was estimated that only a very small area (10 ha) would be treated each year.



Strategy: Tend Impeded Backlog

For the entire area of backlog (41,000 ha) including NSR areas, it is estimated that 25% needs no treatment, 60% need one brushing treatment, and 15% needs two brushing treatments. It is also assumed that 70% of brushing treatments will use herbicides, while the other 30% will be manual. Given two treatments on some areas, it is estimated that 25,800 ha of treatment is required for full achievement of free growing on all backlog sites. Assuming \$400/ha for chemical treatments and \$1400/ha for manual treatments, the total budget required for brushing backlog areas is anticipated to be \$25.8 million.

2.2 Issue: Fire Origin NCB

It is estimated that the Fort Nelson TSA includes 500,00 to 800,000 of land that has regenerated to non-commercial species, primarily brush, after wildfires. Conversion of non-commercial timber types to commercially valuable forest cover would increase the size of the timber harvesting land base.

Strategy: Convert NCB

In the timber supply analysis for TSR II it was assumed that 2500 ha would be converted over the next 10 years. Assuming average productivity for the TSA, this is sufficient to increase the LTHL by 6900 m³/yr. Each additional 2500 ha treated would have a similar effect. Currently, achievement of this assumed treatment is questionable, as funding is insufficient to treat all backlog sites which are considered high priority by the District.

Conversion treatments consist of clearing existing cover, planting, and controlling brush. The cost of these treatments ranges from \$1600/ha to \$2600 /ha.

2.3 Issue: Spruce Budworm Losses

Strategies to protect forest health are intended to maintain conditions favorable for maximizing timber production. Avoiding pest problems will help maintain productivity levels already assumed in TSR, thus no gains per se are expected.

Strategy: Treat Budworm

The largest pest problem in the TSA currently is the spruce budworm, which has experienced dramatically increased population levels in recent years.

A widespread population control program is not anticipated, but localized protection of threatened plantations using spray programs may be of value.

Table 2-1. Silviculture strategies developed by the workshop to mitigate critical TSA issues.

#	P	Issue Name	Issue Description	Objective	Strategy	Target	A Activities
	1	Budworm	Budworm losses heavy in last decade.	Suppress budworm	Spraying	Infested plantations	BT spray
	2	Backlog	TSR assumes backlog reforested in 10 years but assumes herbicide use, does not recognize 1st nations issues, uncertainty wrt funding and underfunding, uncertainty as to priority	Reforestation of backlog	1 Reforestation	Backlog NSR	1 Surveys: all stages 2 site prep; plant; brush;
					2 Stand tending	Impeded	1 brushing chemical brushing manual
	3	Conversion NCB	TSR assumes backlog reforested in 10 years; habitat issue is that willow and grass --> spruce, reduces diversity, question economics; loss of mature willow (habitat opportunities); conflict re herbicide	Afforestation of NCB		NCB	1 surveys 2 site prep 3 plant 4 brush manual 5 brush chemical
	4	Riparian rehab	Harvesting to streamside; backlog; herbicides restricted	Reforestation of riparian zones	Release or protect existing stocking	backlog in riparian zones	manual brushing
					Stratify out for habitat	backlog in riparian zones	none



2.4 Issues requiring investigation

Issues that were identified by the participants as requiring investigation prior to silvicultural action are listed in Table 2-2. The participants assigned a rank to each topic reflecting the consensus priority.

Table 2-2. Issues requiring investigation (the “to-do” list).

Topic	Rank
Herbicide use	1
Concern was expressed in the workshop regarding future availability of herbicides as a silvicultural tool. This concern is rooted in local perceptions of habitat loss from reduced natural variability, and herbicide use being a negotiation item in discussions with the local First Nation. Inability to use herbicides may result in reduced stocking and thus lower yields, and/or reductions to the timber harvesting land base. <i>There is a need to estimate potential stand level impacts of a “no herbicide” policy, and to use FSSIM to investigate impacts on timber supply.</i>	
Mixedwood management	2
Silviculture management of mixedwood stands is not fully understood; practices to maintain current mixtures in future stands are poorly defined if defined at all – existing stocking standards for mixedwoods are based on largely on theory and speculation. Current practice by intent is to “unmix” the mixedwoods, trending toward either pure deciduous or pure conifer stands. Recognized drawbacks to this strategy include potentially higher than necessary silviculture costs and potential degradation of habitat where certain niches depend on conifer-deciduous mixtures. <i>Further support and expansion is required for basic stand level studies into mixedwood management, including both licensee and MoF initiatives, with cooperation across the boreal region of the four western provinces.</i>	
Budworm	3
Levels of budworm losses have become increasingly heavy in the Fort Nelson TSA over the last decade, and particularly in the last year. In unmanaged older stands, increased mortality related to this pest has introduced doubts about the “shelf-life” of old growth volumes in relation to that assumed in TSR. In young managed stands, there is ongoing risk stocking losses, particularly where young stands are immediately adjacent to infested older stands. Understory layers in stands are at particular risk, thus threatening the understory conifer layer in some mixedwoods, resulting in reduced options for future management. <i>There is a need to investigate management options for budworm and their impacts on both timber supply and options for silviculture systems.</i> Such a study should consider both active treatment options and strategies for stand management with budworm populations as part of the overall forest management context (i.e. the budworm is there – how do we best live with it?). It should be cognizant of potential impacts of different strategies on insect population dynamics, timber supply, habitat and	



other resource values.

Aspen suckering on compacted sites

4

Concern was expressed that a recent shift toward increased summer logging of aspen sites may be resulting in increased amounts of permanent access structures. This concern arises from sites where compaction on skid roads and/or roadside processing areas inhibits suckering of aspen, leaving these areas poorly- or non-stocked. It is assumed that with winter harvesting, compaction would be avoided on most of these areas. *A study is required to quantify the impact of summer harvesting on post-harvest stocking conditions.* This information could then be used to make informed decisions about the costs and benefits of this strategy, and to make appropriate area net-downs related to stocked area for TSR.

Salvage

5

Concern was expressed that large amounts of unsalvaged losses occur related to budworm and bark beetle activity. It is perceived that many older stands are losing volume over time, and that TSR yield curves are insensitive to this effect. One study on this problem is nearing completion. *A strategy is required to identify high risk stands so that they can be moved up in the harvest queue.* Current losses to insects are estimated at 34,000 m³/yr.

Low stocking SR

6

Concern was expressed that backlog and older appraisal blocks (approx. pre-1995) may have lower stocking levels than assumed in TSR Blocks with ≥80% conifers only). This could potentially lead to an assumption in the TSR timber supply analysis that yields for these stands are higher than will actually be achieved. *A study is required to assess actual stocking levels on older cut blocks compared to TSR assumptions.* This in turn could lead to an analysis of impacts on timber supply projections.

LRMP Protected Area Exclusions

7

Responsibility for silviculture activities on 8 blocks within the newly created Klua Lakes park needs to be resolved. This process is underway.

Black Spruce

*

Silvicultural and regeneration difficulties associated with a high water table are an obstacle to the to the inclusion of black spruce stands in the conifer timber supply. Ecological (site series) inventories should be undertaken in order to enable specific land base exclusions where regeneration problems are anticipated.



Low Productivity Thresholds

*

Both the conifer and deciduous timber supply are very sensitive to the site index thresholds used to exclude stands of low productivity from the timber harvesting land base. These thresholds represent economic margins and respond to changes in operating costs and market prices.

Given the importance of these thresholds to timber supply, a study should be undertaken to refine or confirm the thresholds used in the TSR.

Type 1.5 Analysis

Many of the items in this To-Do list have associated suggestions for testing of timber supply impacts. It is recommended that potential timber supply impacts of these items, using estimated response levels, be explored using FSSIM and the TSR II data set.

* Items ranked with an asterisk were added to the “to-do” list by the consultant subsequent to the workshop and arose from a review of the TSR2 Timber Supply Analysis Report (see Appendix 3).



3 Silviculture Impacts and Priorities

The silviculture activities required to implement the strategies identified in Table 2.1 are summarized below in Table 3.1, together with their impacts on selected TSA objectives. The workshop determined the opportunity area (i.e., the area available for treatment for the next 5 years), the impacts on timber supply quantity and quality, and habitat effects for each treatment. The employment effects and costs are based on district and licensee records. The rank (priority) of each treatment was determined through consideration of the impacts of each activity on each objective, and represents a consensus of the participants.

4 Silviculture Program

4.1 Tactical Priorities

The rankings of Table 3.1 represent a balance between the participant's strategic concerns and the silvicultural opportunities available on the TSA in the next 5 years.

The highest ranked activities are the restocking of backlog NSR and brushing of impeded backlog SR. Treatment of backlog is necessary to maintain the timber harvesting land base as represented in the TSR, and impacts long term timber supply.

The next priority identified by the participants was spraying for budworm, followed by conversion of NC Br lands. Rehabilitation of riparian zones were ranked last.

4.2 Program Costs and Benefits

Table 4-1 contains the area treated by activity and year.

Table 4-2 contains the expenditure by activity and year, based on the unit costs recorded in the treatment table (Table 4.1).

Table 4-3 contains the silviculture employment benefits associated with the program..

Table 3-1. Silviculture activities, the strategies they implement, their impacts on TSA objectives, and their priorities as determined by the workshop.

Activities/Treatments	Issues Addressed	Opportunity Area	Timber Supply Effects			Quality	Habitat	Jobs Days/ha	Cost \$/ha ¹	MOF Rank	Other Rank
			Short	Medium	Long						
			0-20	21-120	121+						
Budworm											
BT spray	1	560		M	M		+/-	0.1	400	2	M
Backlog											
Surveys: backlog all stages	2	6000			M		+/-	0.1	60	1	H
Site prep, plant, brush - NSR	2	600			M		+/-	2.5	1600		
Brushing chemical - impeded	2	900			M		+/-	0.2	400	1	H
Brushing manual - impeded	2	670			M		+/-	4.0	1400		
Conversion NCB										3	H
Surveys	3	1000			M		+/-	0.1	60		
Site preparation	3	250			M			0.6	400		
Plant	3	250			M			2.0	800		
Brush chemical	3	250			M			0.2	400		
Brush manual	3	250			M			4.0	1400		
Riparian zone rehabilitation										4	L
Manual brushing	4	10					+	4.0	1400		
none (stratify for habitat)	4						+				

Notes:

+, - indicates, respectively, a positive or negative impact on the indicated objective.

+/- indicates that the activity could have a positive or negative effect, depending on its circumstances of application

Table 4-1. Area (ha) treated by activity and year.

Year	Surveys* All	Backlog Establish	NCBr Site Prep	NCBr Plant	Manual Brush	Chemical Brush	BT Spray	Total
1	7,000	600	250	250	930	1,150	560	16,450
2	7,000	600	250	250	930	1,150	560	16,450
3	7,000	600	250	250	930	1,150	560	16,450
4	7,000	600	250	250	930	1,150	560	16,450
5	7,000	600	250	250	930	1,150	560	16,450
Subtot Yr 1 - 5	35,000	3,000	1,250	1,250	4,650	5,750	2,800	82,250
6 - 10	35,000	3,000	1,250	1,250	4,650	5,750	2,800	82,250
Total Yr 1 - 10	70,000	6,000	2,500	2,500	9,300	11,500	5,600	164,500

* Includes prescription and layout

Table 4-2. Expenditure ('000 \$) by activity and year.

Year	Surveys* All	Backlog Establish	NCBr Site Prep	NCBr Plant	Manual Brush	Chemical Brush	BT Spray	Total
1	420	960	100	200	1,302	460	224	3,982
2	420	960	100	200	1,302	460	224	3,982
3	420	960	100	200	1,302	460	224	3,982
4	420	960	100	200	1,302	460	224	3,982
5	420	960	100	200	1,302	460	224	3,982
Subtot Yr 1 - 5	2,100	4,800	500	1,000	6,510	2,300	1,120	19,910
6 - 10	2,100	4,800	500	1,000	6,510	2,300	1,120	19,910
Total Yr 1 - 10	4,200	9,600	1,000	2,000	13,020	4,600	2,240	39,820

Table 4-3. Short term employment benefits (person-years) of the silviculture program, by year and activity.

Year	Surveys* All	Backlog Establish	NCBr Site Prep	NCBr Plant	Manual Brush	Chemical Brush	BT Spray	Total
1	3.5	7.5	0.8	2.5	18.6	1.2	0.3	37
2	3.5	7.5	0.8	2.5	18.6	1.2	0.3	37
3	3.5	7.5	0.8	2.5	18.6	1.2	0.3	37
4	3.5	7.5	0.8	2.5	18.6	1.2	0.3	37
5	3.5	7.5	0.8	2.5	18.6	1.2	0.3	37
Subtot Yr 1 - 5	17.5	37.5	3.8	12.5	93.0	5.8	1.4	185
6 - 10	17.5	37.5	3.8	12.5	93.0	5.8	1.4	185
Total Yr 1 - 10	35.0	75.0	7.5	25.0	186.0	11.5	2.8	371

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



Appendix 1

Issues Reviewed in the Fort Nelson TSA Workshop

The objective of this section is to identify aspects of the timber harvesting land base and its management that govern the supply of timber from the TSA. This information provides the basis for identifying the constraining mechanisms that shape the timber supply forecast for the unit and for specifying possible silvicultural remedies. Unless otherwise indicated, the data in section is drawn from the Fort Nelson TSA Timber Supply Analysis (1993) .

A1.1 TSA Issues Guiding Silviculture Planning

Issues that influence silviculture planning were obtained from the District (the District Enquiry), the most recent Resource Management Plan, and other documents identified by the District. These issues were reviewed and expanded during the workshop.

A1.1.1 Timber Supply Issues

(Source: Fort Nelson Forest District Questionnaire and RMP)

A1.1.1.1 Mixedwood Management Guidelines

Mixed species stands have not been widely utilized in the Fort Nelson TSA. Development of coniferous and deciduous facilities in Fort Nelson has led to increased interest in mixedwood stands. The District has developed an interim mixedwood strategy but there is uncertainty about the dynamics of mixedwood stands. Silviculture stand management techniques for mixedwood stands are currently under development.

A1.1.1.2 Small Scale Salvage Program

The estimated annual loss (TSR) to Spruce beetle, Spruce budworm, and fire on the total land base is 484 569 m³ per year. Annual salvage of this lost amount is 58 173 m³ per year. Blowdown loss in mature stands needs to be estimated. Development of a substantial salvage program would increase timber supply

A1.1.1.3 Budworm Infestation

Many stands, including young plantations, mixedwood stands, and pure spruce stands in this TSA were heavily attacked by budworm during the last 10 years. It was estimated that 1.1 million hectares was affected by a 1999 attack. Improved forest health maintenance projects and increased salvage programs could potentially increase timber supply.

A1.1.1.4 Incremental Silviculture

Due to the late start of harvesting in the Fort Nelson TSA there is no incremental silviculture history. However reforestation of all backlog sites in 10 years and conversion of 2 500 hectares of non commercial brush over the next 10 years will be incorporated in the TSR2 analysis.



In the past, areas harvested in the Fort Nelson TSA have been regenerated with lower than optimum planting densities. Increasing planting density could potentially affect future timber quantity.

A1.1.1.5 Herbicide Use

Herbicide availability will affect future yields and delays in establishment that can affect timber quantity and quality. In many stands with *Calamagrostis Canadensis* aerial application of herbicide is the only option.

A1.1.1.6 Integrated Resource Management

Since TSR1 new administrative constraints brought about by the Forest Practices Code (FPC) and TSA management decisions have impacted timber supply. The following is a list of identified impacts:

Declaration of additional visual quality objectives.

- Changes in green-up requirement.
- Landscape unit planning.
- Wildlife trees (WT) and tree patches (WTP) retention.
- Exclusion of the recommended LRMP proposed protected area from the timber harvesting land base.
- Eight backlog blocks (314 hectares) are included in the new Klua Lakes protected area. The treatment of these areas will be deferred until a management plan is prepared by BC Parks.
- Inclusion of birch leading stands (SI>17) in the AAC.

A1.1.1.7 Soil Compaction – Summer Logging

In order to keep the oriented strand board (OSB) plant operating, Slocan is targeting aspen stands for summer harvesting. The Fort Nelson TSA is comprised of stands with fine textured soils – high harvesting disturbance. The following are possible consequences of harvesting on these sites:

- Increased soil disturbance (all roads are declared permanent).
- Lack of natural regeneration of aspen on compacted sites.
- Permanent loss of productive sites (access, roadside-processing areas).

A1.1.1.8 Stocking Standards

Currently, the Fort Nelson TSA is managing to meet minimum stocking standards instead of targets. The TSA is reestablishing riparian areas through increased stocking and various vegetation management options.



A1.1.2 Habitat Issues

(Source: Fort Nelson RMP; Tory Stevens and Rod Backmeyer, MELP)

The Fort Nelson TSA contains three biogeoclimatic zones. Boreal white and black spruce are the dominant species, covering about two-thirds of the TSA's land base. Table A1-1 summarizes the zones and locations, major tree species present, and other considerations such as climate and wildlife values.

Table A1-1. Biogeoclimatic zones, major tree species, climate and wildlife values, Fort Nelson TSA

Zone	Location	Tree Species	Other
Boreal White and Black Spruce	Covers most of the eastern portion of the timber supply area, to an elevation of 1300 metres. Occupies 68% of TSA land base.	<u>Dominant</u> : white spruce, lodgepole pine, trembling aspen. <u>Minor</u> : black spruce, balsam poplar, tamarack, subalpine fir, common paper birch and Alaska paper birch.	Long, very cold winters and short growing seasons. Rich in wildlife.
Spruce Willow Birch	On middle elevations of northern Rocky Mountains and much of the Liard Plateau (1300 m to 1500 m). Occupies 19% of TSA land base.	Lower elevations <u>Dominant</u> : white spruce and subalpine fir. <u>Minor</u> : black spruce, lodgepole pine and trembling aspen. Upper elevations Dominated by tall deciduous shrubs (birch, willow species).	Harshest climate of all forested zones in BC. Winters long and cold, summers brief and cool. Major wildlife use in summer months.
Alpine Tundra	Above 1500 m. Occupies 13% of TSA land base.	Trees generally absent. Plants are small, close to ground, and often widely separated by bare soil or rock.	Harshest climate of all BC zones. Wildlife diversity and density are low.

Data Source: Fort Nelson Forest District RMP

Seral stage distribution concerns are different east of the Rockies than in the rest of the province. The fire disturbance regimes are not well represented by the Forest Practices Code and in many landscape units/BEC subzones, the old forest values required by the code do not exist, nor have they ever existed. The distribution of forest classes in the age class distribution shows a huge component of young forest, reflecting the frequent fire disturbance history.

A1.1.2.1 Ecosystem level concerns

(Source: Rod Backmeyer, MELP)

Herbicides

Herbicide use is at a high level in the north east. This has the effect of simplifying stands and creating more of a monoculture. As much as that can be avoided or diminished, it will permit natural variability to persist on the stand.

Conversion of non-commercial brush

Areas of non-commercial brush (primarily willow and grass) are being converted to spruce. This involves heavy use of herbicides to keep down the competition that is more suited to the site. The



economic viability of these conversions is in question. There may also be some rare ecosystems (using the code definition of <2% of a landscape unit) being impacted in this way. If companies persist in these conversions there are some ways that the detrimental effects on habitat can be ameliorated. If standard FPC regulations were followed it would add to the diversity of the stand. These include leaving riparian reserves and wildlife tree patches. These reserves and patches would be patches of the willow/grass community that is being displaced.

Mixedwood silviculture

Mixedwood management has not been an issue in the past because there has not been a shortage of pure conifer stands for the conifer licences or pure deciduous stands for the deciduous licences. This may well change in the immediate future. As of now there is no clear direction on how to deal with the maintenance of mixedwood stands. A silvicultural methodology needs to be worked out. There are other jurisdictions that have done trials to determine the best methods e.g. Alberta. Information from these other areas should be compiled and examined and a methodology established for BC.

A1.1.2.2 Single species concerns

General comments

The TSA contains vast tracts of relatively undeveloped land that supports abundant diverse and internationally significant wildlife populations.

Large nomadic mammals such as moose, black bear, grizzly bear and stone sheep are common. Furbearers such as wolverine, wolf, lynx, weasel, mink, river otter, beaver and coyote are prevalent in the TSA. Regionally significant species include mountain goat, caribou, marten, thimhorn sheep, elk, harlequin duck and northern goshawk..

Most reptiles and amphibians are ill-adapted to the northern climate and few species are present in this timber supply area. However, it is home to a unique range of bird species, many of them eastern species not otherwise found in BC. Conversely, many birds found in other parts of the province do not occur in this timber supply area. The abundant rivers, lakes, ponds and marshes provide important staging grounds during the migration of water birds such as pintails, widgeons, geese and teal.

Many fish species important as game are found in the water bodies of this area. These include some trout species, whitefish, Burbot, Arctic grayling, northern pike and walleye. The rare occurrence of some salmon species has also been noted in some of the major rivers. Approximately 15 game and non-game fish species occur only in this part of the province.

The Boreal White and Black Spruce Zone has the least snowfall of all the northern BC zones and consequently is very important for wintering ungulates. Also in that zone, frequent forest fires have formed a mosaic of upland forests of different ages, providing a variety of habitats. The extensive deciduous forests frequently achieve older age classes and are important for ungulates, birds and small mammals.

Caribou

The NE has terrestrial lichen foraging caribou. Much of the caribou range is being managed through LRMP and TSR provisions. Specific recommendations would be silvicultural interventions that prolonged the usefulness of winter habitat and created new winter habitats. The number of hectares involved is not known.



Grizzly bear

The primary issue around grizzly bears is the forage production in areas of high grizzly value. Again, this is an issue of excessive herbicide use that destroys the leafy, berry producing trees and shrubs that are used as grizzly forage. This issue is already dealt with in areas with Pest Management Plans. Outside of these areas the recommendation is to leave islands with no herbicide applications for bear use.

A1.1.3 Employment Issues (none supplied)

A1.1.4 First Nations Issues (none supplied)

A1.1.5 Forest Health

Budworm infestations have been heavy in the last 10 years and the attack in 1999 was the most severe (see section A1.1.1.3). Calamagrostis Canadensis is treated by aerial application (see section A1.1.1.5).

A1.2 Objectives of the Silviculture Program

A1.2.1 Management Unit Objectives

Table A1-2 lists management unit objectives which address TSA issues and proposed silviculture strategies required to meet management unit objectives. This table will be used as starting point for discussion in the workshop.

Table A1-2. Management unit objectives and associated silviculture strategies, Fort Nelson TSA

Objective	Strategy
Timber Supply Objective Increase the amount of merchantable timber contributing to the harvest forecast through incremental silviculture	Reforest all Backlog sites by 2007 (TSR2 Assumption) <ul style="list-style-type: none">Mechanical site preparation and planting on 1 800 hectares of treatable area (6000 ha).Chemical site preparation and fill planting on 4200 hectares of the remaining treatable area (4200 ha). Complete Free Growing on all Backlog Sites by 2015 <ul style="list-style-type: none">There is 30 000 hectares of SR and 11 000 hectares of NSR.24 000 hectares will be mechanically brushed, 17 220 hectares will be chemically treated and 7 380 hectares will be manually brushed.6 150 hectares will need two brushing treatments (70% chemical and 30% manual). Stand Conversion (TSR2 Assumption) <ul style="list-style-type: none">Rehabilitate (convert to spruce) 2 500 hectares of non commercial brush over the next 10 years.
Timber Supply Objective To ensure existing forest resources are protected from damaging agents, and that the damaging agents do not impede silviculture obligations or investments	Protection from Damaging Agents <ul style="list-style-type: none">Achieved through a combination of aerial and ground surveys, forest health studies (i.e. understanding the insect complex and potential damage associated with spruce decline), and forest health treatments (defoliator spraying).
Timber Supply Objective To better understand and apply	Improvement of Silvicultural Treatment in Boreal Mixedwood Stands <ul style="list-style-type: none">This will involve a variety of studies focusing on silviculture systems to



silviculture treatments in the boreal mixedwood

be used in boreal mixedwoods (i.e. ones that would ensure appropriate levels of coniferous understory protection, feasibility of summer harvesting on fine-textured soils, etc), free-growing standards and other pertinent issues.

Habitat Supply Objective

Maintain and improve wildlife habitat quantity and quality

Protect old growth habitat and limit road access to the timber harvesting land base

- Detailed landscape level planning.
- Co-ordinate access management strategies in the TSA and timber harvesting land base.

Data Source: Fort Nelson Forest District RMP



Appendix 2

The Timber Supply Context of Silviculture in the Fort Nelson TSA

The objective of this section on resource dynamics analysis is to further define timber supply issues and identify constraining mechanisms that shape the timber supply forecast for the unit.

A2.1 Synopsis of the Land Base Inventory

This section reviews aspects of the land base inventory that are relevant to determining a silviculture strategy.

The Fort Nelson TSA covers 4.2 million hectares, of which 28% is considered available for harvesting (RMP).

The site class profile of the timber harvesting land base is: 35% poor, 54% medium, 9% good site, and 1% low productive site (RMP).

The species profile of the Fort Nelson TSA is: 43% spruce, 29% aspen, 20% pine, 5% birch and 3% cottonwood.

Seral stage distribution concerns are different east of the Rockies than in the rest of the province. The fire disturbance regimes are not well represented by the Forest Practices Code and in many landscape units/BEC subzones, the old forest values required by the code do not exist, nor have they ever existed. The distribution of forest classes in the graph shows a huge component of young forest. This reflects the frequent fire disturbance history.

A2.2 Silviculture Program

A2.2.1 Silviculture History

Table A2-1 records backlog (pre-1988 openings) silviculture for the TSA, while Table A2-2 records current (post 1998 openings) silviculture. Only silvicultural activities which took place after 1985 are shown for both tables.



Table A2-1. Backlog silviculture history 1986-99, Fort Nelson TSA

Year	Backlog Site Preparation (ha)	Backlog Planting (ha)	Backlog Brushing (ha)
1986	1659	1175	
1987	2136	1640	235
1988	2066	1659	718.5
1989	1932.7	2686.4	822
1990	1975.5	1514.1	698
1991	2924.8	2214.5	2115
1992	2751	2334	2384
1993	1072.5	1409.3	2441.6
1994	1231.8	823.8	2702.6
1995	628.8	994.2	2050
1996	388.4	907.5	513.3
1997	183.9	131.1	1662.9
1998			1017.8
1999			46.2
Total	18950.4	17488.9	17406.9

Data Source: ISIS Onetime November 23, 1999, IEA Section, Forest Practices Branch

Table A2-2. Current silviculture history 1986-99 , Fort Nelson TSA

Year	Backlog Site Preparation (ha)	Backlog Planting (ha)	Backlog Brushing (ha)
1988	368		
1989		346	
1990	76.8	23	171
1991	1377.6	1933.5	
1992	2796.4	2984.4	
1993	3590.9	3415	1600.8
1994	2836.2	3622.7	1271.8
1995	2876.4	3673.2	1526.1
1996	1965.1	4095.6	1702.4
1997	2161.4	5103.8	694.1
1998	1056.9	2956.9	369
1999	45.7	491.7	23.2
Total	19151.4	28645.8	7358.4

Data Source: ISIS Onetime November 23, 1999, IEA Section, Forest Practices Branch



A2.2.1 Backlog

The area of backlog not satisfactorily restocked land is 11 000 ha. The area of satisfactorily restocked land is 30 000 ha.

As of October 1, 1987 the Ministry of Forests took over responsibility for all areas logged prior to this date. In 1988 the forest Service divided the district into administration zones for backlog purposes. Some zones have almost been completed and have little or no NSR hectares within them.

Slocan forest Products Ltd. is an active participant in the backlog program. The company has prepared a backlog silviculture plan for the administration zones assigned to it two years ago and is currently completing on-the-ground activities. Slocan has been assigned three more administration zones last year and they are finishing the planning process and prescriptions for the zones. Majority of the activities for the next year will be in these administration zones.

A2.2.2 Tree Improvement

The projected gain from improved seed for the Fort Nelson Region is tabulated in Table A2-3.

Table A2-3. Project gain from improved seed per species, Fort Nelson TSA

Species & Seed Zone	Elevation (m)	Gain from Improved Seed (%)		
		98-99	99-00	2007-08
Sx PR low	<1200	-	-	23

Data Source: Forest Genetics Council

A2.2.3 Silviculture Costs

Table A2-4 represents current silviculture activities and their associated costs.

Table A2-4. Silviculture activities and costs, Fort Nelson TSA

Activity	Unit	Cost (\$)
Surveys	ha	30 to 40
Site preparation	ha	400 to 700
Planting	ha	800
Seeds and seedlings	tree	0.38
Brushing manual	ha	1000 to 1400
Herbicide	ha	400

Data Source: Fort Nelson Forest District RMP



A2.2.4 Silviculture Labour Requirements

The silviculture labour requirements for the Fort Nelson TSA are listed in Table A2-5.

Table A2-5. Silviculture labour requirements, Fort Nelson TSA 2000

Activity proposed for 2000/01	Goals	Unit	Jobs days/unit	Jobs days	DirectCost\$ /unit
Backlog surveys	6240	ha	0.05	312	~35
Backlog site preparation	900	ha	0.3	270	600
Backlog brushing (Manual)	670	ha	4	2680	1200
Seed purchase	1,060,000	trees	-	-	
Backlog brushing (Chemical)	1520	ha	0.2	304	400
Planting	780	ha	2	1560	800
FH maintenance aerial surveys	35	hours	-	5	815
Defoliator spraying	560	ha	0.1	56	850
Current fire and pest surveys	1000	ha	0.05	50	35
Current fire and pest site preparation	50	ha	0.3	15	600
Current fire and pest planting	200	ha	2	400	800
Current fire and pest brushing	30	ha	4	120	1200

Data Source: Fort Nelson Silviculture Strategy Workshop Questionnaire, Jan. 24, 2000

A2.3 TSR1 Management Assumptions

In addition to the inventory, or current state of the forest, assumptions about how it will be managed as essential for determining a silviculture strategy.

A2.3.1 Inventory Profile

The current inventory of the Fort Nelson TSA is recorded in Table A2-6. Mixedwood stands are a component of Table A2-6.



Table A2-6. Current inventory profile by area, Fort Nelson TSA 2000

Current Species Profile of the THLB	
Species	Area%
Spruce	43
Aspen	29
Pine	20
Birch	5
Cottonwood	3

Data Source: Fort Nelson Silviculture Strategy Workshop Questionnaire, Jan. 24, 2000

A2.3.2 Management Zones and Forest Cover Requirements

The TSR1 forest cover requirements used to achieve integrated resource management objectives are listed in Table A2-7a. Table A2-7b illustrates the TSR2 forest cover requirements used in management zones, while Table A2-7c lists the forest cover requirements used in draft landscape units.

Table 2-7a. TSR1 management zones and forest cover requirements for the Aspen Resource Analysis, Fort Nelson TSA 1992

Analysis unit	Critical minimum green-up age (yrs)	Maximum percent area younger than the critical minimum (green-up %)	Critical minimum mature cover age (yrs)	Maximum percent area younger than the critical minimum (mature cover %)
All analysis units	12	50	80	20

Data Source: Fort Nelson TSA Timber Supply Analysis Report Aspen Resource, 1993, p.32

Table A 2-7b. TSR2 management zones/groups and forest cover requirements, Fort Nelson TSA 1997

Management Zone/Group	Green-up height (metres)	Maximum allowable disturbance (% area)
Retention VQO	5	3
Partial retention	5	10
Modification	5	20.5
Maximum modification VQO	5	33
Integrated resource management	3	39
Integrated resource management in major river corridors	3	39
Special management	3	39
Special management in major river corridors	3	39

Data Source: Fort Nelson TSA TSR2 Data Package, 1997, p. 26



Table A2-7c. Draft landscape unit forest cover requirements, Fort Nelson TSA 1997

Management Zone/Group	NDT	Biogeo-classification	Minimum age mature and old (years)	Minimum retention area per cent (%)	Minimum age old (yrs)	Minimum retention area per cent (%)
All draft landscape units	2	SwB	n/a	n/a	250	9.4
	3	BWBS-Decid.	80	19.6	100	13.6
	3	BWBS-Conif.	100	18.7	140	11.5

Data Source: Fort Nelson TSA TSR2 Data Package, 1997, p. 27

A2.3.3 Minimum Harvestable Criteria

Minimum harvestable criteria used in TSR1 are found in Table A2-8a, while minimum harvestable ages used in TSR2 are found in Table A2-8b.

Table A2-8a. Minimum harvestable criteria by leading species, Fort Nelson TSA 1992

Type group	Distance zone	Alternative Plan Minimum harvestable volume		Aspen minimum harvestable volume (volume/ha)
		A (volume/ha)	B (volume/ha)	
All analysis unit except Aspen	Near	140	100	
	Medium	140	100	
	Far	140	100	
Aspen	Near			150
	Medium			150
	Far			n/a

Data Source: Fort Nelson TSA TSR1 Data Package 1992, p.37


Table A2-8b. Minimum harvestable criteria by leading species, Fort Nelson TSA 1997

	Analysis unit	Height (metres)	Minimum criteria	
			Volume (m ³ /hectare)	Minimum harvestable age (yrs)
1	Spruce	20	140	n/a
2	Spruce/pine	20	140	n/a
3	Spruce/deciduous	20	140	n/a
4	Aspen/coniferous	20	140	n/a
5	Aspen/deciduous	20	140	n/a
6	Pine	20	140	n/a
7	Pine/deciduous	20	140	n/a
8	Cottonwood/coniferous	20	140	n/a
9	Cottonwood/deciduous	20	140	n/a
10	Spruce/larch	20	140	n/a
11	Balsam fir	20	140	n/a

Data Source: Fort Nelson TSA TSR2 Data Package, 1997, p. 19

A2.2.4 Harvesting Practices

The 3-year average area harvested is 4088 hectares. This area is a combination of coniferous and deciduous area. The area which was clearcut was approximately 95%.

The annual volume harvested between 1995 and 1998 is represented in Table A2-9.

Table A2-9. Annual volume harvested, Fort Nelson TSA

Year	Forest License A17007	Balsam Poplar Forest License A22797	Pulpwood Agreement NO 14
1994/04/01-1995/03/31	Total 608,615m ³	Total 61,355m ³	
1995/04/01-1996/03/31	Total 774,430m ³	Total 26,027m ³	
1996/04/01-1997/03/31	Sw (65%) 569,510m ³ PI (19.4%) 170,354m ³ At & Ac (15.6%) Total 876,877m ³	Total 22,173m ³	Total 373,473m ³
1997/04/01-1998/03/31	Sw (64%) 320,418m ³ PI (17%) 83,794m ³ At & Ac (19%) 92,906m ³ Total 497,118m ³	No harvesting	Sw (23%) 82,664m ³ PI (2%) 8853m ³ At (75%) 275,616m ³ Total 367,134m ³
1998/04/01-1999/03/31	Sw (84%) 253,628m ³ At (13%) 38,491m ³ Ac (3%) 10,279m ³ Total 302,221m ³	No harvesting	Sw (15%) 106,295m ³ At (82%) 553,614m ³ Ac (3%) 17,348m ³ Total 677,257m ³

Data Source: Fort Nelson Silviculture Strategy Workshop Questionnaire, Jan. 24, 2000



A2.4 Timber Supply Dynamics

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 landbase 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 any “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.

Due to the TSR2 time frame, it was decided to use the timber supply analysis from TSR1. Observations drawn from this analysis are used to describe the timber supply dynamics of the management unit and to suggest how silviculture treatments might enhance timber supply.¹

The Fort Nelson TSA timber supply analysis (1992) separates the timber supply forecast into coniferous-deciduous and aspen components and so this section is presented in two parts:

- Coniferous and Non-Aspen Timber Supply Dynamics, which deals only with the coniferous harvest forecast and sensitivity analysis;
- Aspen Timber Supply Dynamics, which deals only with the aspen harvest forecast and sensitivity analysis.

A2.4.1 Coniferous and Non-Aspen Timber Supply Dynamics

The 1992 Fort Nelson Timber Supply Analysis was accomplished before the introduction of the Forest Practices Code. In an attempt to integrate Integrated Resource Management (IRM) guidelines into TSR1 three options were developed:

1. Option I - Current Plan
2. Option II - Current Performance
3. Option III - Alternative Plan (A)

A2.4.1.1 Timber Supply Dynamics – No Constraints or Silviculture

Option I – Current Plan

For Option I – Current Plan, harvest constraints for accessibility and IRM were assumed to decrease over the next 50 years. The initial amount of net immature timber, which is economically available for harvesting was 18%. This value increased to 30% at the end of 50 years, and 100% for the rest of the planning horizon. The constraints for accessibility (harvest pattern constraints) do not simulate field operations, therefore the effect of these constraints are

¹ Subsequent to the workshop, a review copy of the TSR2 Fort Nelson Timber Supply Area Analysis Report was made available to the consultant. (see Appendix 3).

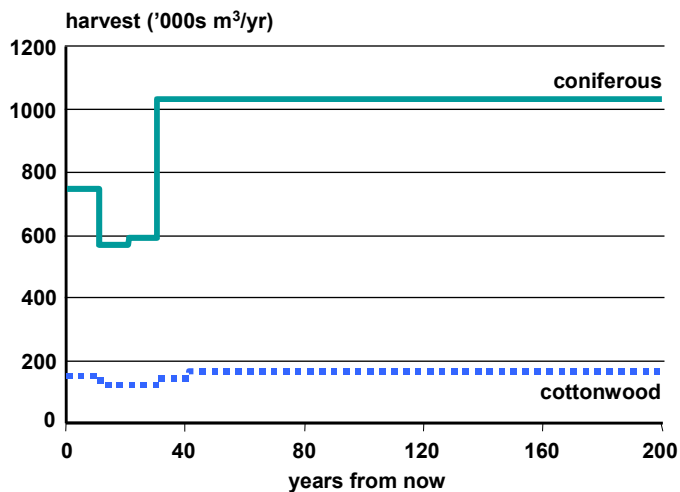


not considered when viewing the results. The resultant timber supply forecast is not constraint by any factors.

The area of coniferous stands in the timber harvesting land base for TSR1 was 612 763 hectares. The 1992 TSR, upon which the current AAC determination was based, forecasts an initial harvest level of 750 000 m³ for the first 10 years, declining to a low of 575 000 m³ at the end of 20 years (Figure A2-1). This harvest level then rises to the LRSY of 1 042 000 m³ in 40 years time.

The area of cottonwood stands in the timber harvesting land base for TSR1 was 53 612 hectares. The 1992 TSR, upon which the current AAC determination was based, forecasts an initial harvest level of 169 000 m³ for the first 10 years, declining to a low of 123 000 m³ at the end of 30 years (Figure 2-1). This harvest level then rises to the LRSY of 166 000 m³ in 50 years time.

Figure A2-1. Coniferous and cottonwood base case harvest forecast, Fort Nelson TSA 1992



The harvest forecast for coniferous stands can increase by 45% after decade 4 because of the amount of immature sites becoming operable. The initial percentage of merchantable immature stands was 18%, but when the forecast reaches the 4th decade 100% of these stands become operable contributing to the timber supply forecast.

The cottonwood harvest forecast can also be explained by the amount of immature stands coming on-line. Once immature stands become operable harvest levels can be increased.

A2.4.1.2 Sensitivity to Land Base Reductions and Forest Cover Constraints

Option II – Current Performance

Option II – Current Performance sets constraints to account for harvest pattern by utilizing a two pass harvesting system (50%/50%) with a 10 (cottonwood) and 20 (coniferous) year harvesting delay between passes. It was assumed this scenario would account for buffer strips, site degradation, and roads and rights of way. Also constrained is the amount of area in the timber harvesting land base. For the coniferous scenario the THLB was reduced by 42%, while the cottonwood scenario THLB was reduced by 86%. Both of these reductions drastically lowered the amount of available timber and subsequent harvest levels.



In this early attempt to model constraints such as buffers, site degradation and roads as well as possible land base reductions it was shown that these constraints will decrease harvest levels as shown by the differences in the harvest forecasts for Option I and Option II for both coniferous (Figure A2-2) and cottonwood (Figure A2-3) harvest forecasts.

Figure A2-2. Sensitivity of coniferous harvest forecast to THLB reductions and constraints, Fort Nelson TSA 1992

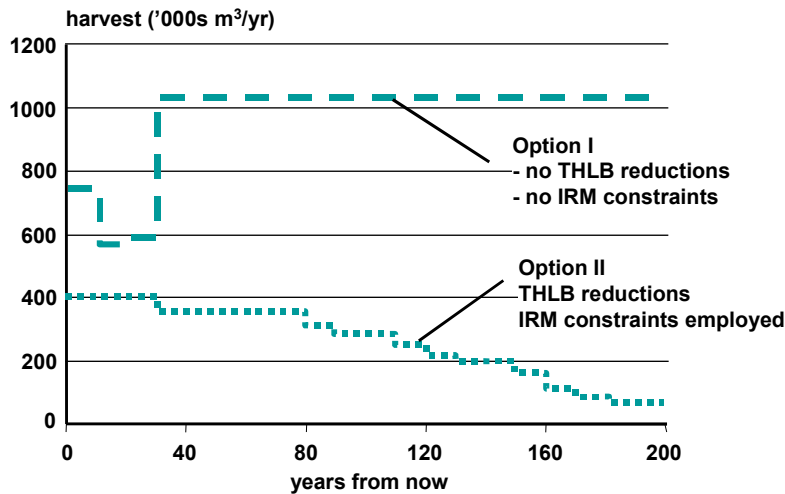
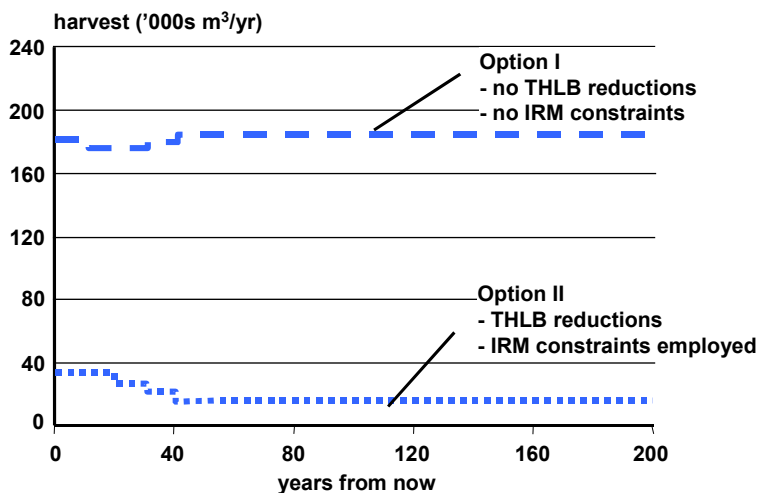


Figure A2-3. Sensitivity of coniferous harvest forecast to THLB reductions and constraints, Fort Nelson TSA 1992



Various silvicultural activities and shifts in forest product objectives can be interpreted as bringing land into the timber harvesting land base and so the comparison of Option I and Option II (Figure A2-2 and Figure A2-3) will provide information on the magnitude and timing of the benefits. Decreases to the timber harvesting land base will decrease timber supply across the entire planning horizon.



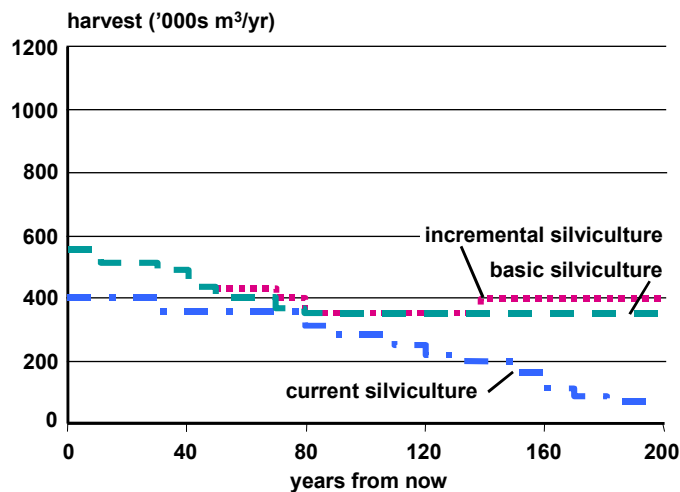
A2.4.1.3 Sensitivity to Silvicultural Activities and Integrated Resource Management

Option II – Current Performance

Figure A2-2 illustrates three scenarios examining alternative silviculture scenarios on the coniferous component of the THLB. The first scenario which employs current silviculture (1992) has a lower harvest rate compared to the second scenario which utilizes basic silviculture. Basic silviculture, in this case, increases the amount of merchantable stands found in the timber harvesting land.

The last scenario, incremental silviculture defined as a planned level of NSR and NCB_r reforestation will have a higher harvest level than the basic silviculture scenario because the future inventory is increased by 1 800 hectares per year.

Figure A2-3. Silvicultural impacts on the coniferous harvest forecast, Fort Nelson TSA 1992



Option III – Alternative Plan (A)

In this scenario, the simulation of timber harvesting activities integrated with other resource values was accomplished. Table A2-12 lists the resource units and management priorities.

Table A2-12 Resource units and associated management priorities, Fort Nelson TSA 1992.

Resource Unit	Management Priority
RU 1	An area with future timber potential, but not economic at this time. This area has other resource values which at the time are conserved through the exclusion of these areas from the AAC.
RU 2	An area that has world class wilderness and outdoor recreation opportunities. This area will be conserved through limited timber harvesting with harvesting constraints to achieve wildlife habitat objectives.
RU 3	An area that, in addition to some moderate timber values, has important visual, outdoor recreation, and wildlife habitat. This area will be conserved through limited timber harvesting with harvesting constraints to achieve visual, outdoor and wildlife habitat objectives.
RU 4	An area that has important timber values as well as important wildlife objectives. This area will also be managed as an integrated resource area but with less severe harvesting constraints.
RU 5	An area with less important timber values but important subsurface values. No timber harvesting constraints are applicable in this area.



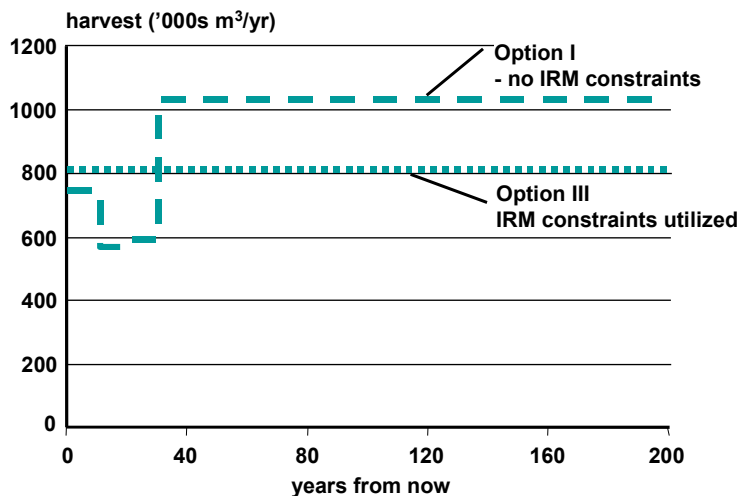
RU 6 An area that has existing and potential agriculture development. This land base no longer supports the AAC.

Data Source: Fort Nelson TSA Analysis Report 1992, p. 7

The forest inventory was disaggregated into the resource units in order to have the applicable constraints imposed. A three pass harvesting system was modeled in the RUs 2 and 3, and a two pass system in RU 4.

Figure A2-4 illustrates the effects of integrated resource management on the harvest forecast. The harvest forecast which does not take into account other values (Option I), is substantially higher than Option III.

Figure A2-4. Sensitivity to integrated resource management on the coniferous harvest component, Fort Nelson TSA 1992



Changing environmental and social values affects the harvest forecast because of constraints placed on the amount of stands older than a specified age (Figure 2-4). When old-growth forest cover requirements become increasingly restrictive the amount of area which can be of a mature age is lessened causing the harvest forecast to be lower than Option I which employs no IRM constraints. This decrease can be attributed to further restrictions placed on the mature surplus of timber. Constraints set in the analysis will be increasingly met when the mature cover constraints are increased.

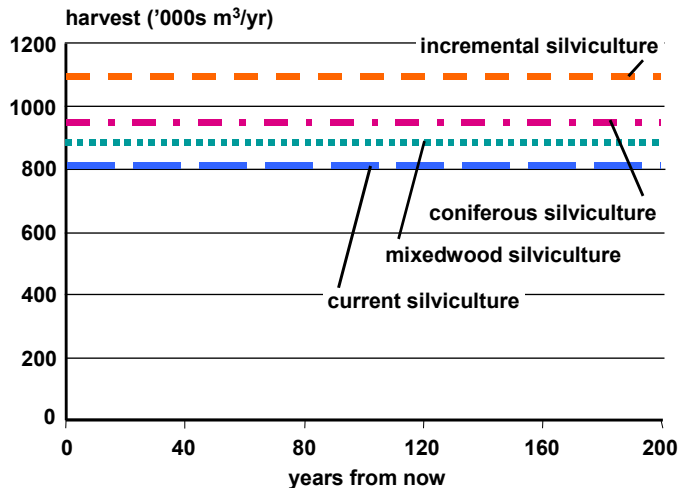
It should also be noted that employing alternative silvicultural treatments aids in alleviating certain forest cover constraints. Several harvesting techniques and equipment could be used to retain merchantable older timber in a certain area, therefore lessening the number of green-up and old-growth forest cover constraints being met. This allows the harvest forecast to capture additional volume from the surplus available.

Figure A2-5 demonstrates the effects of silvicultural activities on the harvest forecast. Increasing regeneration capabilities of regenerating and non-merchantable stands leads to increased harvest forecasts. Bringing non-merchantable land into the THLB through incremental silviculture, will



have immediate and long-term effects on the timber supply forecast. It should also be noted that coniferous volumes are higher than mixedwood volumes, therefore if the land base regenerates to coniferous stands the growing stock will increase leading to increased harvest forecasts.

Figure A2-5. Sensitivity of the coniferous harvest component to silviuctural activities, Fort Nelson TSA, 1992



Silvicultural regimes can be employed to reduce the number of years to reach free-growing status (regeneration delay). Pre-free growing regimes such as improved planting stock, site preparation, herbicide and fertilization are just a few examples of regimes which could lessen the number of years required to reach free-growing status.

A2.4.1.4 Sensitivity to Utilization Standards

Option III – Alternative Plan (A) – Alternative Utilization Strategies

Two scenarios were employed to demonstrate the effects of alternate utilization standards:

- current utilization standards of deciduous species and basic silviculture of all harvested areas emphasizing mixtures of coniferous and deciduous species in mixedwood stands;
- close utilization standards of deciduous species and basic silviculture of all harvested areas emphasizing mixtures of coniferous and deciduous species in mixedwood stands.

Figure A2-6 to A2-8 illustrate the effects of alternate utilization standards on coniferous, cottonwood, and aspen components of the THLB.



Figure A2-6. Sensitivity to alternate utilization standards on the coniferous harvest forecast, Fort Nelson TSA, 1992

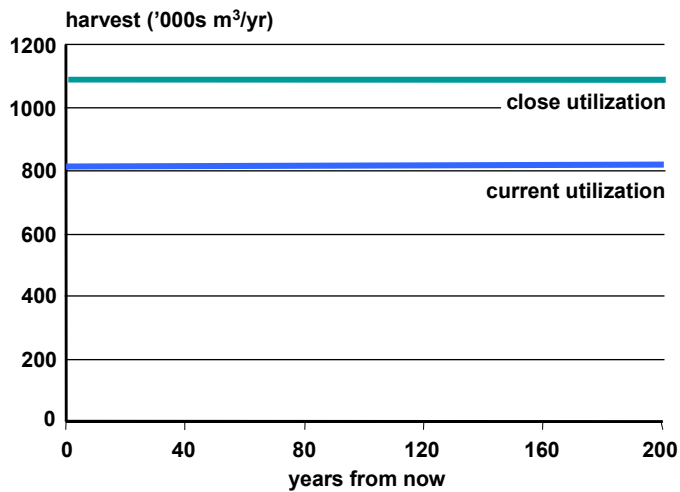


Figure A2-7. Sensitivity to alternate utilization standards on the cottonwood harvest forecast, Fort Nelson TSA, 1992

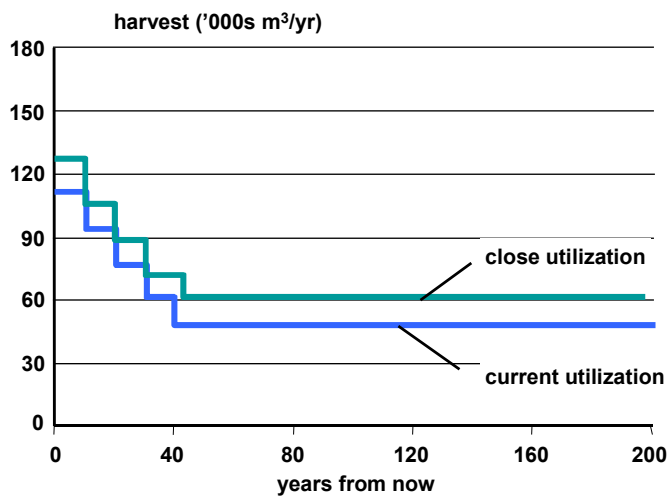
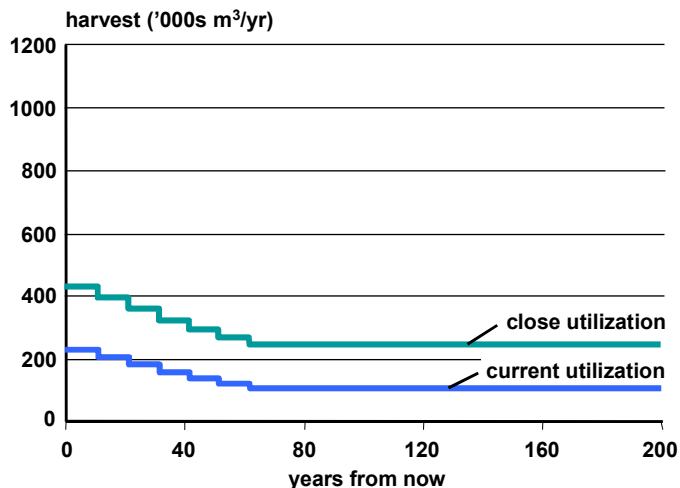




Figure A2-8. Sensitivity to alternate utilization standards on the aspen harvest forecast, Fort Nelson TSA, 1992



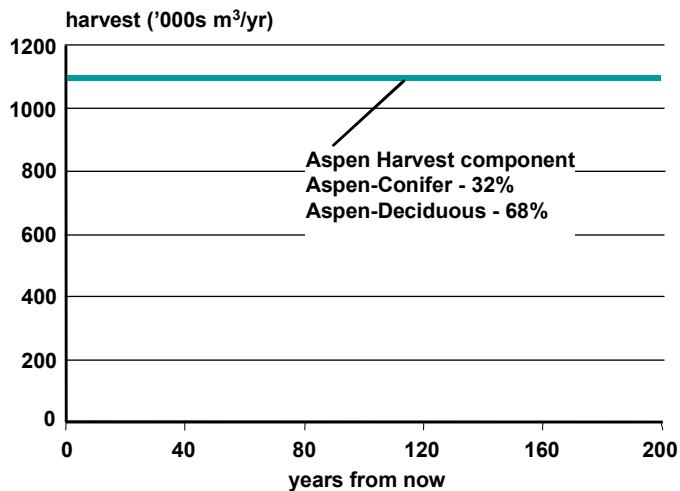
In all three scenarios the harvest forecast can be increased by utilizing additional portions of the THLB. Several harvesting techniques and equipment could be used to retain merchantable species in stands. This allows the harvest forecast to capture additional volume from the surplus available.

2.4.1 Aspen Timber Supply Dynamics

The aspen review was limited to Forest Licence A32900. The THLB supporting the analysis was 472 716 hectares. A priority of the analysis was incorporating the IRM objectives listed in Table A2-7a.

An even-flow harvest level of 1 108 500 m³ per year is forecasted (Figure A2-9). The level can be maintained due to the current age class distribution and growth rate of the deciduous species. Over 70% of the area is mature. Once aspen leading stands are harvested they are assumed to regenerate back to aspen. Aspen stands will have a high growth rate due to the competitive nature of the species (non-shade species). These stands will have accelerated life cycles, therefore constantly replenishing the growing stock and supporting the harvest forecast.

It should be noted that the IRM objective of no more than 50% of the THLB be in a non greened-up state (less than 12 years old) at any time could be pushed to no more than 11% of the THLB in a non greened-up state before the LTHL would be adversely affected (not shown).

**Figure A2-9. Aspen harvest forecast, Fort Nelson TSA, 1992**

Timber Supply Dynamics - Summary

The only constraint on timber supply in the Fort Nelson TSA is the physical scarcity of harvestable timber in the early short to early mid-term. This scarcity requires that volumes of existing mature timber from unmanaged stands be rationed until immature stands are ready for harvest. The rationing mechanism (TSR harvest flow constraints) can also be used to convey back to the short- and early mid-term the future timber supply benefits resulting from manipulating forest-level parameters. Silvicultural practices that modify stand yields, and the extent of the timber harvesting land base will have significant effects on timber supply.

Utilizing alternative silvicultural methods can lessen the amount in which the timber supply is reduced. Numerous harvesting techniques and equipment could be utilized to alleviate the constraints set by integrated resource management and utilization standards, therefore allowing harvesting to occur in stands which were previously tied up in forest cover requirements or lost entirely due to differing utilization standards.



Appendix 3

The Timber Supply (TSR2) Context of Silviculture

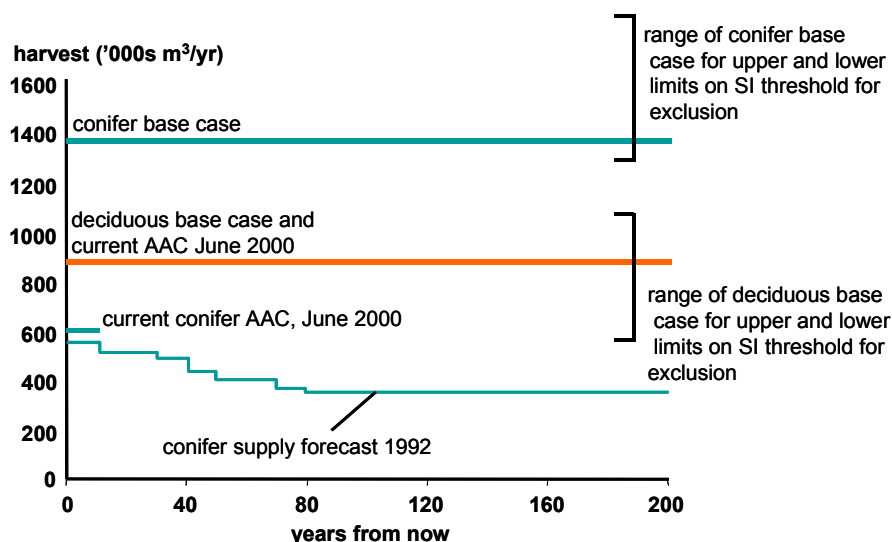
Subsequent to the Type 1 workshop (February 28-28, 2000) a review copy of the TSR2 Fort Nelson Timber Supply Area Report was made available to the consultant. This appendix describes salient points of the analysis document that have implications for silviculture planning.

Timber Supply Forecast and the AAC

Figure A3-1 shows the base case forecast for deciduous stands remaining at the current AAC of 900,000 m³ for 200 years. However, the TSR2 representation of the timber harvesting land base is forecast to sustain a conifer harvest of 1,396,000 m³. This base case level is more than twice the current conifer AAC.

The timber supply (both conifer and deciduous) is most sensitive to the site index thresholds used to exclude stands of low productivity from the timber harvesting land base. These thresholds were developed from a review of recent harvesting operations but they respond to shifts in costs and market prices, so are inherently uncertain. As illustrated on Figure A5-1, conifer supply fluctuates from 19% below the base case to 32% above, depending on whether or not the upper or lower end of the range of uncertainty is used to set the threshold. Similarly, the deciduous resource could increase to 21% above the base case if the lower end of the site index threshold were used, and would be 35% lower (long-term timber supply) if the upper end were used.

Figure A3-1 Base case harvest forecasts for conifer and deciduous stands.





Black Spruce – A Critical Issue

The potential to include black spruce in the timber harvesting land base was identified in the report as critical issue with respect to timber. Black spruce was excluded due to uncertainties about the inventory as well as limited harvesting performance. However, the potential impact on conifer timber supply of including black spruce (above a site index threshold specified in the report) is substantial – 30% over the next 100 years, relative to the base case harvest projection. A reduction in inventory related uncertainties may make black spruce an attractive resource.

A further obstacle to the harvesting of black spruce stands are silvicultural and regeneration difficulties associated with a high water table. The report notes that as more specific ecological (site series) inventories are completed, it may be possible to make specific land base exclusions where regeneration problems are anticipated.

Mixed Wood Management -- A Critical Issue

The management of mixedwood stands is also identified in the report as a critical issue. Mixedwood coniferous leading stands comprise 35% of the coniferous timber harvesting land base and excluding them reduces timber supply by 27.5%. Mixedwood deciduous leading stands comprise 32% of the deciduous timber harvesting land base and excluding them reduces timber supply by 33% over the long term. The report notes that Ministry of Forests staff are currently working with the local forest industry to develop a mixedwood management strategy.

Conclusion

The TSR2 Fort Nelson Timber Supply Area Analysis Report identifies three issues that may help guide silviculture planning on the management unit:

1. Both the conifer and deciduous timber supply are very sensitive to the site index thresholds used to exclude stands of low productivity from the timber harvesting land base. These thresholds represent economic margins and respond to changes in operating costs and market prices.
2. Silvicultural and regeneration difficulties associated with a high water table are an obstacle to the to the inclusion of black spruce stands in the conifer timber supply.
3. Silviculture management of mixedwood stands is not fully understood and current practices may result in silviculture costs that are higher than is necessary and degradation of habitat.



Appendix 4

Executive Summary of *The Incremental Silviculture Strategy For British Columbia (Interim)*

STRATEGY AT A GLANCE

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	<ul style="list-style-type: none">• Sustainable Use• Community Stability• A Strong Forest Sector
Key Principles	<ol style="list-style-type: none">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 important 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	<p>Within the context of the guiding principles:</p> <p>WT 1: Minimize the anticipated interim reduction in timber supply so that provincial annual harvests of at least 65 million m³ can be achieved during this period.</p> <p>WT 2: Create a long term timber supply capable of supporting a steady long term provincial harvest level of at least 75 million m³.</p> <p>WT 3: Over the long term, maintain the production of premium quality logs at or above 10% of total harvest.</p>
Major Silvicultural Strategies	<ul style="list-style-type: none">• 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. <p>Other silvicultural and non-silvicultural strategies must also be implemented to achieve the working targets.</p>
Strategy Implementation	Regional and management unit strategies must be developed, followed by programs and plans to implement them.



Appendix 5

Workshop Feedback – Fort Nelson TSA

Please circle the number that best represents your view.

1 Length of session	5 too long	4	3 just right	2	1 too short
2 Level of detail of content	5 too much	4	3 just right (6)	2	1 not enough
3 Instructional method (style, interaction, clarity)	5 excellent	4 (2)	3 adequate (4)	2	1 poor
4 Relevance to your interests/needs	5 extremely (1)	4 (4)	3 average (1)	2	1 not at all
5 Extent to which your needs were met	5 entirely	4 (5)	3 average (1)	2	1 not at all
6 Usefulness of the handout graphics and texts	5 very (2)	4 (2)	3 adequate (2)	2	1 useless

What were the strengths of this workshop?

- Getting together and discussing the issues and developing the strategy to deal with them.
- Very current information.
- Confirmed silviculture investments to date.
- The actual descriptive process used through the PowerPoint to see the actual benefits.

What were the weaknesses of this workshop?

- Needed more “upper management” personnel in attendance to discuss the pros and cons of specific silviculture investments.

How could this workshop be improved?

- No comments.

Other comments? (use back if necessary)

- No comments.