
Morice TSA

Silviculture Strategy (Type 1)

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Acknowledgements

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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. This strategy, which deals with incremental silviculture activities, is part of a larger District planning effort that includes the development of the Morice Forest District Resource Management Plan (2000-2004).

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.

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: backlog NSR and impeded backlog, concerns about seral stage distributions and the species composition of “created” early-seral, and providing for a wide range of log quality grades.

Elements of the Strategy

1. Survey impeded backlog stands and brush as required.
Restock all treatable backlog NSR of an estimated potential of 3153 ha by conducting surveys, site preparation, planting and brushing.
2. Maintain habitat quality through the transition from natural to managed stands by encouraging the establishment of early seral species similar to those in natural stands, creating mature and old seral characteristics in mid-seral stands, maintaining natural levels of aspen in mixedwood stands, and managing wildlife tree patches and riparian areas for habitat values rather than timber objectives.
3. Provide an even flow of local, all-season employment opportunities through a steady level of defined labour-intensive silviculture activities undertaken with long-term silviculture services contracts.



4. Produce 5 m clear logs with minimum 30 cm diameter as 10% of the volume from high site index lodgepole pine stands by planting improved stock, spacing to 900 sph at 5.5 m top height then pruning to 3.3 m, pruning again to 5.5 m when the top height is 8 m, and fertilizing every 15 years beginning three years after pruning.

Produce 5 m clear logs with minimum 30 cm diameter on good and medium pine stands as 10% of the volume by spacing to 1000-1800 sph and fertilizing every 15 years beginning three years after spacing.
5. Reduce volume losses from the balsam bark beetle in an estimated 102 000 ha of balsam stands by assigning harvest priority to these stands in older age classes and to areas with known beetle infestations. The extent of balsam bark beetle in the Morice TSA needs to be better understood for appropriate management to control populations and optimize timber salvage opportunities.

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.

Workshop participants ranked the treatment of impeded backlog and backlog NSR as the two highest priority items. Issues related to the changing balance of seral stages and to the plant species present in "created" (as opposed to "natural") early-seral ranked third and fifth respectively. Activities related to providing high quality sawlogs ranked fourth.



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

Activities/Treatments	Opportunity (ha)	Workshop Rank
Surveys		
backlog impeded stands	7000 ha/yr	1
backlog NSR (in year 1)	3153 ha	2
Site Preparation		
treatable backlog NSR	640 ha	2
Planting		
plant improved stock (for production of clear sawlogs)		4
plant site-prepared treatable backlog NSR	640 ha/yr	2
Brushing & Spacing		
brush backlog impeded stands	350 ha/yr	1
brush backlog NSR after site preparation and planting	400 ha/yr	2
space or commercial thin to create old-growth attributes in pilot study area	200 ha/yr	3
space to 900 sph (for production of clear sawlogs)	100 ha/yr	4
space to 1000-1800 sph (for production of clear sawlogs)	500 ha/yr	4
Fertilization		
fertilize 3 yr after thinning (to create old-growth attributes in pilot study area)	200 ha/yr	3
fertilize 3 yr after pruning, repeat on 15-yr cycle (on high S.I. pine stands to produce clear logs)	100 ha/yr	4
fertilize 3 yr after spacing, repeat on 15-yr cycle (on good and medium site pine stands to produce clear logs)	500 ha/yr	4
Pruning		
pruning (to create old-growth attributes in pilot study area)	200 ha/yr	3
pruning for production of clear sawlogs (1 st lift)	100 ha/yr	4
pruning for production of clear sawlogs (2 nd lift)	100 ha/yr	4
Other treatments and activities		
encourage establishment of natural early seral species in "created" early-seral areas	?	5



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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. These strategies were assessed by the workshop participants as to their appropriateness and efficacy. Some of these strategies were selected by the participants as feasible and desirable for the TSA and are listed in Table 1-1. This set of strategies constitutes the silviculture strategy for the Morice TSA, as determined by the workshop participants.

1.1 Backlog NSR

Some backlog sites on the timber harvesting land base remain untreated. Sites left with inadequate stocking levels will probably not reach the projected yields used in the timber supply analysis. An estimated 3153 ha could be restocked, and impeded backlog stands require brushing to achieve free-growing status.

Strategies:

1. Restock all treatable backlog NSR over a five-year planning period. Survey the entire area (3153 ha) in the first year, site prepare as required (20% of treatable area per year), plant, and brush as required.
2. Survey impeded backlog stands (approximately 7000 ha) and brush as required.

To Do:

1. Investigate the significance of managing to minimum stocking standards rather than target, including "uncounted" stems in yield projections.
2. Develop more accurate OAFs that represent minimum stocking instead of target stocking.

1.2 Balsam Bark Beetle

An estimated 102 000 ha of balsam stands are highly susceptible to balsam bark beetle infestations (Morice TSR1 Analysis, 1996). The TSR1 analysis report assumed that 63 000 m³ per year would be lost during the first 50 years, after which the loss is expected to drop slightly to 61 000 m³ per year due to increased forest management. The potential loss of timber volume to balsam bark beetle must be reduced.

Strategies:

1. Assign harvest priority to balsam-leading stand types in older age classes and to areas with known infestations.

To Do:

1. Assess the extent of the balsam bark beetle in the Morice TSA and determine if high priority should be placed on harvesting susceptible and infested stands.
2. Obtain information about balsam bark beetle biology from Art Stock's paper.



3. Calibrate yield predictions with actual yields on stands infested with balsam bark beetle.

1.3 Silviculture Employment

A steady level of defined labour-intensive silviculture employment is required for the Morice TSA. However, employment and silviculture allocation must be balanced while providing an even flow of local, all-season employment opportunities.

Strategies:

1. Provide an even flow of local, all-season employment opportunities by preparing five-year silviculture activity plans and conducting the required training for the local workforce. Enter into long-term silviculture services agreements with contractors, including multi-phase silviculture contractors.

1.4 Habitat

This issue is divided into five sub-issues relating to specific aspects habitat supply in the Morice TSA.

1.4a, b Early Seral Stands

Some of the workshop participants are concerned that managed early seral stands will not have the same habitat value as natural early seral because of the different plant species composition.

Strategies:

Issue 4a is deferred to strategic planning (LRMP, landscape unit plans and the Lakes-Morice IFPA).

The strategy for issue 4b is to encourage, where required, the establishment of natural early seral plant species in managed stands. MELP will work with licensees to ensure that pest management plans address this concern.

1.4c Old Seral

There is a perceived shift to less old seral species and more “created” early seral and mid-seral area.

Strategies:

1. Create mature and old seral characteristics in mid-seral stands by accelerating the production of certain attributes (variety of stem sizes, coarse woody debris, species diversity, and large-diameter stems) in areas with high site productivity in plantations and large burns. Identify candidate pilot study areas and prepare prescriptions that specifically address landscape unit requirements. Space or commercial thin, fertilize and prune as required to create required attributes.



To Do:

1. François Ouellet and Andy Witt will work together to define the stand attributes.

1.4d Aspen Component

The aspen component in mixedwood stands is declining due to management practices that promote conifer stocking.

Strategies:

1. Address in pest management plan with issue 4b.

1.4e Stand-Level Biodiversity

In stands harvested before the inception of the Forest Practices Code in 1995, wildlife tree patches and riparian areas should be managed for their desired characteristics rather than for timber production.

Strategies:

1. Identify and establish stand-level retention area candidates (future WTPs and riparian areas) and goals in stands regenerating after logging or wildfire. Manage for habitat values rather than crop tree objectives.

1.5 Expansion of Timber Harvesting Land Base

There is potential to increase the timber harvesting land base through rehabilitation of permanent access structures (roads and landings).

Strategies:

1. Devise strategies after the IFPA has completed its analysis of this issue.

1.6 Timber Quality

Lower timber quality is expected in regenerated stands than in first-growth stands. Management in the Morice TSA should provide for a wide range of forest products, including high quality grades.

Strategies:

1. On lodgepole pine stands with high site index, produce 5m clear logs with minimum 30 cm diameter as 10% of the volume by planting improved stock at a density to be determined, spacing to 900 sph at 5.5 m top height then pruning to 3.3 m, pruning again to 5.5 m when the top height is 8 m, and fertilizing every 15 years beginning three years after pruning.



2. On good and medium pine stands, produce 5m clear logs with minimum 30 cm diameter as 10% of the volume by spacing to 1000-1800 sph and fertilizing every 15 years beginning three years after spacing.

To Do:

1. Determine dimensions and characteristics for premium logs.
2. Determine the area of pine-leading stands with site index greater than 20m.



2. Silviculture Impacts and Priorities

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

Table 1-1. Workshop issues, objectives, strategies, activities, targets, and impacts, Morice TSA

Issues	Objectives	Strategies	Target	Activities	Opportunity --- Timber Supply Effects					Habitat	Jobs	Cost	Rank
					Area	Short	Mid	Long	Qual	Effects	Days/ha	\$/ha	
1 Backlog NSR	Treat all treatable backlog NSR (est. 3153 ha).	Treat all treatable backlog NSR over 5 yr plan period.	Backlog NSR	Survey entire area first year	3153 ha		+	+		+/-	0.067	30	2
				Site prep as needed (20%/yr)	640 ha/yr		+	+		+/-	1	1200	
				Plant	640 ha/yr		+	+		+/-	1	1040	
				Brush as required	400 ha/yr		+	+		+/-	2	550	
Treating impeded backlog stands	Achieve FG on backlog areas within 10 years.	Survey, brush.	Backlog impeded stands	Survey	7000 ha/yr						0.067	30	1
				Brush	350 ha/yr		+	+		+/-	2	550	
2 Unsalvaged losses to balsam bark beetle (63 000 m3/yr)	Reduce area of stands susceptible to balsam bark beetle.	Harvest priority will be for older age classes in balsam-leading stand types and in areas with known infestations.	balsam-leading stand types and areas of known infestations	Direct harvesting to high-priority (target) stand types	1500 ha/yr								
3 Employment and allotment of silviculture funds	Generate a steady level of labour-intensive silviculture employment (amount to be defined).	Provide even flow of local employment opportunities through all seasons as much as possible.		Prepare 5-yr silviculture activity plans.		0	0	0	0	0			
				Conduct training.		0	0	0	0	0			
				Enter into long-term silviculture services agreements with contractors.		0	0	0	0	0			
				Enter into agreements with multi-phase silviculture contractors.		0	0	0	0	0			
4 Habitat	Habitat												
4a Concern that managed early seral stands will not have the same value as natural early seral because of the different plant species composition.	Ensure establishment of adequate areas of natural early seral plant communities.	Establish landscape-level objectives for establishing natural early seral plant communities in managed stands.		Deferred to strategic planning (LRMP, LU plans, IFPA)						+			
4b		Where required, encourage establishment of natural early seral plant species in "created" early seral areas.		MELP will work with licensees to ensure pest management plans address this concern.						+			5
4c Perceived shift to less old seral, and more "created" early seral and mid-seral area.	Create mature and old-seral characteristics in mid-seral stands.	Accelerate creation of certain attributes: - Variety of stem sizes - CWD - Diversity of species - Large diameter - Uneven canopy	Areas with high SI in large burns, plantations	Identify candidate pilot study areas (eg. Paul burn) and prepare prescriptions that address landscape unit requirements.	200 ha/yr				+	++	total 1 day		3
				Space or CT	200 ha/yr		+	+	+	++	2	600	
				Fertilize (3-4 yrs after thinning)	200 ha/yr		+	+	+	++		350	
				Prune	200 ha/yr		+	+	+	++	6	750	
4d Loss of aspen component in mixed stands	Maintain pre-harvest spp composition (esp. deciduous component) in regenerating mixed stands.	Best addressed in pest management plan; see early seral strategy (4b).											
4e Stand-level biodiversity in stands harvested "pre-Code"	Need to manage WTPs and riparian areas for desired characteristics, rather than for timber production.	Identify and establish stand-level retention area candidates (future WTPs and riparian areas) and goals in regenerating stands (e.g., logged, burned).	Regenerating stands harvested pre-Code and riparian mgmt zones established post-Code	Locate WTPs and riparian management zones whenever treating these stands; manage for habitat values rather than crop tree objectives.	80 ha/yr		-	-		++			
5 Potential to expand THLB	Expand THLB through silvicultural treatment (e.g. rehab permanent access structures).	Devise strategies after IFPA has completed its analysis of this issue.											
6 Lower timber quality expected in regenerated stands	Provide for a wide range of forest products (log quality grades).	10% of volume from high SI pine stands, should be 5 m clear logs, 30-cm min diameter	Pine stands with SI > 20 m	Plant improved stock.	to do		+	+			1	1100	4
		1		Planting density to be determined.					++				
				Space to 900 sph at 5.5 m top ht.	100 ha/yr				++	+	2	600	
				Prune first lift (to 3.3 m) at 5.5 m top ht	100 ha/yr				++	+	6	800	
				Prune second lift (to 5.5 m) at 8 m top ht	100 ha/yr				++	+	6	750	
				Fertilize 3 yr after pruning, repeat on 15-yr cycle.	100 ha/yr		+	+	++	+	0.0333	350	
		2	G and M pine stands	Space to 1000-1800 sph	500 ha/yr				+	+	2	600	4
				Fertilize 3 yr after spacing, repeat on 15-yr cycle	500 ha/yr		+	+	+	+	0.0333	350	



Table 2. Summary of silvicultural activities, Morice TSA

Objectives/Strategies	Activities	Target	Opportunity Area	Rank
Survey and treat impeded backlog stands	Survey	Backlog impeded stands	7000 ha/yr	1
	Brush as needed	Backlog impeded stands	350 ha/yr	1
Treat all treatable backlog NSR in next 5 yr	Survey entire area first year	Backlog NSR	3153 ha (estimated)	2
	Site preparation as needed (20%/yr)	Treatable backlog NSR	640 ha/yr	2
	Plant	Site-prepared treatable backlog NSR	640 ha/yr	2
	Brush as needed	Portion of site-prepared area above	400 ha/yr	2
Create mature- and old-seral characteristics in mid-seral stands by accelerating the creation of: diversity of species and stem sizes; CWD; uneven canopy; large diameters	Identify candidate pilot study area (e.g., Paul burn); prepare prescriptions that address landscape unit requirements	Areas with high site index in large burns, plantations	200 ha/yr	3
	Space or commercial thin	"	200 ha/yr	3
	Fertilize 3-4 years after thinning	"	200 ha/yr	3
	Prune	"	200 ha/yr	3
Provide for a range of log quality grades by managing so that 10% of volume from high SI pine stands will be 5 m clear logs, with 30 cm min diameter	Plant improved stock	Pine stands with SI > 20 m	to do list	4
	Space to 900 sph at 5.5 m top ht		100 ha/yr	
	Prune first lift to 3.3 m at 5.5 m top ht		100 ha/yr	
	Prune second lift to 5.5 m at 8 m top ht		100 ha/yr	
	Fertilize 3 yr after pruning; repeat on 15 yr cycle		100 ha/yr	
	Space to 1000-1800 sph	Pine stands with "G" and "M" site index values	500 ha/yr	4
	Fertilize 3 yr after spacing; repeat on 15 yr cycle		500 ha/yr	
Ensure establishment of adequate areas of "natural early seral" plant communities	Encourage establishment of natural early seral plant species in "created" early seral areas	MELP work with licensees to ensure pest management plans address this concern	?	5



3. Silviculture Program

3.1 Tactical Priorities

Tactical priorities for Morice 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 Morice TSA, workshop participants felt that the most important tasks are to treat impeded backlog stands and backlog NSR. Activities related to these objectives—surveys, site preparation, and brushing—were ranked highest.

Addressing concerns about the changing balance between the area of old-seral and that of early and mid-seral ranked third in importance. The strategy adopted is to accelerate the creation of certain old-seral attributes: diversity of plant species and tree stem sizes; coarse woody debris (CWD); large diameter trees; uneven canopy height. A 200-ha pilot study area will be established (the "Paul burn" was suggested), in which treatments of spacing or commercial thinning, fertilization and pruning will be undertaken.

Activities to produce a range of log quality grades ranked fourth at the workshop. About 10% of the volume from high site index pine stands should come from stands treated with a regime of improved planting stock, spacing to 900 sph, pruning, and fertilization, or with a regime of spacing to 1000-1800 sph, followed by fertilizing. Following the workshop concerns were expressed about whether these regimes would create the desired clear log products. Perhaps District and licensee staff should revisit the regimes to ensure that they are effective in achieving the desired productive characteristics.

Addressing concerns about the characteristics of "created" (as opposed to "natural") early seral areas ranked fifth in importance. The establishment of natural early-seral plant species should be encouraged in "created" early-seral areas. MELP will work with licensees to address this concern.

3.2 Program Costs and Benefits

The costs and benefits of the program developed in the workshop are summarized in Tables 3-6 (below). Table 3 shows the assumed unit costs and employment associated with each activity. Employment multipliers were estimated by the consultant and should be verified by the District. Tables 4-6 show the area treated, expenditures, and employment respectively by program year.

Table 3. Unit cost (\$/ha) and employment (person-days/ha) assumptions

	Backlog impeded stands		Backlog NSR				Create old growth attributes ¹			Produce clear sawlogs ² (high S.I. pine stands)				Produce clear sawlogs ³ (G, M site pine stands)	
	Survey	Brush	Survey	Site Preparation	Plant	Brush	Space or CT	Fertilize 3 yr after thin	Prune	Space to 900 sph	Prune 1st lift	Prune 2nd lift	Fertilize 3 yr after pruning, repeat every 15 yrs	Space to 1000 to 1800 sph	Fertilize 3 yr after spacing, repeat every 15 yr
\$/ha average	30	550	30	1200	1040	550	600	350	750	600	800	750	350	600	350
PDs/ha	0.067	2	0.067	1	1	2	2	0.03	6	2	6	6	0.03	2	0.03

¹ Create old-growth attributes in pilot study area

² Production of clear sawlogs from 10% of volume harvested from high S.I. pine stands

³ Production of clear sawlogs from 10% of volume harvested from good and medium site pine stands

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

Year	Backlog impeded stands		Backlog NSR				Create old growth attributes			Produce clear sawlogs (high S.I. pine stands)				Produce clear sawlogs (G, M site pine stands)		Total
	Survey	Brush	Survey	Site Preparation	Plant	Brush	Space or CT	Fertilize 3 yr after thin	Prune	Space to 900 sph	Prune 1st lift	Prune 2nd lift	Fertilize 3 yr after pruning, repeat every 15 yrs	Space to 1000 to 1800 sph	Fertilize 3 yr after spacing, repeat every 15 yr	
1	7,000	350	3,153	640	640	400	200	200	200	100	100	100	100	500	500	14,183
2	7,000	350	0	640	640	400	200	200	200	100	100	100	100	500	500	11,030
3	7,000	350	0	640	640	400	200	200	200	100	100	100	100	500	500	11,030
4	7,000	350	0	640	640	400	200	200	200	100	100	100	100	500	500	11,030
5	7,000	350	0	640	640	400	200	200	200	100	100	100	100	500	500	11,030
Subtotal Yr 1-5	35,000	1,750	3,153	3,200	3,200	2,000	1,000	1,000	1,000	500	500	500	500	2,500	2,500	58,303
6 - 10	35,000	1,750	0	3,200	3,200	2,000	1,000	1,000	1,000	500	500	500	500	2,500	2,500	55,150
Total Yr 1-10	70,000	3,500	3,153	6,400	6,400	4,000	2,000	2,000	2,000	1,000	1,000	1,000	1,000	5,000	5,000	113,453

Table 5. Expenditure (\$ x1000) by activity and year

Year	Backlog impeded stands		Backlog NSR				Create old growth attributes			Produce clear sawlogs (high S.I. pine stands)				Produce clear sawlogs (G, M site pine stands)		Total
	Survey	Brush	Survey	Site Preparation	Plant	Brush	Space or CT	Fertilize 3 yr after thin	Prune	Space to 900 sph	Prune 1st lift	Prune 2nd lift	Fertilize 3 yr after pruning, repeat every 15 yrs	Space to 1000 to 1800 sph	Fertilize 3 yr after spacing, repeat every 15 yr	
1	210	193	95	768	666	220	120	70	150	60	80	75	35	300	175	3,216
2	210	193	0	768	666	220	120	70	150	60	80	75	35	300	175	3,121
3	210	193	0	768	666	220	120	70	150	60	80	75	35	300	175	3,121
4	210	193	0	768	666	220	120	70	150	60	80	75	35	300	175	3,121
5	210	193	0	768	666	220	120	70	150	60	80	75	35	300	175	3,121
Subtotal Yr 1 - 5	1,050	963	95	3,840	3,328	1,100	600	350	750	300	400	375	175	1,500	875	15,700
6 - 10	1,050	963	0	3,840	3,328	1,100	600	350	750	300	400	375	175	1,500	875	15,606
Total Yr 1 - 10	2,100	1,925	95	7,680	6,656	2,200	1,200	700	1,500	600	800	750	350	3,000	1,750	31,306

Table 6. Short term employment benefits (person-years), by year and activity

Year	Backlog impeded stands		Backlog NSR				Create old growth attributes			Produce clear sawlogs (high S.I. pine stands)				Produce clear sawlogs (G, M site pine stands)		Total
	Survey	Brush	Survey	Site Preparation	Plant	Brush	Space or CT	Fertilize 3 yr after thin	Prune	Space to 900 sph	Prune 1st lift	Prune 2nd lift	Fertilize 3 yr after pruning, repeat every 15 yrs	Space to 1000 to 1800 sph	Fertilize 3 yr after spacing, repeat every 15 yr	
1	2	4	1	3	3	4	2	0.03	6	1	3	3	0.02	5	0.1	37
2	2	4	0	3	3	4	2	0.03	6	1	3	3	0.02	5	0.1	36
3	2	4	0	3	3	4	2	0.03	6	1	3	3	0.02	5	0.1	36
4	2	4	0	3	3	4	2	0.03	6	1	3	3	0.02	5	0.1	36
5	2	4	0	3	3	4	2	0.03	6	1	3	3	0.02	5	0.1	36
Subtotal Yr 1 - 5	12	18	1	16	16	20	10	0.15	30	5	15	15	0.08	25	0.4	183
6 - 10	12	18	0	16	16	20	10	0.15	30	5	15	15	0.08	25	0.4	182
Total Yr 1 - 10	23	35	1	32	32	40	20	0.30	60	10	30	30	0.15	50	0.8	365



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 7).

Table 7. Issues identified in the workshop that require investigation, Morice TSA

Rank	Issue	Issue	
1	1	Minimum stocking standards	Investigate the significance of managing to minimum stocking standards rather than target, including "uncounted" stems in yield projections.
2	1	Operational Adjustment Factor (OAF)	Develop more accurate OAFs that represent minimum stocking instead of target stocking.
3	6	Premium logs	Determine premium log dimensions and characteristics.
4	6	High site lodgepole pine	Determine area of pine-leading stands with SI >20 m.
5	2	Balsam bark beetle	Assess extent of problem and determine if higher priority should be placed on harvesting susceptible and infested stands.
6	2	Balsam bark beetle	Get information about biology from Art Stock's paper.
7	2	Balsam bark beetle	Calibrate yield predictions with actual yields on beetle-infested stands.
8	4c	Perceived shift to less old seral and more "created" early seral and mid-seral area.	F. Ouellet and A. Witt meet to define stand attributes for this topic (regime 4c).



Appendix A. 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 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 Allowable Annual Cut (AAC).

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

Timber Supply and the AAC

The 1996 TSR, upon which the current AAC determination was based, forecasts a harvest level of 1 995 000 m³ maintained for the first 9 decades (Figure A-1). In the tenth decade the harvest level declines 4% per decade until the long term harvest level is reached in decade 14. The long-term harvest level, the potential maximum that can be harvested in perpetuity, is 925 000 cubic metres per year, a 19% decline from the initial harvest level.

Figure A-1. TSR1 Base harvest forecast, Morice TSA, 1996

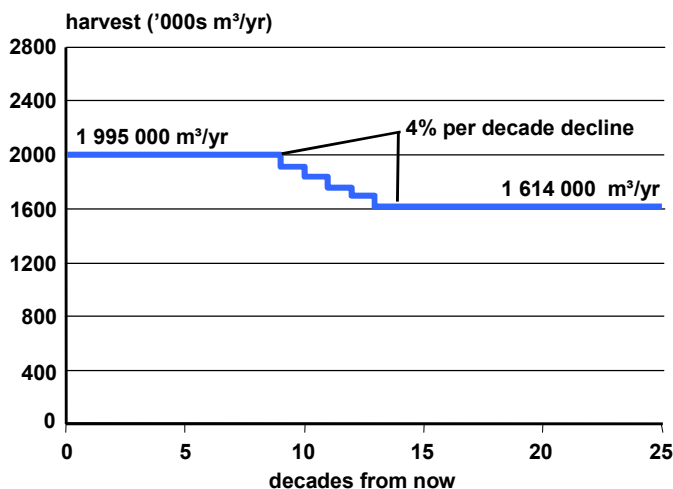


Figure A-1 also demonstrates the robustness of the base case harvest forecast. The initial harvest level can be maintained for 9 decades, and reduced gradually over 4 decades (4% per decade) down to the LTHL.

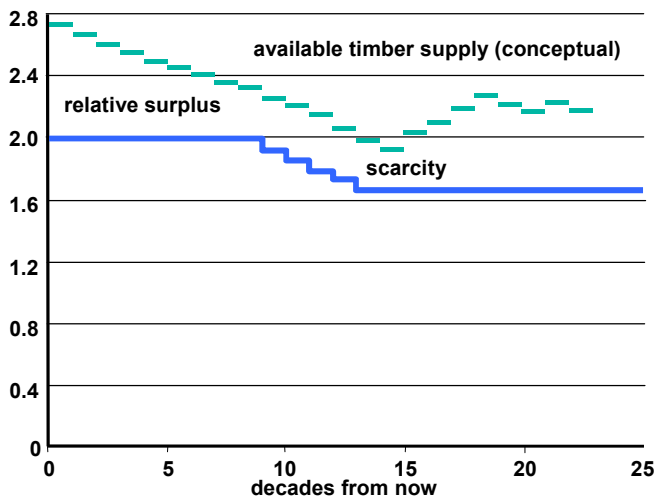
Figure A-2 illustrates the conceptual amount of available timber. At this time there is a relative surplus of available timber. The surplus must be rationed until later periods when there is a



scarcity of available timber. Timber rationing is the main objective of constraints placed on the rate of change of harvest levels.

The surplus will decline until there is a transition from natural to managed stands. This transition occurs around decade 14 when a majority of managed stands come on-line contributing to the amount of available timber.

Figure A-2. Base case harvest and available timber supply (conceptual) forecast, Morice TSA



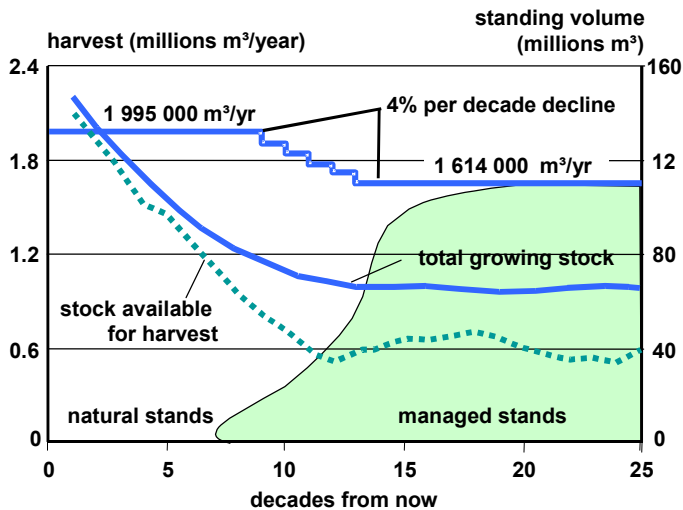
Transition from Managed to Natural Stands

The transition of the harvest from old growth to predominantly second growth is plotted on Figure A-3. Note that this transition line is an estimate – this information was not reported from the TSR1 analysis. The transition curve helps identify the response framework for Type 1 and Type 2 silviculture analyses--the end of the mid term and beginning of the long term is the point at which the harvest is predominantly dependent on managed stands. We have identified 140 years as the end of the mid-term for the Morice TSA. The short term is arbitrarily defined as the first 20 years.

The growing stock curves outlined in Figure A-3 demonstrate that the growing stock will decrease steadily during the short to mid-term until the levels are stabilized in the long-term. The growing stock levels will be stabilized once the transition from natural to managed stands occurs at decade 13. From period 14 onward, the growing stock reaches an even-flow level, therefore maintaining the long-term harvest level in perpetuity.

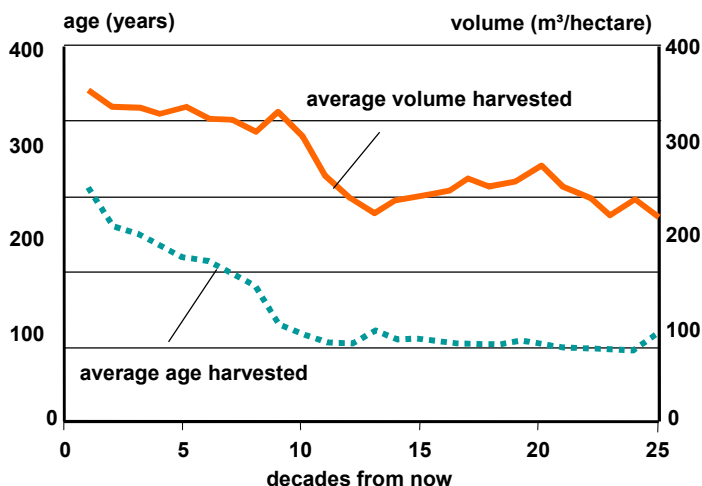


Figure A-3. Total and harvestable growing stock and harvest composition, Morice TSA



The average volume per hectare and average harvest age are represented in Figure A-4. The average harvest age declines gradually until period 11 when the average age reaches 85 years. At this time a majority of the managed stands come on stream. The average volume per hectare will decrease from approximately 350 m³ per hectare to 250 m³ per hectare. The decline can be attributed to the harvest transition from natural to managed stands. This approximate level will be maintained in perpetuity.

Figure A-4. Base case average harvest age and average volume harvested per hectare, Morice TSA



The harvest forecast is shaped by the current high volume of growing stock. The growing stock slowly declines until it reaches an even-flow level when managed stands reach harvestable



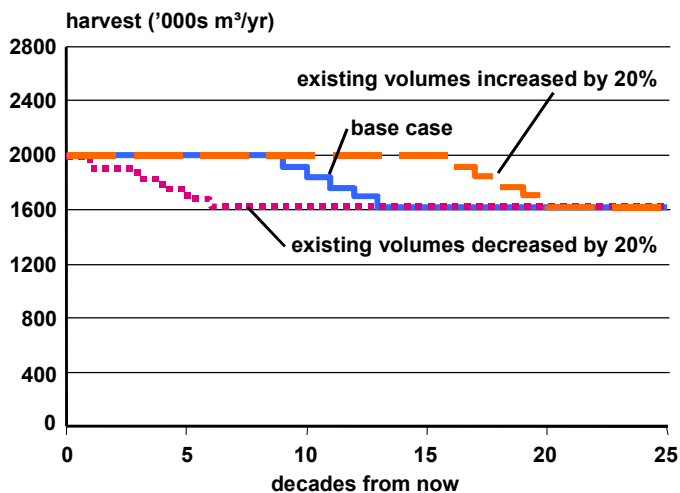
size. There are no apparent pinch points in supply except the distant transition and the TSR harvest flow conventions utilized by the chief forester.

Sensitivity to Existing Stand Volumes

Increasing existing stand yields has a significant effect on the short to mid-term harvest levels (Figure A-5). Since there is a majority of stands over the minimum harvestable age, increasing yield estimates will mean that increased volume will be obtained from these stands, and the current harvest level can be maintained an extra 7 decades.

Decreasing the stand yields causes a drastic decline in the harvest level. The current harvest level can only be maintained for 1 decade if yields for existing stands are reduced. This can be attributed to the fact that the potential volume from the mature stands is lessened due to the decreased yield estimates. As these mature stands are harvested there is a steady decline in the harvest level. Decreasing stand volumes indicates the risk of loss in inventory or overestimation of merchantability.

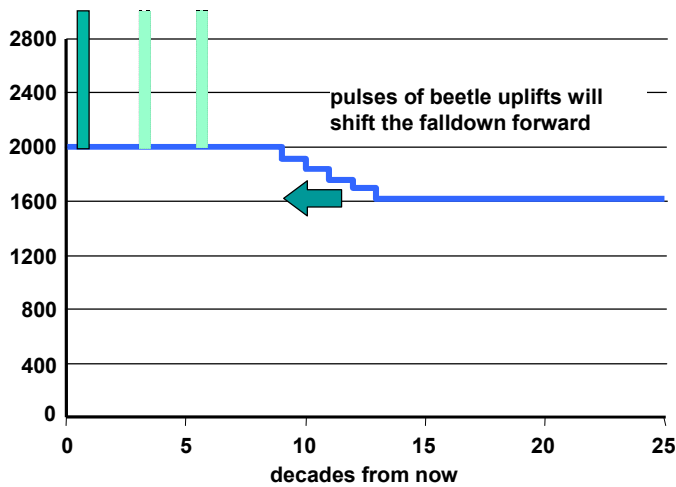
Figure A-5. Base case harvest forecast with existing volumes changed by 20%, Morice TSA



The Morice TSA is susceptible to mountain pine beetle infestations. Figure A-6 gives some indication of the current mountain pine beetle uplift, and possible future pulses of infestations. Infestations could bring the falldown occurring in the timber harvest forecast forward. A resultant trough could develop due to the shift in the harvest level. The number of years forward and severity of the trough depends on the level of infestation and the amount of silviculture applied to managed stands.



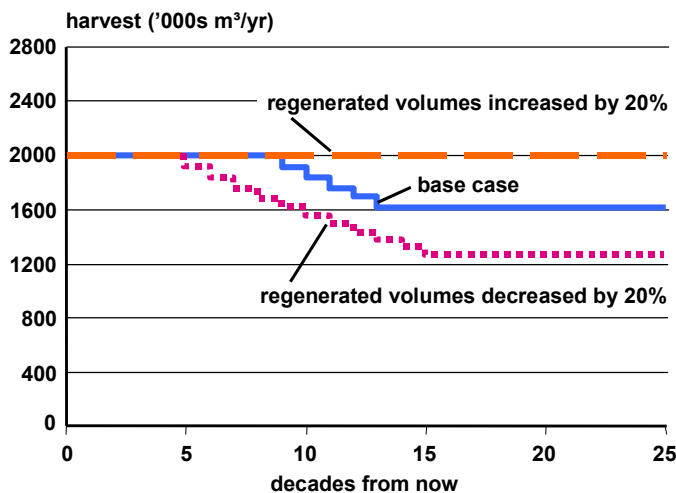
Figure A-6. Possible impacts of mountain pine beetle infestations, Morice TSA



Sensitivity to Regenerated Stand Volumes

Enhancing regenerated stand volumes by 20% creates an even-flow harvest level forecast (Figure A-7). The LTHL will be about 21% higher than the base case LTHL. Decreasing regenerated volumes increases the number of decades in the decline from the current harvest level to the LTHL (Figure A-7). The LTHL will be approximately 17% lower than the base case harvest forecast LTHL. Reductions in the regenerated stand volumes can be attributed to overestimation of site productivity and increased pest infestations.

Figure A-7. Base case harvest forecast with regenerated volumes changed by 20%, Morice TSA



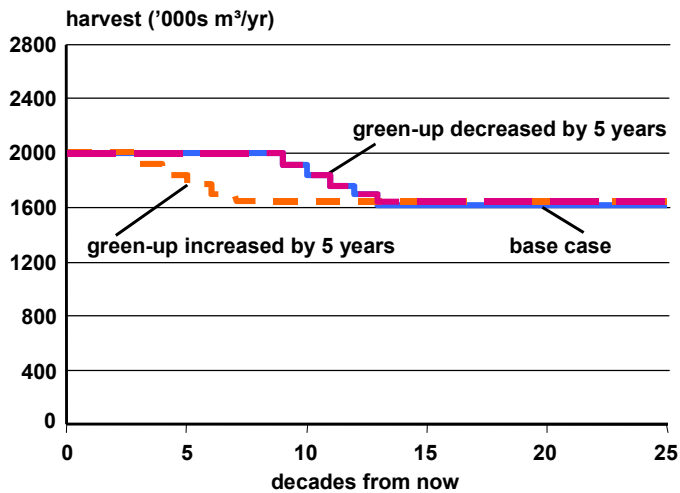
Sensitivity to Green-up Age

Another way of affecting managed stand volumes is increasing or decreasing green-up age (Figure A-8). Silvicultural regimes can be employed to reduce the number of years to reach the



desired green-up age. 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 desired green-up requirements.

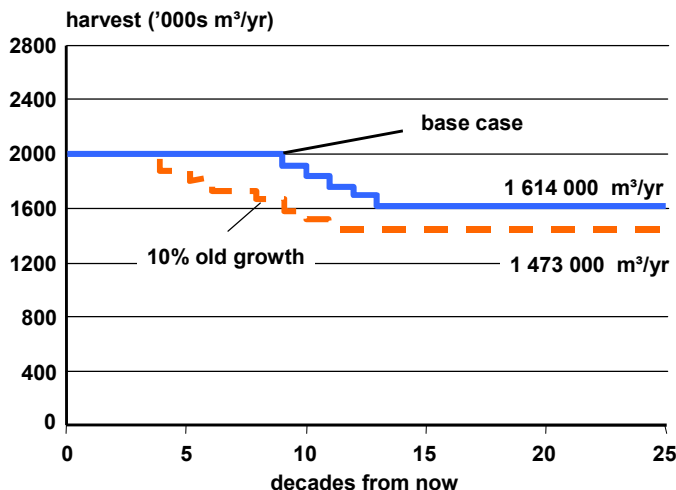
Figure A-8. Base case harvest forecast with changes to green-up ages, Morice TSA



Sensitivity to Mature Cover

Environmental and social values affect the harvest forecast through forest cover constraints applied to stands older than a specified age (Figure A-9). When old-growth forest cover requirements become increasingly restrictive the amount of area available for harvesting is reduced, causing the harvest forecast to decline five decades earlier than in the base case forecast. Employing alternative silvicultural treatments could be used to mitigate this effect by allowing harvesting when and where it had been previously restricted.

Figure A-9. Base case harvest forecast with varying mature cover constraints, Morice TSA



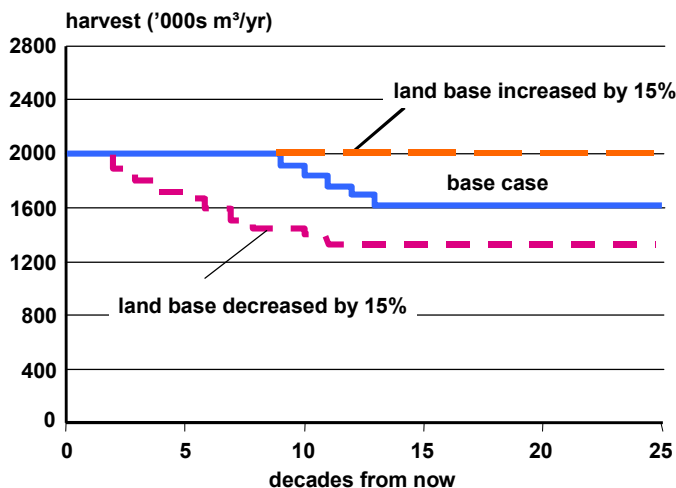


Future Land Base Access Complications

Due to administrative constraints there is uncertainty about access to portions of the Morice TSA. Potential sources of uncertainty are the size of streamside buffers needed to protect fish habitat, area reserved from harvesting to protect old growth and biodiversity, and outcomes of land use guidelines and planning processes. A sensitivity analysis was carried out with differing amounts being removed from the timber harvesting land base (Figure A-10).

Increasing the timber harvesting land base allows an even-flow harvest forecast for the entire planning period. Decreasing the land base causes the harvest forecast to decline 6 periods earlier, with a LTHL 15% lower than the base case.

Figure A-10. Base case harvest forecast with differing land base constraints, Morice TSA



Timber Supply Dynamics - Summary

The main constraint on timber supply in the Morice TSA is the physical scarcity of harvestable timber in the late mid-term. This scarcity requires that volumes of existing mature timber from unmanaged stands be rationed until managed stands are ready for harvest. The rationing mechanism (TSR harvest flow constraints) can also be used to convey back to the short-term 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.

However, the same mechanism works in reverse if timber supply is reduced at the period of physical scarcity. Currently mature and available timber must be rationed to offset the reduction in available supply during the critical period. If operable mature stands cannot be harvested due to cover constraints the decline to the LTHL must begin at an earlier period in the harvest forecast.

Utilizing alternative silvicultural methods can reduce the amount by which the timber supply is reduced because of forest cover constraints. Numerous harvesting techniques and equipment could be utilized to alleviate the constraints set by green-up and old-growth forest cover



constraints, therefore allowing harvesting to occur in stands which were previously tied up in forest cover requirements.

Administrative constraints such as access restrictions to certain areas of the timber harvesting land base could cause far-reaching decreases to the timber harvest forecast.



Appendix B. Executive Summary, Incremental Silviculture Strategy for BC

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 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

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 m³ 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 m³.
- 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



Appendix C. Summary of Workshop Evaluations



Workshop Evaluation —Morice TSA (10-11 Feb 2000)

Please circle the number that best represents your view.

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

What were the strengths of this workshop?

- Was a very good forum to get into the type of naval gazing needed to determine not only what to do, but what should be done, and not done.
- Group interaction, good representation of various views and interests.
- Good communication within the group.
- Brought all parties together in MELP, MoF, licensees, and FRBC.
- Presentation – on screen display.
- Good participation from all parties (MoF, MELP, and Licensees). Good material and facilitators.
- Good preparation and licensee involvement.

What were the weaknesses of this workshop?

- Data and projectors went to timber supply – without any data on habitat supply.
- More specifics on objectives prior to start of workshop – when first notified.
- Lack of clarity on main objective i.e. is this an entire TSA strategy or only incremental.
- Objectives, goals were not clear.
- Although it was beyond your control, I felt that too much time was spent on habitat concerns.

How could this workshop be improved?

- Did not know what to expect or what would be done, a good brief on goals, expectations, what information and ideas to bring. (WORD?) the data Tory Stevens suggests into the package rather than just the Timber (WORD?) stuff. Pre-workshop handout – suggested reading.
- Fine as is.

Other comments?

Are there other ideas strategies generated in other districts that we didn't think of, that would be applicable/useful in this TSA?

