Mid Coast
Timber Supply Area

Incremental Silviculture Strategy (Interim)

-- Version 1.0 --

Contents

British Columbia

Ministry of Forests

Funded By

Forest Renewal BC

August 31, 1998

STRATEGY AT A GLANCE

General Strategy

The primary focus of this incremental silviculture strategy in the Mid Coast TSA is to improve the quantity and quality of timber supplies over the long term. Strategies towards this end are reducing green-up ages, increasing regenerated stand volumes, and spacing newly regenerated stands. Pruning of some stands will ensure at least a minimal supply of premium logs in the future.

Working Targets

Quantity: Manage mid-term timber supplies to yield a harvest of approximately 0.7 million m3/yr and long term supplies to yield 0.8 million m3/yr.

Quality: Manage regenerated stands to yield at least 4% premium logs by volume, with the majority of the remainder being of sawlog quality.

Product Objectives

The following are product objectives at the log level for the Mid Coast TSA.

Quality Class	Species	Characteristics
Premium Log:	Douglas-fir, clear, pruned	45 cm min DBH, pruned, min 5.5 m log.
	Hemlock, clear	45 cm min DBH, pruned, 3.5 - 5.5 m log.
	Cedar pole	45 cm min DBH, over 20 m long min 20 cm top, few knots.
	Sitka spruce	45 cm min DBH
Sawlog:	Minimum average stand DBH by species and site class as follows:	
	Cedar, G/M	56 cm
	Douglas-fir, P	40 cm
	Hemlock/Balsam, P	35 cm
	All other	45 cm

Major Silvicultural Strategies

Quantity

(Some of the following are not within the traditional scope of incremental silviculture but are included here for completeness.)

1. Achieve green-up 2 years earlier by planting second generation improved stock, fertilizing seedlings at the time of planting, and fertilizing 200 ha/yr of post free-growing cedar stands on the outer coast.
2. Brush or girdle 60 ha/yr of backlog plantations to ensure free growing status is achieved.
3. Increase regenerated stand volumes 15% through a variety of silvicultural actions (tree improvement is critical to success).
4. Space 500 ha/yr of Douglas-fir and hemlock-balsam stands to increase avg. piece sizes and prepare stands for pruning and commercial thinning.
5. Reduce minimum harvest ages and raise stand volumes by fertilizing 200 ha/yr of hemlock stands on the outer coast.

Quality

1. Produce 3% clear timber by volume by pruning 200 ha/yr to 3.5 m and 200 ha/yr to 5.5 m.

Habitat

Space 10 ha/yr to improve riparian habitat.

Incremental Silviculture Program

(ha)

Year	Surveys	Backlog Brush / Conifer Rel	Space	Prune	Fertilize	Total
1	2,500	60	510	400	400	3,870
2	2,500	60	510	400	400	3,870
3	2,000	60	510	400	400	3,370
4	1,500	60	510	400	400	2,870
5	1,500	60	510	400	400	2,870
Subtot Yr 1 - 5	10,000	300	2,550	2,000	2,000	16,850
6 - 10	7,500	-	2,550	2,000	2,000	14,050
Total Yr 1 - 10	17,500	300	5,100	4,000	4,000	30,900

Introduction

About the Interim Strategy

The terms of a service agreement between Forest Renewal BC (FRBC) and the BC Ministry of Forests (MoF) require the MoF to develop, and FRBC to fund, what is essentially an incremental silviculture strategy. This document is in fulfillment of this contractual requirement.

Incremental silviculture is part of a suite of strategies which together may influence the future quality and quantity of habitat and timber supply. This strategy document broadly analyzes the full potential range of silviculture activities in order to create a context for an incremental silviculture strategy.

An incremental silviculture strategy should not be confused with the allowable annual cut (AAC) determination process. AAC's are based on actual practice and current information at the time of the determination. This strategy, on the other hand, is about creating a future state of our forests. The degree to which the strategy proves appropriate and is achieved may influence future, but not necessarily present, AAC determinations.

This strategy is founded on readily available information and the knowledge of forestry professionals. It is intended as an interim strategy until a more in-depth analysis-based review is completed.

Methodology

This strategy was prepared through the following process:

1. Prior to the district working session, L. P. Atherton & Associates prepared a preliminary draft of this document, summarizing all available information relevant to a strategy and identifying opportunities to improve the future quantity and quality of timber supply.
2. A district working session was held August 5 & 6, 1998 in Campbell River, attended by representatives of the MoF and a forest licensee of the Mid Coast TSA. Larry Atherton of L. P. Atherton & Associates and Doug Williams of Cortex Consultants Inc. led the session. Participants reviewed the potential opportunities identified in the draft document along with others that arose. The outcome of the session was a regime table, complete with priorities.
3. The consultants incorporated the results of the working session into the draft document and added forecasts of future harvest quantity and quality and of job outcomes.
4. After ministry review, the consultants submitted a completed strategy document to the MoF in electronic format as version 1.0. (The ministry will assign higher version numbers (e.g., 1.1, 1.2, etc.) as the strategy evolves and changes are made.)

Acknowledgments

The participation of representatives of the following organizations at the district working session is gratefully acknowledged.

Ministry of Forests:

- Mid-Coast Forest District
- Vancouver Forest Region

Forest licensees of the Mid Coast TSA:

- Western Forest Products

The project was managed by Mr. Larry Sigurdson of the Ministry of Forests, Vancouver Forest Region. Funding was provided by Forest Renewal BC.

Basic Data

Note: Base case confined to the non-partitioned component (870 000 m3).

Land Area

Description	Area (ha)	Area %
Total Area of TSA	2 217 800	100
Total Productive Crown Forest	755 200	34
Net Timber Harv. Land Base	155 600	7

Source: TS analysis report - rounded to nearest 100 ha.

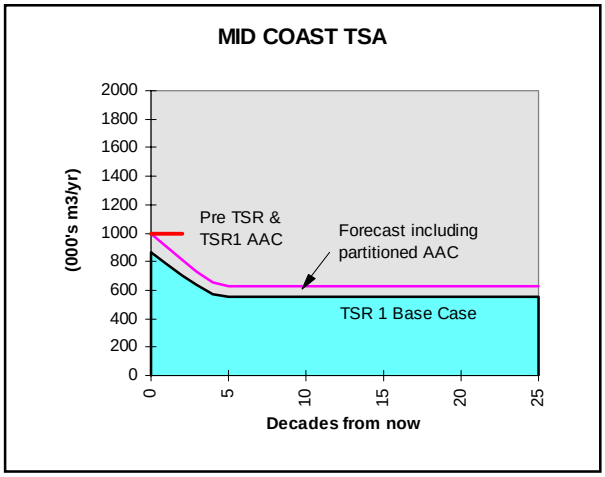
AAC

AAC Type	Pre-TSR	TSR1*	Change (%)
Conventional	1 000 000	870 000	-13.0
Deciduous	-	-	-
Insect/Disease	-	-	-
Marginal	-	130 000	∞
Total	1 000 000	1 000 000	0.0

Woodlot AAC

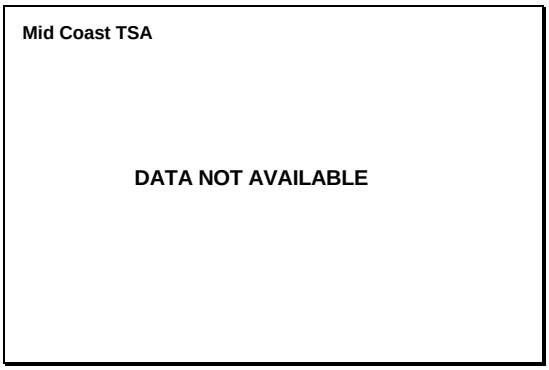
*effective Jan 1/95

Harvest Forecast

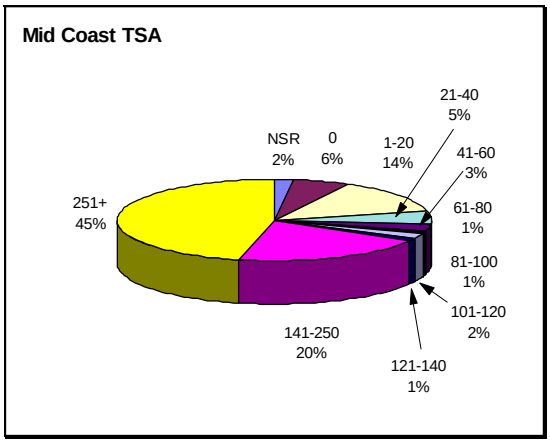


Harvest forecast with partitioned AAC reduced at same rate as the base case harvest forecast (10%/decade, 5% in decade 5) and then held constant after 50 years.

Site Class

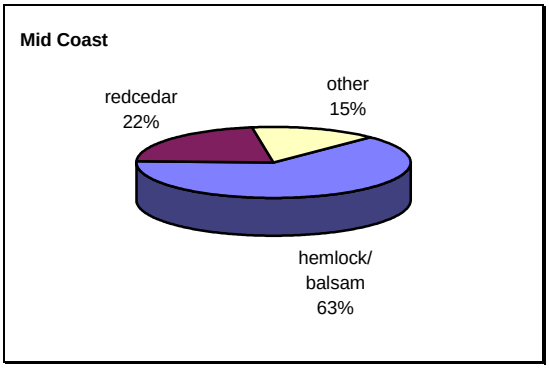


Age Class



Data scaled from chart in TS analysis report.

Tree Species



Issues

Individual Issue Analysis

The following information is primarily from documentation produced under the first timber supply review, or TSR1. Sources are noted, with full references given on page 29. Only information which is relevant to an incremental silviculture strategy is recorded. Key statements are bolded.

Abbreviations: AAC - allowable annual cut; THLB - timber harvesting land base; IHL - initial harvest level; LTHL - long term harvest level; CF - chief forester; TSR - timber supply review; CT - commercial thinning.

Species abbreviations: Fd - Douglas-fir; Fdc - coastal Douglas-fir; Hw - western hemlock; Cw - western redcedar; B or Ba - balsam fir.

Site class abbreviations: G - good; M - medium; P - poor.

♦ Harvest Forecast	**Significant forecast reduction of 37%** from the non-partitioned AAC of 870 000 m3/yr, commencing after the 1st decade at a rate of 10% per decade, to a long term harvest level of 550 000 m3/yr 50 years from now (start of decade 6). (analysis, 10)
♦ Age Class	**Very few stands between 20 and 200 years of age**. Approximately 63% of THLB in stands aged 200+. Consequently the harvest of existing old growth must taper off steadily in order to reach the LTHL and still avoid an interim shortfall of timber. By decade 9, almost all of the remaining old-growth timber in the THLB is part of the 7% of each forest type being maintained for wildlife and biodiversity and therefore is not available for harvesting. (analysis, 10)
♦ Forest Cover	*General Zone*: XX% of THLB. Base case requirement of at most 30% of THLB permitted to be < 3 m tall. Sensitivity test of ± 5%. (analysis, 23-24) Relaxation: (+5% to 35%) Insensitive. Base case forecast is not significantly constrained by cutblock adjacency. Increase: (-5% to 25%) Insensitive over all terms except for minor reduction below base case in decade 9. *Visual Quality Zones*: 15% of THLB in partial retention. Base case requirement of at most 5% (retention areas) and 10% (partial retention) to be < 6 m tall. (analysis, 24) Sensitivity test of ± 5% for partial retention only. (analysis, 24-25) Relaxation: (+5% to 15%) Slightly sensitive. No change in first decade, followed by a decline of 7%/decade (vs. 10% in base case), reaching a steady LTHL one decade later and 2% higher than base case. Increase: (-5% to 5%) Moderately sensitive - **decrease of 4% in first 5 decades, 5% thereafter**. *Green-up*: 15 yrs for 3m; 23 yrs for 6m. (analysis, 21,41) CF notes risks to achieving green-up if the approx. 30% of logged areas requiring brushing do not receive timely treatment (rationale, 15). Sensitivity test of ± 5 years. (analysis, 21-23)

Relaxation: (- 5 yrs) First decade insensitive. Reduces the rate of decline from 10% (base case) to 7%/decade. **Increases mid term supply by 3 - 10%** and LTHL by 2%. Reducing ages improves the availability of areas for timber harvesting over time.

Increase: (+ 5 yrs) Moderately sensitive - initial harvest level 6% below base case. Decreases mid term supply by approx. 5 - 8% (visual estimate from charts) and LTHL by 2.5%. A compounding factor is the large area of timber licences scheduled to revert to the THLB over the 1st 3 decades. These do not contribute to the AAC when logged, but are added to the area not greened-up when they revert to the TSA. (analysis, 23)

- ♦ Backlog NSR: 3 367 ha of backlog NSR assumed to be restocked within 10 years. (rationale, 16)
- ♦ Quality:
  - Approx. 6 000 ha of overstory alder scheduled for removal to release hemlock beneath by the year 2 000. Hemlock incorporated in analysis as 20 yr old regenerated stand. (rationale, 16-17)
  - 491 ha of brush deducted from THLB. (analysis, 4)
  - 29 897 ha of problem forest types sites deducted from THLB (all pine other than white pine leading species; all deciduous leading stands; all low productivity stands; and older red cedar, hemlock and balsam stands < ht class 4). (analysis, 41) Partition of 130 000 m3 of AAC for height class 3 stands on the outer coast, decadent hemlock-balsam stands, and stands in difficult terrain outside traditional operating areas (proportions left to the discretion of the district manager). (rationale, 29)
- ♦ Older Forests: Base case requirement for old growth or biodiversity of a minimum of 7% of each forest type (approx 10 000 ha) be older than 140 years at all times.

  Sensitivity tests of complete removal of requirements and of increasing the requirement by 5% (from 7% to 12%) (analysis, 25-27).

  Relaxation: (Old growth constraint removed; assumes requirements are met by other areas not in THLB) Initial harvest level maintained for 2 decades. **Very sensitive mid term**; harvests 10 - 14% above base case (visual estimate from charts). **LTHL increased 5%**.

  Increase: (12 % older than 140) **Very sensitive, especially in the mid term**. Results in a 6% decrease in initial harvest level from the base case; 8-12% reduction over the next several decades and 5% reduction in LTHL.
- ♦ Min. Harvest Ages: Base case uses time it takes for species to reach min avg. harvestable DBH as min age (these are longer than culmination ages). Ages range from 60 for G/M site spruce to 150 years for poor-site Fdc. HB G/M age 105 at 45 cm dbh. HB P site age 110 at 35 cm dbh. Redcedar G/M site 90 yrs at 56 cm, poor site ate 110 yrs at 45 cm. (analysis, 43).

  Sensitivity analyses of ± 10 yrs. (analysis, 19-21)

  Decrease: (- 10 yrs) Slightly sensitive. Initial harvest level maintained; declines thereafter by 8% (vs 10% in base case) to LTHL one decade later than base case. Long term insensitive.

  Increase: (+10 yrs) **Very sensitive in short and mid term** with a reduction of 10% in first decade followed by steeper decline (12% vs 10%) to LTHL in 3rd decade (2 decades earlier than base case). Long term insensitive.

  A sensitivity test linking min harvest ages to culmination of MAI was also done (25 yrs lower for G/M site HB, 10 yrs lower for all redcedar - analysis, 43), indicating **substantial harvest increases in mid term** (analysis, 21). However, as this does not represent current practice, CF accepted ages as used in base case. (rationale, 11)
- ♦ Silvicultural Systems: Most of the THLB is currently managed under a clearcut harvesting system. Alternative systems are planned for 10% of district SBFEP harvesting. **CF notes potential to increase harvests using alternative silvicultural systems** in areas otherwise unavailable because of forest cover constraints. (rationale, 16)

♦ Estimates of Timber Volumes	**VDYP used for both existing and regenerated stands**, except TIPSY used for good and medium site Fdc ≤ 20 yrs (analysis, 46). *Existing stand volumes*: No separate sensitivity test for existing stand volumes alone. Combined test of changing all yield estimates ± 10% indicates timber supply is highly sensitive in the short and mid terms to changes in existing stand volumes (when compared to sensitivity test for changes in regenerated stand volumes alone). (analysis, 28-29) *Regenerated stand volumes*: Sensitivity tests for ±20% in volume plus commensurate ± 10 year change in min harvest age. Short term insensitive to either. Highly sensitive to both in long term. (analysis, 27-28) Increase: (+20%) LTHL 20% higher than base case, starting to rise from mid term shortfall 80 years from now. [This creates a mid-term dip below LTHL - potential for commercial thinning?] Decrease: (-20%) LTHL 19% lower than base case. Short term insensitive. Anomaly of mid term being slightly above base unexplained [presumably related to longer step down to a lower LTHL].

Summary of Issues by Period

Short Term (1 to 20 years)

A preponderance of old-growth (65% aged 141+), coupled with a dearth of middle-aged stands (only 8% aged 41-140 years) creates a situation where large volumes of old growth must be reserved for a substantial length of time until stands currently aged 40 years or less, as well as regenerated stands, become available. While not sensitive to forest cover constraints, this large volume of older stands is highly sensitive to changes in older forest requirements and to an increase in minimum harvest ages. The short term is also sensitive to increases in the already substantial adjacency constraint in the partial retention visual quality zone, which covers 15% of the THLB. The base case constraint only allows 10% of the area to be less than 6m tall at any time.

Mid Term (21 to 50 years)

The mid term is characterized by tightening supplies of remaining old growth which are being held to cover the shortage of currently middle aged stands until regenerated stands become available. Consequently, the mid-term is the most sensitive of all periods. Decreasing green-up ages by 5 years increases mid term levels 3-10%. Removing the mature forest constraint significantly increases harvest levels by 10-14%. Conversely, increasing this constraint by 5% reduces harvest levels 8-12%. Reducing minimum harvest ages to match culmination ages results in substantial increases to mid term harvest levels.

Long Term (51+ years)

Long term harvests are principally sensitive to changes in regenerated stand volumes. A 1% increase or decrease in regenerated volumes results more or less in a corresponding 1% increase or decrease in LTHL's. The long term is also sensitive to changes in the mature forest constraint, increasing or decreasing harvest levels by 5% when the base case constraint is respectively removed or increased 5%.

Future

The timber supply review could not take into account the impact of the Forest Practices Code, as the changes had yet to be seen in practice. Implementation of the code is likely to have a downward effect on timber supplies.

The Central Coast land and resource management planning process is in its early stages. Among other things, this process will review the mapping and classification of visually sensitive areas. An increase in area classified as visually sensitive or more restrictive management requirements would also have a downward effect on timber supplies.

Incremental Silviculture History

Approximately 1 600 ha are harvested annually.

Treatment	TSR1 Status (1993)		Current Status (1998)
	Incorporated in Timber Supply Analysis	**Not Incorporated in Timber Supply Analysis**	Source: MCFD[1]
♦ Backlog	3 367 ha of backlog NSR assumed to be restocked within 10 years. (rationale, 16)		There is now about 500 ha of backlog NSR in 7 areas. About half of this is treatable through conifer release and other half reclassified.
♦ Conversion			
♦ Commercial Thin		CF notes high transportation costs discourage CT. Lack of stands in appropriate age groups. (rationale, 17)	
♦ Space			<u>Planned spacing program:</u> 1998 301 ha 1998 313 2000 71 Avg 300 ha/yr.
♦ Prune			Every spaced stand is pruned. Program is often in support of social objective to create jobs. <u>Planned pruning program:</u> 1998 301 ha 1998 308 2000 203 Avg 300 ha/yr.
♦ Fertilize			300 ha fertilized in 1993. None since.

[1] MCFD - Mid Coast Forest District

Higher Level Goals and Objectives

This section documents higher level goals and objectives relevant to an incremental silviculture strategy for the TSA.

Provincial Goals

Fundamentally, government's goals can be characterized as:

- sustainable use;
- community stability; and
- a strong forest sector. (MoF, 1998a)

Provincial Objectives

Until provincial targets for timber quantity and quality are established, management unit strategies are to consider the following interim provincial strategic objectives (MoF, 1998a). Incremental silviculture strategies must also be in keeping with higher level plans under the Forest Practices Code.

Objective 1: Maintain current harvest levels as long as possible without creating disruptive shortfalls in future timber supply.

Objective 2: Create a long term timber supply capable of supporting a steady long term provincial harvest level similar to current levels.

Objective 3: Minimize the interim shortfall in provincial harvest anticipated before a steady long term timber supply is achieved.

Objective 4: Create a long term timber supply which will enable the timber quality profile of future harvests to be the same or better than the current profile.

It is recognized that not every management unit has the same capability to contribute to these interim objectives. Further, it is recognized that these objectives may not be attainable at current funding levels. Their purpose is to provide general guidance to the application of available funds.

Regional Objectives

The objectives of the regional incremental silviculture strategy are to:

- Ensure a long term sustainable harvest which approximates the current harvest value and volume levels and that produces a diversified mix of products necessary to create and maintain sustainable forest employment.
- Balance treatments that enhance growth and yield such as fertilizing, spacing and forest health activities with those that increase the value of the wood such as pruning.
- Utilize incremental silviculture treatments to contribute to sustainable management of non-timber values at the landscape level. (MoF, 1998b)

Opportunities to Increase Timber Supply

Opportunities Indicated Through TSR Sensitivity Analyses

TSA modelling in support of planning incremental silviculture has not yet been undertaken. In its absence, sensitivity analyses from the TSR1 analysis report are the best source of information as to the opportunities for incremental silviculture to increase future timber supply. The following are selected sensitivity analsysis charts from the TSR1 analysis report, to which opportunity information is added. Detailed analyses are required to confirm the indicated effects.

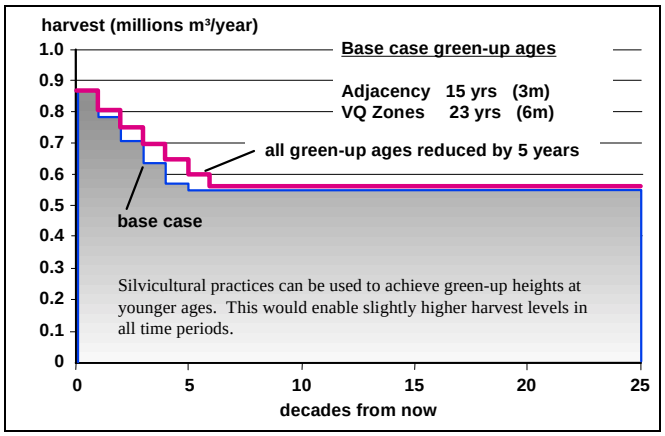


Figure 1. Changes in green-up ages, Mid Coast TSA

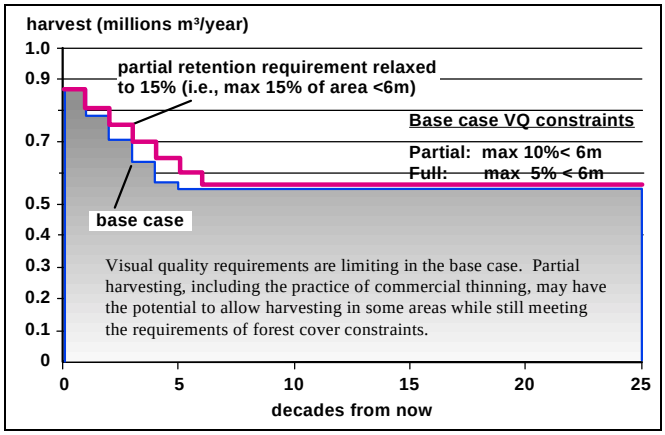


Figure 2. Changes in adjacency requirements in the visual quality zones, Mid Coast TSA

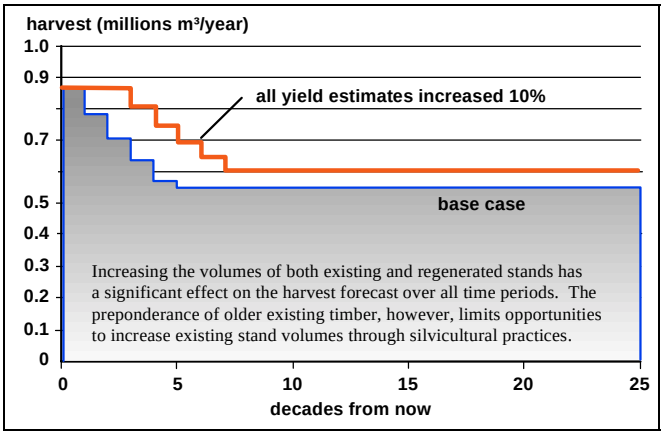


Figure 3. Changes in yield estimates for both existing and regenerated stands, Mid Coast TSA

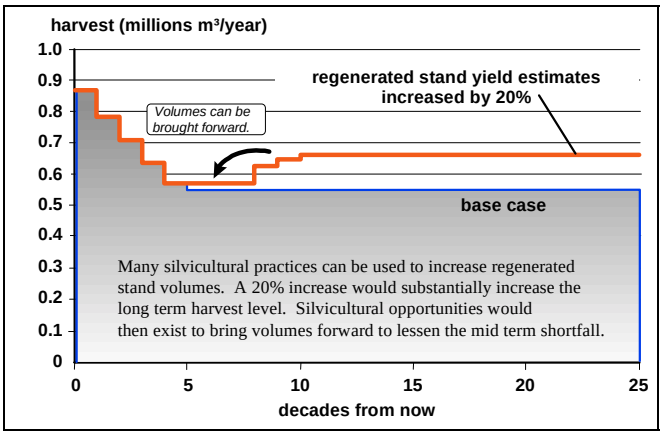


Figure 4. Changes in regenerated stand volumes, Mid Coast TSA

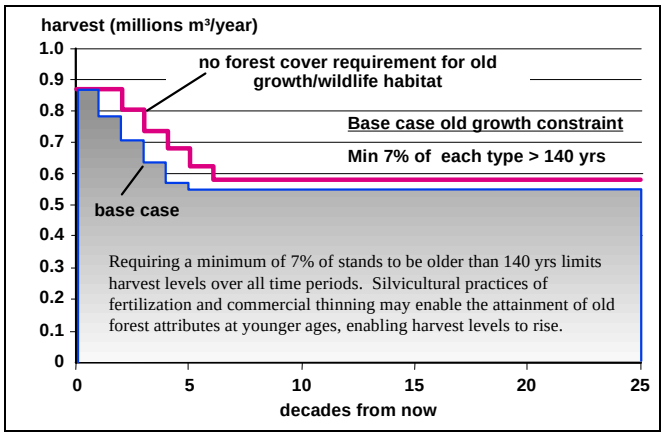


Figure 5. Changes in old growth requirements, Mid Coast TSA

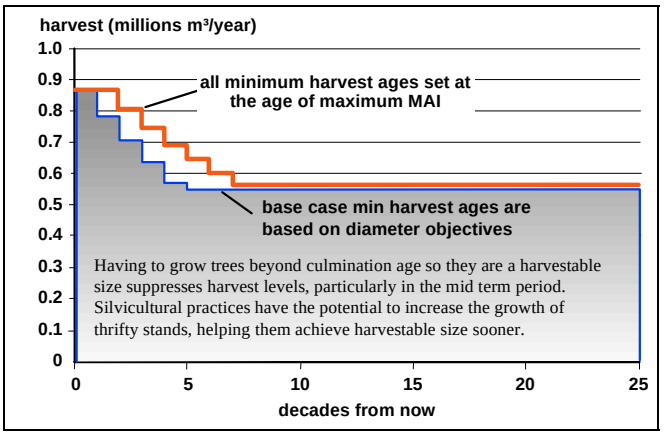


Figure 6. Effect of lowering minimum harvest ages, Mid Coast TSA

Preliminary Identification of Silviculture Opportunities

Prior to the district working session, information in the previous sections was used to identify the following silvicultural strategies as having potential to increase future timber supply at the TSA level. Each of these was discussed in detail in the district working session, the results of which are recorded in "Potential Strategies by Response Time Frame," page 10, along with additional strategies that arose during the meeting. Strategies that are ultimately adopted are noted in "Silviculture Strategies," page 24.

♦ Short Term (1 - 20 yrs)

ST 1: reduce green-up ages 5 years reduce minimum harvest ages (target hemlock-balsam stands - 20 years on M/G sites and 10 years on P sites?);

ST 2: overcome adjacency constraint in PR VQO;

ST 3: increase the volume of some existing stands;

ST 4: expand the timber harvesting land base;

ST 5: create old-growth attributes earlier.

♦ Mid Term (21 - 50 yrs)

MT 1: reduce green-up ages 5 years reduce minimum harvest ages (target hemlock-balsam stands - 20 years on M/G sites and 10 years on P sites?);

MT 2: overcome adjacency constraint in PR VQO;

MT 3: increase regenerated stand volumes 20%;

MT 4: space post FG stands to set up for CT to bring forward harvest from long term into mid term (increasing regenerated stand volumes creates a mid term shortfall);

MT 5: increase the volume of some existing stands;

MT 6: expand the timber harvesting land base; and

MT 7: create old-growth attributes earlier.

♦ Long Term (51+ yrs)

LT 1: increase regenerated stand volumes 20%;

LT 2: reduce green-up ages 5 years reduce minimum harvest ages (target hemlock-balsam stands - 20 years on M/G sites and 10 years on P sites?);

LT 3: overcome adjacency constraint in PR VQO; and.

LT 4: create old-growth attributes earlier.

Available Information Regarding Potential Treatments and Treatable Area

This section summarizes available information directly relevant to the potential treatments for the TSA.

Treatment	Comment	Treatable Area
♦ General	Opportunities are limited as stands are generally too remote to economically treat. Situation exacerbated by there being few local contractors. (rationale, 17)	
♦ Spacing	In addition to above, opportunities limited by root rot. (rationale, 17)	
♦ Fertilization	Fertilization not assessed in TSR.	Candidate stands limited by type and location. District looks for 80%+ Fdc, G or M site. Lack of continuous stands.
♦ Commercial Thinning	High transportation costs for CT products. No stands currently proposed for commercial thinning. (rationale, 17)	Few stands of appropriate age. Opportunities are limited by root rot. (rationale, 17) There is about 5 000 ha of potential CT area coming up (1 000 ha currently in age class 2 & 4 000 in age class 1).
♦ Conversion	Conversion of alder stands already incorporated in TS analysis. (rationale, 16) An interest has been expressed by a hardwood manufacturing company in harvesting alder stands. Because of this the district is not actively rehabilitating alder stands.	There is less treatable area than would appear due to terrain, access and riparian concerns. Likely 200 ha of harvestable stands.
♦ Backlog NSR	Planned for restocking by end of decade. No additional opportunity.	

Potential Strategies by Response Time Frame

Explanatory notes with respect to the following tables.

Column Number	Note
1	The response time frame is the period in which the anticipated result is expected, not the period in which actions must necessarily commence.
2	Strategy numbers correspond with the numbers recorded earlier in "Preliminary Identification

Column Number	Note
	of Silviculture Opportunities," page 9.
3	Information in this column is largely from a meeting of ministry personnel and forest licensees held in Campbell River August 5 & 6, 1998, combined with information presented earlier in this document.
4	Anticipated results are calculated using the timber supply response indicated by TSR1 sensitivity analyses.
5	The harvest forecast for the short term uses the TSR1 AAC as the starting level in the first decade, declining at a rate of 10%/decade thereafter until 50 years from now, after which it is held constant. The harvest forecast column was not thoroughly reviewed during the district meeting. Results are purely conjecture and are meant to illustrate the potential of the strategies.

In the AAC rationale, the chief forester identified a number of potential downward influences on timber supply. For the purposes of this strategy, however, a status quo is assumed with respect to these. Should any arise, the following strategies would serve to mitigate their effects rather than increase timber supply.

Opportunities to improve timber supply in this TSA are limited due to distance to market for products, species types, age class distributions, presence of root rot, and difficulty in obtaining reasonable bid prices for silviculture work from non-resident contractors.

Response Time Frame	Potential Strategy/Action	Discussion / Current Status	Anticipated Result	Potential Harvest Forecast (000 000s m3/yr)
♦ Short Term (1 - 20 yrs) ♦ ST 1	1. Achieve green-up 5 years earlier in all zones ~~(target H/B?)~~ by:	1. The best opportunities to achieve earlier green-up are pre-FG. However, green-up is not really an on-the-ground constraint, except on the outer coast. The economics of harvesting on the mid-coast require a true "pass" system, where drainages are left for 20 - 30 years between passes. By the time of return for the next pass, all areas will be greened up. Participants at the district working session felt old growth requirements to be more restricting. (note: "target H/B" moved to ST6) Ages to reach specified tree heights (FG ages are district estimates; 3M & 6M ages are from TSR1). Species / FG Ht (m) / FG / 3M / 6M Cw / 1.5 / 9-11 / 15 / 23 H/B / 3 / 9-11zonal / 15 / 23	1. TSR1 indicates a 5 yr earlier green-up yields an approximately 3% increase in harvest levels in the 2nd decade. Except on outer coast green-up is not really a limiting factor, which indicates TSR 1 assumptions may be pessimistic. Assume 2 yr earlier green-up achieved on all areas (2/5 X 3% ⇒ 1%).	1.00 Initial. 0.90 2nd dec. 0.01 grn-up 0.00 prt harv 0.00 fert 0.00 incr THLB 0.00 old growth 0.05 min ages 0.96 total
	(a) planting large genetically improved stock;	1.(a) Planting larger stock is a basic silv matter - not likely to change w/o funding assistance. Due to high transportation costs for larger seedlings, it is cheaper to plant regular stock and fertilize. Genetically improved stock is expected to reach green-up sooner than stock from unimproved seed, although gain in years is not known. A relatively high proportion of planting stock comes from A seed. Cy comes from cuttings. See MT3 for more info. Assume 1 year earlier green-up.		
	(b) increasing proportion of area planted & plant all areas sooner (to reduce regeneration delay 1-2 yrs);	1.(b) Regeneration delays in the TSR1 analysis were up to 6 years (further detail is not available). Reducing regen delay is a basic silv matter. Overall, approx. 95% of harvested areas are planted within 1 yr of harvest, so there is no room to increase the proportion planted or reduce regeneration delay further. Natural regeneration is on outer coast sites which comes in very thick. Due to prohibitive cost trends, licensees may move to rely more heavily on natural regeneration which would have a tendency to lengthen regen delay. Assume no reduction in regen delay.		
	(c) brush for growth enhancement; and/or	1.(c) Brushing is currently for survival - unlikely to change w/in current funding structure. Only really nutrient-rich sites require brushing (10-20% of sites).		
	(d) fertilize suitable regenerated stands. ~~to increase the growth of residual trees~~.	1.(d) Trend may be to fertilizing all seedlings at time of planting. WFP is fertilizing 30-40% of seedlings. MoF is not fertilizing. Post FG aerial fertilizing Cw/Hw on the outer coast is an option. About 30% of cut is outer coast and ½ of this is Cw types **(≅ 200 ha/yr)**. **Purpose of a post FG fert would be to get green-up sooner and release other timber.** Costs for fertilizing low elevation stands are reasonable as can be done from a barge. Few cedar-salal types, so SCHIRP info not useful guide as to response. Requires research - noted under "Summary of Information and Research Needs," page 25. **Summary**: On the whole, it appears green-up is or could be achieved at least 2 years earlier than in the base case.		

Response Time Frame	Potential Strategy/Action	Discussion / Current Status	Anticipated Result	Potential Harvest Forecast (000 000s m3/yr)
♦ ST 2	2. Implement partial harvesting/CT regimes in PR VQO zone to increase timber supply from areas limited by adjacency constraints.	2. Some partial harvesting is planned. Will possibly increase when there is no alternative to harvesting in areas limited by forest cover constraints, but harvesting and access, terrain and costs are limiting factors. There are no areas of suitable age and location available for CT in this time period. Harvesting and transportation costs are high. No plans.	2. N/A	
♦ ST 3	3. Increase the volume of some existing stands ~~volumes~~ through fertilization.	3. Because of the present age class distribution, there are no suitable stands scheduled for harvest in this time period which would respond to fertilization. Not possible to find large contiguous areas for fert.	3. N/A.	
♦ ST 4	4. Expand the timber harvesting land base through: (a) rehabilitating backlog NSR; and (b) recover area lost to roads.*[2]	4.(a) Very little treatable backlog remaining (see "Incremental Silviculture History," page 6). **Minor amount of backlog brushing (20 ha/yr) and conifer release (40 ha/yr) required to maintain earlier plantations**. Impacts already included in TSR1 base case. 4.(b) 4 400 ha deducted in TSR1 for roads. This is 4 400/155 600 or 3% of THLB. Amount seems reasonable. Conclusion: no opportunity.	4. (a) Already in base case forecast. (b) N/A.	
♦ ST 5	5. Create old-growth attributes earlier.	5. No short term impact because there are no treatable stands in this period. Also, due to the abundance of older timber in this period, this cannot be a directly limiting factor in the short term. Complete removal of old growth requirement allows the initial harvest level to be maintained for 2 decades (1 more than base case). This is an allowable cut effect related to the age class structure of the TSA, because existing older timber no longer has to be held through the mid term time period until replacement regenerated stands become available. Little present knowledge and experience with creating old-growth attributes earlier through silvicultural practices. Noted under "Summary of Information and Research Needs," page 25. Assume no gain possible at this time. See MT 7 & LT4.	5. N/A.	
♦ ST 6	6. Reduce minimum harvest ages by 10 years.*	6. TSR 1 ages are determined on a technical rotation basis using TIPSY. However, volumes at these ages for both existing and regenerated stands (except Fdc) are determined using VDYP. Trees must reach a certain diameter in order to be profitable to harvest. These diameter limits are at sizes and ages which exceed sizes and ages where MAI is at its maximum. (cont'd next page)	6. TSR 1 sensitivity analysis indicates a 10 year reduction in ages results in a 10% gain in the 2nd decade harvest level. A 5 yr reduction = (.5 X .10) ⇒ 5%	

[2] * Indicates potential strategy added during the district meeting.

Response Time Frame	Potential Strategy/Action	Discussion / Current Status	Anticipated Result	Potential Harvest Forecast (000 000s m3/yr)
		The following compares VDYP with TIPSY for the same minimum DBH used in TSR1. TIPSY age - age at which specified avg stand dia is reached; TIPSY vol - vol at above age, 17.5 cm merch. TIPSY Establishment density - 1 000 st/ha, same as used in TSR		

		TSR1			TIPSY		
Species/site	%THLB	DBH	min age	vol	SI	age	vol
Hw G&M	30	45	105	518	33	90	1238
Cw G&M	6	56	90	421	30	120	1502
"		45*			30	80	934
Cw P	14	45	110	302	22	140	918

		*The reason for the larger dia limit for Cw G&M (56 cm) is not supplied in the TSR1 analysis report. For comparison, a TIPSY age & yield at 45 cm DBH is given. The above table indicates that **managed stands will yield 2 to 3 times the volume of unmanaged stands** and, with the exception of Cw-P (assuming Cw -G/M DBH of 45 cm), **at younger ages than used in TSR1**. (Note: AAC rationale, p 9, indicates 34% higher yields overall.) Given that: minimum harvest ages cannot be restricting harvest of the large old-growth component and only 8% of stands are aged 41 -140, it can be expected that min ages are therefore most restricting to those stands regenerated over the past 20 yrs and in the future. However, as the above table shows, these stands will have lower minimum ages and yield substantially higher volumes than used in TSR1. The implications of this for an incremental silviculture strategy require modelling. For the purposes of this exercise, assume a 5 yr min age reduction (this would seem conservative, these volumes are without OGSI adjustments or benefits of tree improvement).		
♦ Mid Term (21 - 50 yrs) ♦ MT1	1. Achieve green-up 5 years earlier in all zones (target H/B?)	1. See ST 1 above. This is largely a basic silv. activity. Assume a 2 yr reduction can be achieved.	1. Sensitivity analysis indicates a 5 yr reduction in green up ages reduces the rate of decline in the harvest forecast over the mid term by 3% per decade, starting in decade 2. Decade 3 has a 6% higher harvest level than the base case, etc. 2/5 X 6 = 2%; 2/5 X 9 = 4%; 2/5 X 12 = 5%	0.81 3rd dec. 0.02 grn up 0.00 prt harv 0.00 rgn vol 0.00 br fwd 0.00 exist stnd 0.00 THLB 0.00 old grwth 0.02 min ages 0.85 total
♦ MT 2	2. Overcome adjacency constraints in PR VQO zone by: (a) partial harvesting; and (b) setting up stands for CT through spacing.	2. (a) See discussion under ST 2 above. (b) Of the species present in the TSA, only Hw offers CT potential. There are approximately 4 000 ha and 1 000 ha of potentially commercially thinnable Hw stands presently in age classes 1 & 2 respectively. Most of these stands are already spaced. In 30 (start of mid term) and 50 years (end of mid term) from now the age class 1 stands will be 40 and 60 years old respectively and the age class 2 stands will be 60 and 80 years respectively, ages at which they might be commercially thinned. However, these stands are not in the PR zone, so there is not reason for CT'ing them	2.(a) N/A 2.(b) N/A	0.73 4th dec. 0.03 grn up 0.00 prt harv 0.00 rgn vol 0.00 br fwd 0.00 exist stnd 0.00 THLB 0.00 old grwth

Response Time Frame	Potential Strategy/Action	Discussion / Current Status	Anticipated Result	Potential Harvest Forecast (000 000s m3/yr)
		to overcome adjacency constraints. Other factors related to CT include • could be used to accelerate old growth characteristics of stands, but need for this is not certain; • thinning material would be below the minimum required diameter, so would have to be a high market price for the wood to make operations profitable. • while CT might capture mortality, it will also transfer harvest forward in time, possibly creating a harvest shortfall (below the LTHL) somewhere in decades 6-8. • setting up stands now for potential commercial thinning creates flexibility, however WFP has some advice from European contacts that it may be better to plan to CT unspaced Hw stands which may yield clear gang logs. Conclusion: Opportunities and benefits of partial harvesting and CT are unclear. **Requires modelling.** Old growth requirements may be limiting future harvest levels, but there is uncertainty as to how silviculture practices might be used to alleviate this. For now, assume no opportunity. Decisions can be made as appropriate sometime in the future when stands are ready for CT.		0.02 min ages 0.78 total
♦ MT 3	3. Increase regenerated stand volumes 20% by: (a) reducing time to regeneration; (b) using A class seed or better; (c) using large planting stock; (d) managing stocking to reduce voids 5%;	3. (a) See discussion under ST 1 above. Assume no reduction in regen delay. 3. (b) Approx. 95%+ of harvested areas are planted. 70% of plantations are Fdc & Cw, 30% is Ba, SS & Cy. Fdc, Cw and SS all come from A seed. No A seed for Ba. Cy comes from cuttings. Latest estimates of yield gains are (%):[3] Species / 1st gen / 2nd gen Doug-fir 3-5 15 Hemlock 3 20 Cedar 3 10 Sitka spruce 3-5 15 Yellow cedar 5-9 (cuttings) Balsam N/A N/A Assume 2nd gen seed will be available in due course for most species in the TSA (need Balsam) ⇒ 10% avg gain. 3. (c) See ST 1 above. May be cheaper to fertilize at time of planting than using larger stock due to the high transportation costs for larger stock. Trend is towards fertilizing. Volume gain difficult to determine. If 3 years taken off a 100 year rotation ⇒ 3%. 3. (d) TIPSY not used for most regenerated stands so 15% OAF for voids is not directly relevant when reviewing TSR1 sensitivity analyses. See ST 6 for volume differences between VDYP and TIPSY. Reducing OAF 1 from 15% to 10% would increase the indicated TIPSY yields by 5%. Voids can be desirable for grizzly bear habitat (10% of THLB). Current free growing requirements will result in < 15% in voids, however amount is unknown. Participants in the district working session felt	3. Sensitivity tests indicates a 20% increase in regenerated stand yields do not directly increase MT harvests in decades 3-5. **However, the sensitivity analysis indicates increased regenerated stand volumes increase LTHL starting 80 years from now,** fundamentally changing the shape of the forecast and creating a MT shortfall. This has implications for the potential for spacing, fertilization and commercial thinning programs to attempt to raise volumes 40 to 80 years from now.	0.66 5th dec. 0.03 grn up 0.00 prt harv 0.00 rgn vol 0.00 br fwd 0.00 exist stnd 0.00 THLB 0.00 old grwth 0.03 min ages 0.72 total Unknown if effects are additive or perhaps compounded. Increased site productivity may compound these effects. Age reduction factors may overlap, with the combined total being less than when separately analyzed.

[3] Source: participants at district meeting.

Response Time Frame	Potential Strategy/Action	Discussion / Current Status	Anticipated Result	Potential Harvest Forecast (000 000s m3/yr)
		10% may be more reasonable. Actual voids could be surveyed. Noted under "Summary of Information and Research Needs," page 25. Assume 5% reduction. 3. (e) See (c) above re fertilizing at time of planting. Post FG could be done with FRBC funding, however has been no fertilization since 1993.- see discussions under MT 5 below. Summary: A 15% gain on TIPSY yields can be anticipated through implementation of the indicated actions.		
	(e) fertilizing regenerated stands (cedar?) where efficacy is proven.			
♦ MT 4	4. Space ~~all~~ post FG stands to: (a) set up for CT; (b) bring forward harvest from long term into mid term.	4. Determining the value of/need for this strategy depends upon assumptions about (i) the increase in regenerated stand volumes associated with TIPSY yields (vs VDYP), (ii) the results of the OGSI project and (iii) potential increases in regenerated stand volumes over TIPSY (as in MT3 above). Potentially, these three factors could increase the long term harvest forecast by 35% to 100%. Were this the case, a substantial mid term "shortfall" may develop, approximately in the period 40 to 80 years from now. Based on an avg annual area harvested of 1 600 ha/yr, there is a substantial annual area of candidate stands to be set up for possible CT. To fill the anticipated supply gap, all age class 1 stands and newly regenerated stands should be considered for spacing. Due to high harvesting and transportation costs, there is likely to be more need to harvest whole stands earlier than there is for commercial thinning. However, to keep options open, spacing prescriptions should generally be to a higher stocking level associated with future CT. Because Hw is prolific, it has occupied sites for which it is not the optimum species from a timber productivity standpoint. The following shift in proportions of the THLB by species is anticipated as some older Hw stands are harvested and reforested with more appropriate species: Species Present % Future % HwBa 65 50 Cw 20 25 Fdc 10 15 SS 5 10 SS & Cw are not spaceable. Based on 1 600 ha harvest annually, Fdc would be regenerated on **240 ha/yr, (rounded to 250 ha/yr). All Fdc could be spaced. Of these approx, 200 ha could be spaced to allow for future CT, with the remaining 50 ha spaced to achieve harvestable piece sizes earlier.** Approximately 30% of HwBa stands could be spaced. This nets to a program of 50% X 30% X 1 600 ha/yr = **240 ha/yr (rounded to 250 ha/yr). Of these, approx 200 ha could be spaced to allow for future CT, with the remaining 50 ha spaced to achieve harvestable piece sizes earlier.**	4. Requires better data and modelling to determine effect on harvest forecast.	
♦ MT 5	5. Fertilize existing (a) hemlock and (b) cedar stands to raise their volumes.	5. No fertilization currently taking place. (a) Need to identify characteristics of hemlock stands that show a fertilization response so treatable area can be expanded. (Noted as a requirement for further research under "Summary of Information and Research Needs," page 25.) 5. (b) No opportunity to fertilize older existing Cw stands. (Younger stands discussed under ST 1 (d) & MT 8.)	5. (a) N/A 5. (b) N/A	

Response Time Frame	Potential Strategy/Action	Discussion / Current Status	Anticipated Result	Potential Harvest Forecast (000 000s m3/yr)
♦ MT 6	6. Expand the timber harvesting land base through continuing ST4.	6. See ST 4 above. No opportunity.	6. See ST 4 above. Effect already in base case forecast.	
♦ MT 7	7. Create old-growth attributes earlier.	7. See ST 5 above. Little present knowledge and experience with creating old-growth attributes earlier through silvicultural practices. Assume no gain possible at this time.	7. N/A	
♦ MT 8	8. Reduce minimum harvest ages and raise volumes by fertilizing Hw.	8. See ST 6 re reducing min harvest ages. Assume 5 yr reduction. About **200 ha/yr of fertilization could be done on the outer coast in Hw stands**. On a 10 yr repeat cycle, this would mean 2 000 ha under management.	8. Sensitivity analysis indicates a 10 yr min age reduction results in a rate of decline of 8%/decade vs 10% in the base case. Decade 3 has a 4% higher harvest level than the base case, etc. 5/10 X 4 = 2%; 5/10 X 6 = 3%; 5/10 X 8 = 4%	
♦ Long Term (51 + yrs)	1. Increase regenerated stand volumes 20% by continuing MT3.	1. See MT 3. A 15% gain can be anticipated from silvicultural practices. Also, substantial gains can be anticipated from managed stands generally. This will be accounted for when TIPSY yields are applied. Further gains may occur if site indexes are underestimated. TSR2 will no doubt give a more accurate representation of future volumes.	1. 15% to 50%	0.55 base 0.07 partition 0.08 rgn vol 0.01 grn up adjacency old grwth 0.71 total
	2. Achieve green-up 5 years earlier in all zones (target H/B?)	2. See discussion under ST 1 above. This is a basic silv. activity. Assume a 2 yr reduction in green-up ages is achievable.	2. Sensitivity analysis indicates a 2% increase in LTHL. 2/5 X .02 = 1%.	
	3. Overcome adjacency constraints in PR VQO zone	3. See discussion under MT 3 above. Opportunities and effects are unclear.	3. N/A	
	4. Create old-growth attributes earlier.	4. See discussions under ST 5 above. Opportunities and effects are unclear.	4. N/A	TSR sensitivity analysis indicates an increased harvest in long term would begin 80 years from now.

Potential Harvest Forecast

Figure 7 graphs the potential harvest level that may be attained through implementation of the silvicultural strategies in the preceding tables. This forecast is highly speculative and requires confirmation through computer-based modeling and analysis. It also includes silvicultural activities that are not within the traditional scope of incremental silviculture. Modeling may indicate more precise timing, targeting and program levels associated with incremental silviculture activities than could be developed in this interim strategy.

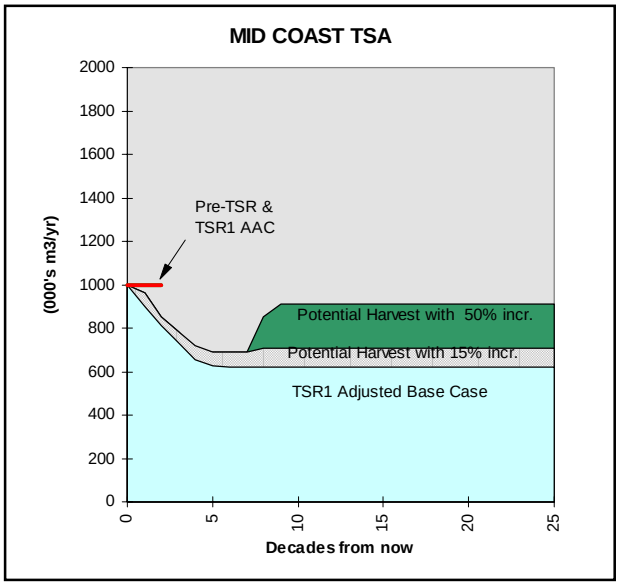


Figure 7. Potential harvest forecast, Mid Coast TSA

TSR 1 base case adjusted as follows:

- initial harvest level set at TSR 1 AAC;
- 1st 5 decades decreased at 10%/decade, same rate as TSR 1 base case;
- After 50 years the harvest level is held constant.

Two potential harvest forecasts are shown.

- The forecast "with 15% increase" shows the effect of increasing regenerated stand volumes 15% above those used in the base case. This reflects a scenario of using silvicultural practices to increase regenerated stand volumes by 15%, using the VDYP yields of the base case.
- The forecast "with 50% increase" shows the combined effect of increasing regenerated stand yields as above, along with an assumption that TIPSY yields will average at least 35% higher than VDYP yields.

Opportunities to Improve Timber Quality

The effects of incremental silviculture on the future quality of the timber resource were not analyzed in the timber supply review. Information in this section was gathered during the district working session.

Product Objectives

The following are product objectives at the log level for the Mid Coast TSA.

Quality Class	Species	Characteristics
Premium Log:	Douglas-fir, clear, pruned	45 cm min DBH, pruned, min 5.5 m log.
	Hemlock, clear	45 cm min DBH, pruned, 3.5 - 5.5 m log.
	Cedar pole	45 cm min DBH, over 20 m long min 20 cm top, few knots.
	Sitka spruce	45 cm min DBH
Sawlog:	Minimum average stand DBH by species and site class as follows:	
	Cedar, G/M	56 cm
	Douglas-fir, P	40 cm
	Hemlock/Balsam, P	35 cm
	All other	45 cm

Available Information Regarding Potential Treatments and Treatable Area

Treatment	Comment/ Potential Treatment Regimes	Treatable Area
♦ Spacing		
♦ Commercial Thinning		
♦ Pruning		
♦ Space/ Prune		
♦ Space/ Prune/Fert		
♦ Other		

Potential Strategies by Response Time Frame

The following strategies have potential to increase timber quality. These were identified in the district working session. The response time frame is the period in which the anticipated result is expected, not the period in which actions must necessarily commence.

Response Time Frame	Potential Strategy/Action	Discussion / Current Status	Anticipated Result	Premium Log Forecast
♦ Short Term (1 - 20 yrs)	None	Short term harvests will come from existing very old stands which are not treatable to improve quality.	Quality profile of existing old growth will prevail. Assume this is equal to a recent coast-wide estimate of 15%.	15%?
♦ Mid Term (21 - 160 yrs)	1. Prune 200 ha/yr to 3.5 m and 200 ha/yr to 5.5 m to yield a 5 m log.	1. In the past, more single lift pruning has taken place than two-lift. Because of the need to increase premium log content, the potential strategy is based upon changing to two lifts on all pruned stands. Spacing is a pre-requisite to pruning. Calculation of % of tree volume that is pruned: 35 m tree less 8 m top = 27 m merch length The 1st 0.5 m of tree is left in the stump, therefore a 5.5 m pruning ht yields a 5 m pruned 1st log. 5 m pruned log = 5/27 = 19% of the tree. However, because diameter is greater in the bottom log, there is more volume in the bottom part of the tree. Assume 25% of volume is in 1st 5.5 m log.	1. 200 ha is approx 13% of annual area harvested (200/1600). Assume 5 m log is 25% of tree vol. (.13 X .25) ⇒ 3%.	1. 3% clear 2. 1% poles Total: 4%
		Pole content calculation: The characteristics of stands yielding poles are higher density, G or M site. The higher density reduces knot sizes and stem taper. TIPSY indicates that for Cw with an initial density of 4 000 st/ha, SI 30, at age 100, 28% of stems will be ≥ 50 cm dbh. However, not all of these stems will be pole quality. Assume ½ of this or 14%. It is anticipated that Cw will shift to being 25% of all stands (see Quantity - MT 4). However, not all of these will have sufficient density or site quality. Assume 1/3 of stands will have these characteristics. (25%/3 = 8% of THLB)	No estimate available. If 1/3 of Cw leading species (25/3 = 8% of THLB) is higher density G & M site Cw and 14% of stand is poles ⇒ 1% of future harvests will be poles.	

Response Time Frame	Potential Strategy/Action	Discussion / Current Status	Anticipated Result	Premium Log Forecast
♦ Long Term (161 + yrs)	As above.	As above.	As above.	4%

Timber Quality Forecast

The foregoing analysis indicates the premium log content of harvests in the mid and long term will be substantially lower than today's levels (4% forecast vs. current estimate of 15%). This estimate does not include a large log component of the premium log definition and therefore may be lower than otherwise would be the case. A higher level of pruning program than currently planned would serve to improve future timber quality, however, there is a lack of treatable stands due to accessibility and cost.

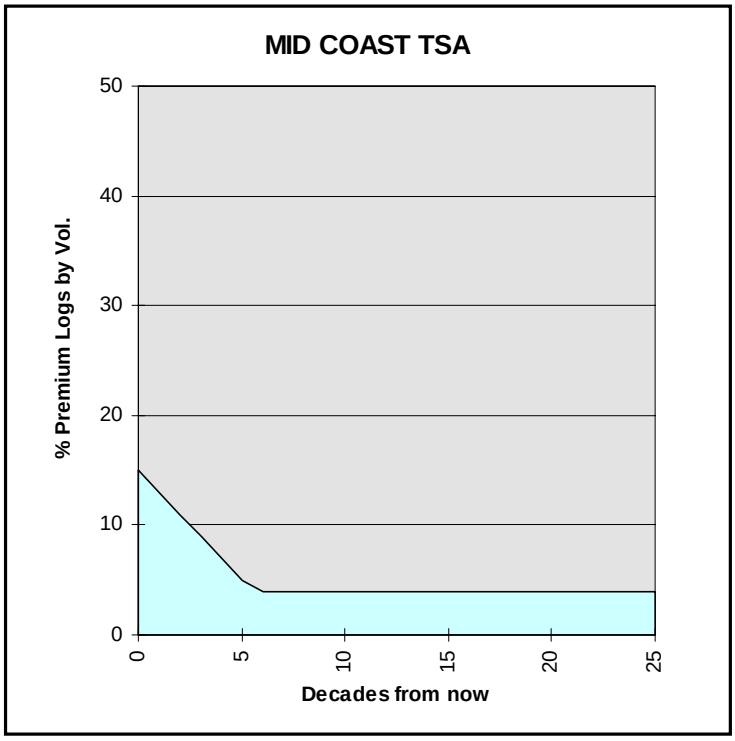


Figure 8. Potential Quality Forecast, Mid Coast TSA

Incremental Silviculture Strategy

This section synthesizes the preceding background information and analysis into an incremental silviculture strategy for the TSA.

Preparing an accurately targeted incremental silviculture strategy for the Mid Coast TSA is difficult until two major uncertainties in information are overcome. The first of these is with respect to yield assumptions. TSR 1 used VDYP yields for the majority of regenerated stands, which are considerably lower than TIPSY yields. When TIPSY yields are applied, a significant rise in the long term harvest forecast can be anticipated. Similarly, because of the abundance of older existing stands, if site indexes for these stands prove underestimated there may also be a significant upwards adjustment to the long term harvest forecast for this TSA. These may alter

the TSA's sensitivity to some other factors. At this time, therefore, it is prudent to focus on incremental silviculture strategies that will be appropriate regardless of whether or not such changes occur.

General Strategy

The primary focus of the incremental silviculture strategy in the Mid Coast TSA is to improve the quantity and quality of timber supplies over the long term. Strategies towards this end are reducing green-up ages, increasing regenerated stand volumes, and spacing newly regenerated stands. Pruning of some stands will ensure at least a minimal supply of premium logs in the future.

Working Targets

The preceding analysis indicates the following working targets are attainable. Figure 9 illustrates these.

WT 1 (Quantity): Manage mid-term timber supplies to yield a harvest of approximately 0.7 million m3/yr and long term supplies to yield 0.8 million m3/yr.

WT 2 (Quality): Manage regenerated stands to yield at least 4% premium logs by volume, with the majority of the remainder being of sawlog quality.

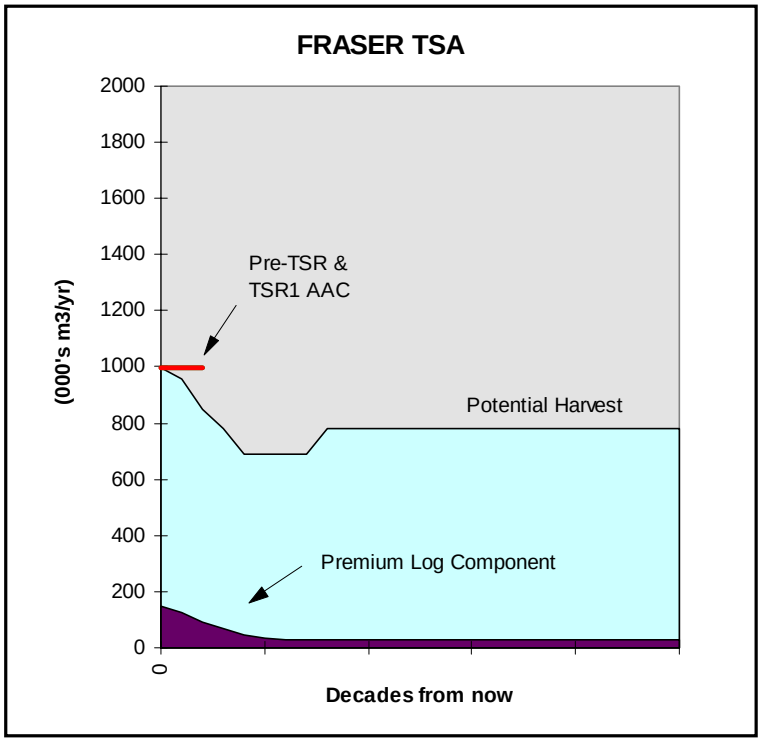


Figure 9. Combined Potential Quantity and Quality Harvest Forecasts, Mid Coast TSA

Log Product Objectives

The following are product objectives at the log level for the Mid Coast TSA.

Quality Class	Species	Characteristics
Premium Log:	Douglas-fir, clear, pruned	45 cm min DBH, pruned, min 5.5 m log.
	Hemlock, clear	45 cm min DBH, pruned, 3.5 - 5.5 m log.
	Cedar pole	.....45 cm min DBH, over 20 m long min 20 cm top, few knots.
	Sitka spruce	....45 cm min DBH
Sawlog:	Minimum average stand DBH by species and site class as follows:	
	Cedar, G/M	56 cm
	Douglas-fir, P	40 cm
	Hemlock/Balsam, P	35 cm
	All other	.....45 cm

Silviculture Strategies

♦ Strategies to Increase the *Quantity* of Future Timber Supply

The following strategies have identified potential to increase the quantity of the timber supply of the Mid Coast TSA. (Strategy numbers correspond with those recorded earlier.)

(Note: Some of these are pre free growing silviculture activities. Where licensees can meet their free-growing obligations without undertaking such activities they are not likely to voluntarily undertake them due to the extra cost. In such cases, funding assistance would likely be necessary.)

No.	Strategy
ST1 / MT1 / LT2	Achieve green-up 2 years earlier in all zones by: (a) planting genetically improved stock; and (d) fertilizing seedlings at the time of planting as well as fertilizing 200 ha/yr of post free-growing cedar stands on the outer coast.
ST4 / MT6	Brush or girdle 60 ha/yr of backlog plantations to ensure free growing status is achieved.
MT3 / LT1	Increase regenerated stand volumes 15% by: (b) using (2nd generation) A class seed or better; (d) managing stocking to reduce voids 5%; and (e) fertilizing seedlings at time of planting.
MT4	Space 500 ha/yr of Douglas-fir and Hemlock-Balsam stands to increase avg. piece sizes and

prepare stands for pruning and commercial thinning.

MT8 Reduce minimum harvest ages and raise volumes by fertilizing 200 ha/yr of hemlock stands on the outer coast.

Tree improvement is critical to achievement of a number of the preceding strategies.

♦ Strategies to Increase the *Quality* of Future Timber Supply

The following strategies have identified potential to increase the quality of the timber supply of the Queen Charlotte TSA.

No.	Strategy
Q1	Produce 3% clear timber by volume by pruning 200 ha/yr to 3.5 m and 200 ha/yr to 5.5 m.

♦ Strategies to Increase the *Quantity* or *Quality* of Future Habitat Supply

(Note: The following strategy was developed in the district working session during discussion of the regime table. Consequently there is no prior documentation in this report.)

The following strategy has identified potential to increase the quality or quantity of the habitat supply of the Mid Coast TSA.

No.	Strategy
H1	Space 10 ha/yr to improve riparian habitat.

Summary of Information and Research Needs

During the assessment process, the following needs for further information and research became apparent. The outcome of these have implications for an incremental silviculture strategy.

1. Hemlock response to fertilization is variable. Were the causes for this determined there may be considerable potential for hemlock fertilization to improve the harvest forecast. Also need research trials on cedar fertilization on the outer coast. (ST1, MT5)
2. Experimental trials and guidelines are required for creating old-growth attributes earlier through silvicultural practices. (ST5)
3. Require TIPSY yields for regenerated stands. (ST6)
4. OAF 1 factor of 15% requires confirmation. Survey techniques are available. Requires statistical validity at the management unit level if to be used for AAC determination. (MT3)
5. Old growth site index and existing stand volume estimation studies require completion.

Silviculture Regimes and Investment Priorities

The following table indicates incremental silviculture regimes which are suitable to attaining the above working targets and strategies.

Regime Table, Midcoast TSA, August 1998

	Regimes	Strategy	Opportunity Area (Ha/Yr)	Timber Supply Effects Short	Medium	Long	Quality	Habitat	Direct Silv. Jobs Days/ha	Direct Cost $/ha	Rank
1	**Backlog**										
	Girdling	ST4,MT6	40	0	0	+	0	0	3	1000	1
	Brushing		20	0	0	+	0	0	4	1250	1
	Spacing										
	Fd >5000 to 900										
2	<12m G-M for CT	MT4	200	0	++	0	+	0	4	1400	2
3	P, no CT P	MT4	50	0	+	0	+	0	3	1400	4
	Hw > 5000 to 900										
4	M-G for CT	MT4	200	0	++	0	+	0	5	1800	4
5	P, no CT	MT4	50	0	+	0	+	0	4	1800	6
6	Riparian habitat	H1	10	0	0	0	0	+	7	2200	*
	Pruning (spaced stands)										
7	Fd leading 1st lift to 3.5 m	Q1	200	0	0	0	+++	+?	10	1800	3
8	Hw leading 1st lift to 3.5 m	Q1		0	0	0	+++	+?	12	2200	5
9	Fd leading 2nd lift to 5.5 m	Q1	200	0	0	0	+++	+?	10	1800	3
10	Hw leading 2nd lift to 5.5 m	Q1		0	0	0	+++	+?	12	2200	5
	Fertilization										
	Outer coast										
	Cw, post FG, pre greenup	ST1	200	+	0	0	0	0	.1	1000	7
	HB repeated	MT-8	200	0	+	0	0	0	.1	1000	*

Notes
* Experimental

Incremental Silviculture Program

The following annualized program will contribute to achieving the above goals and strategies.

Program Table - Hectares Treated, Midcoast TSA, August 1998

Year	Surveys	Backlog Brush / Conifer Rel	Space	Prune	Fertilize	Total
1	2,500	60	510	400	400	3,870
2	2,500	60	510	400	400	3,870
3	2,000	60	510	400	400	3,370
4	1,500	60	510	400	400	2,870
5	1,500	60	510	400	400	2,870
Subtot Yr 1 - 5	10,000	300	2,550	2,000	2,000	16,850
6 - 10	7,500	-	2,550	2,000	2,000	14,050
Total Yr 1 - 10	17,500	300	5,100	4,000	4,000	30,900
Unit cost ($/ha)	100	1,083	1,612	2,000	1,000	

Program Table - $ 000s, Midcoast TSA, August 1998

Year	Surveys	Backlog Brush / Conifer Rel	Space	Prune	Fertilize	Total
1	250	65	822	800	400	2,337
2	250	138	822	800	400	2,410
3	200	138	822	800	400	2,360
4	150	138	822	800	400	2,310
5	150	138	822	800	400	2,310
Subtot Yr 1 - 5	1,000	617	4,110	4,000	2,000	11,727
6 - 10	750	-	4,110	4,000	2,000	10,860
Total Yr 1 - 10	1,750	617	8,220	8,000	4,000	22,587

Job Outcomes

The following are the anticipated job outcomes of the preceding program, assuming the program is maintained into the future as necessary to achieve the working targets.

Program Job Outcomes, Midcoast TSA, August 1998

Short term *employment associated with undertaking the silviculture activity, in person years*

Year	Surveys	Backlog	Space	Prune	Fertilize	Total
1	1.4	1.1	12.3	24.4	0.2	40
2	1.4	1.1	12.3	24.4	0.2	40
3	1.1	1.1	12.3	24.4	0.2	39
4	0.8	1.1	12.3	24.4	0.2	39
5	0.8	1.1	12.3	24.4	0.2	39
Subtot Yr 1 - 5	6	6	62	122	1	196
6 - 10	6		62	122	1	191
Total Yr 1 - 10	11	6	123	244	2	387

Note: Assumes 180 days of silviculture work = 1 job (Source: Jobs and Timber Accord)

Long term *employment associated with improved quality and quantity of the timber resource*[1]

Decade	Harvest Increment ('000 m3)	Incremental Jobs per year by decade TSA[2]	Prov[3]	Total by decade TSA	Prov
1	-	-	-		
2	40	6.4	64.0	64	640
3	51	8.2	81.6	82	816
4	34	5.4	54.2	54	542
5	100	15.9	159.2	159	1,592
6	100	16.0	160.0	160	1,600
7	100	16.0	160.0	160	1,600
8	190	30.4	304.0	304	3,040
9	190	30.4	304.0	304	3,040
10	190	30.4	304.0	304	3,040
11	190	30.4	304.0	304	3,040
12	190	30.4	304.0	304	3,040
13	190	30.4	304.0	304	3,040
14	190	30.4	304.0	304	3,040
15	190	30.4	304.0	304	3,040
16	190	30.4	304.0	304	3,040
17	190	30.4	304.0	304	3,040
18	190	30.4	304.0	304	3,040
19	190	30.4	304.0	304	3,040
20	190	30.4	304.0	304	3,040
21	190	30.4	304.0	304	3,040
22	190	30.4	304.0	304	3,040
23	190	30.4	304.0	304	3,040
24	190	30.4	304.0	304	3,040
25	190	30.4	304.0	304	3,040
Total				6,151	61,511

Notes

Assumes continuation of on the incremental silviclture program beyond the first 10 years, in accordance with the strategy. The total harvest increment is associated with all the silvicultural practices documented in the "Opportunities" section and is only partly attributable to spacing and fertilization practices. Some of the increase may be associated with pre-free growing silviculture that was not current practice at the time of TSR1.

Assumes 0.16 TSA level harvesting and processing jobs (PYs) per 1000 cubic metre (Source: Mid Coast SEA)

Assumes 1.6 Provincial level harvesting and processing jobs (PYs) per 1000 cubic metre (Source: Mid Coast SEA)

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