Queen Charlotte 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

Working Targets

The Queen Charlotte TSA has limited ability to overcome forecast reductions in timber supply. To offset this, ensuring future timber quality is particularly important.

Quantity: Manage mid-term timber supplies to yield a harvest of 260 000 m3/yr and long term supplies to yield 340 000 m3/yr.

Quality: Manage regenerated stands to yield 8% premium logs by volume, with the majority of the remainder being of good grade sawlog quality.

Product Objectives

The following are product objectives at the log level for the Queen Charlotte TSA.

Premium Log: Pine pole..... 30+ cm min dia over 15 m, few knots (pole).
Cedar pole ..... as above but younger age class.
Cedar large timber: ..... min. 45 cm & low taper for 10 m, mature wood.
Spruce/Hemlock clear..... clear for 2.5 m log, diameter not as important.

Sawlog: Minimum average 45 cm DBH and stand vol. of 350 m3/ha.

Major Silvicultural Strategies

Quantity

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

1. Increase regenerated stand yields 15% and reduce minimum harvest ages by 10 years by
   - reducing time to regeneration;
   - using A class seed or better (requires tree improvement for hemlock & cedar);
   - using large planting stock; and
   - tea-bagging plantation seedlings and fertilizing 200 ha/yr of cedar-salal sites.
2. Other strategies, particularly fertilization and possibly commercial thinning of younger existing stands, may commence approximately 50 years from now.

Quality

1. One-lift prune (5.5 m) all spaced zonal hemlock and spruce stands (150 ha/yr).
2. Manage selected stands to higher densities to yield pole-sized trees.
3. Space 400 ha/yr to increase piece sizes and prepare stands for pruning.

Habitat

1. Rehabilitate 60 ha/yr of riparian habitat through conifer release, spacing and planting.

Incremental Silviculture Program (Ha)

Year	Surveys	Backlog Brushing	Riparian Rehab	Space	Prune	Fertilize	Total
1	2,000	120	60	400	150	200	2,930
2	2,000	-	60	400	150	200	2,810
3	2,000	-	60	400	150	200	2,810
4	2,000	-	-	400	150	200	2,750
5	2,000	-	-	400	150	200	2,750
Subtot Yr 1 - 5	10,000	120	180	2,000	750	1,000	14,050
6 - 10	10,000	-	-	2,000	750	1,000	13,750
Total Yr 1 - 10	20,000	120	180	4,000	1,500	2,000	27,800

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 range of potential 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 July 8, 1998 in Queen Charlotte City, attended by representatives of the MoF and forest licensees of the Queen Charlotte 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:

- Queen Charlotte Forest District
- Vancouver Forest Region.

Forest licensees of the Queen Charlotte TSA:

- TimberWest
- Husby Forest Products
- Naden 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

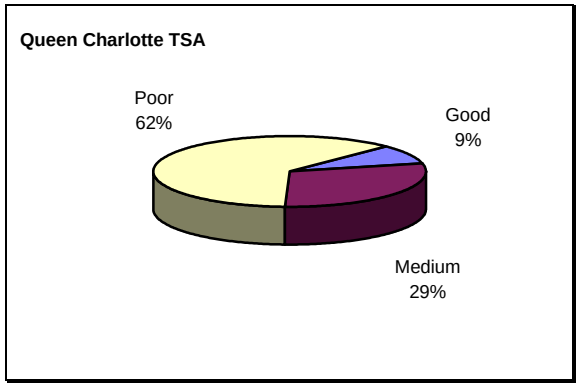
All charts are with respect to the net timber harvesting land base.

Land Area

Description	Area (ha)	Area %
Total Area of TSA	464 800	100
Total Productive Crown Forest	348 400	75
Net Timber Harv. Land Base	60 400	13

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

Site Class



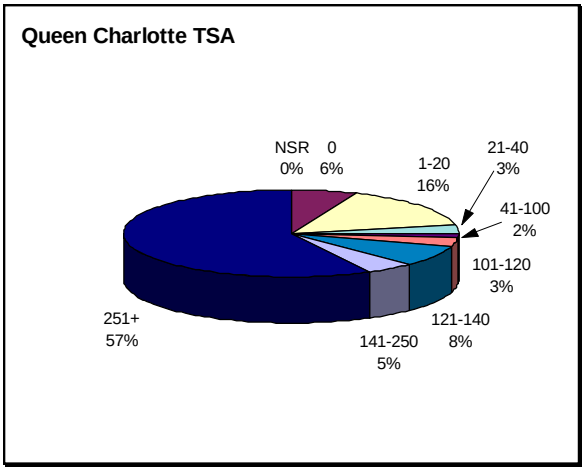
AAC

AAC Type	Pre-TSR	TSR1*	Change (%)
Conventional	509 861	400 000	-21.5
Deciduous	-	-	-
Insect/Disease	-	-	
Marginal	-	75 000	∞
Total	509 861	475 000	-6.8

Woodlot AAC	4 474

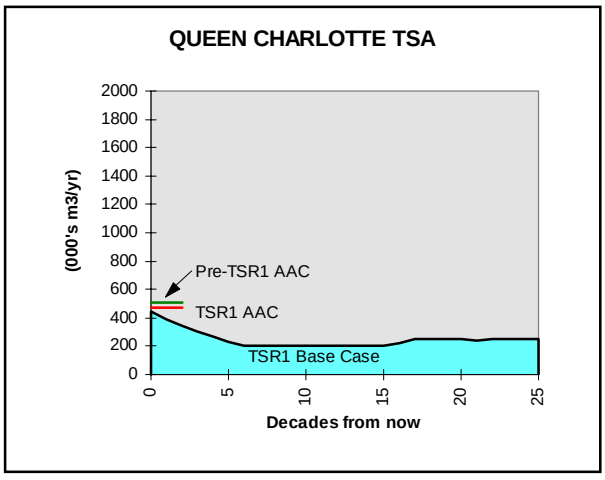
*effective May 1/96

Age Class



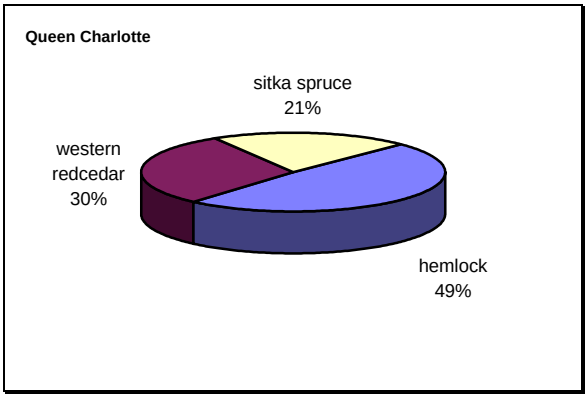
Data scaled from chart in TS analysis report.

Harvest Forecast



Base case does not include 75 000 m3/yr partitioned AAC for cedar sites.

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 23. 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.

♦ Harvest Forecast	Initial harvest level of 442 000 m3/yr (14% below the pre TSR AAC of 509 861 m3/yr) can only be maintained for one decade, followed by declines at the rate of 12%/decade over the next five decades to a mid term level of 205 000 m3/yr (60% below the pre-TSR AAC, 54% below the IHL) 60 years from now, rising to a long term harvest level at the beginning of decade 18 of 248 000 m3/yr (51% below the pre-TSR AAC, 44% below the IHL). (rationale, 11) In general, increased yields from regenerated stands do not show their effect until about decade 18 when the last of the older stands have been harvested (analysis, 36). The base case does not include the 13 000 ha of low volume cedar stands the CF determined could contribute to timber supply through a partitioned AAC of 75 000 m3/yr. A sensitivity analysis with this included indicates an IHL of 473 000 m3/yr and could significantly reduce the base case shortfall between decades 11 and 18. (rationale, 13)
♦ Age Class	**Approximately 75% of THLB in stands aged 121+** (rationale, 16). The preponderance of old growth results in the unique situation where the removal of <u>all</u> forest cover constraints has relatively little effect over the base case (about 3% higher over short and mid term and < 1% higher over the long term). (analysis, 33) Presumably the need to step down the harvests to have an orderly transition to second growth also meets the majority of constraints in the process. Only 8% of THLB in stands aged 21-120, resulting in mid term harvest levels below LTHL for an extended period. (rationale, 16)
♦ Forest Cover	*IRM Zone*: 77% of THLB. Base case requirement of at most 25% of THLB permitted to be < 5 m tall (4 pass system). (analysis, 14) Sensitivity test of ± 1 pass (20% and 33%). Insensitive to either as the area less than 5m never exceeded 18%. (analysis, 30) *Visual Quality Zones*: 23% of THLB. Base case requirement of at most 5% (retention areas), 15% (partial retention) to be < 5 m tall. (analysis, 13-14) Sensitivity analysis indicates that the short term timber supply is relatively insensitive to a relaxation of forest cover objectives for visual quality. (rationale, 22) *Green-up*: Green-up age 13 years for all zones to reach a ht of 5 m (analysis, 56). Sensitivity test of ± 5 and ± 10 years. (analysis, 29-30) <u>Relaxation</u>: (- 5, 10 yrs) Relatively insensitive over all terms. <u>Increase</u>: (+ 5, 10 yrs) Insensitive to a 5 yr increase. Moderately sensitive in short and mid term to a 10 yr increase, with the IHL 2% below base case and the rate of decline increased from 12% to 16% until the same mid term shortfall level as in the base case is reached.
♦ Backlog NSR	70 ha of backlog NSR. Assumed to be restocked within 2 years. (rationale, 19)
♦ Quality	• 142 085 ha of problem forest types completely deducted (low site, pine or alder dominant species). (analysis, 8, 50) • CF determines in AAC rationale that 13 000 ha low site cedar may be operable and creates

75 000 m3 partitioned AAC. (rationale, 14)

- **Older Forests**

Base case includes a requirement for at least 6% of the THLB be > 150 yrs old in all management zones (analysis, 13-14).

Sensitivity analysis of 0%, 4%, and 8%. (analysis, 32)

Relaxation: (0%, 4%) 4% level virtually unchanged from base case over all terms. 0% level allows slightly higher harvest levels over short and mid term, and a rise to LTHL 2 decades earlier than the base case.

Increase: (8%) Harvest forecast nearly identical to base case, except rise to LTHL delayed by 2 decades.

- **Min. Harvest Ages**

Range from 100 - 150 years, based upon age trees reach 45 cm DBH and stand vol. of 350 m3/ha. If neither criteria met by 150 yrs, min harvest age set at 150. (rationale, 18)

Sensitivity analyses of ± 10 and ± 20 yrs. Very minor sensitivity in mid and long term to 10 yr change. (analysis 27 - 29)

Decrease: (- 20 yrs) Very minor sensitivity long term (1% below base case), resulting from harvesting trees before culmination. See also "Estimates of Timber Volumes," below.

Increase: (+20 yrs) **Short and mid term highly sensitive**. Initial harvest level 6% below base case, then falling 20%/decade for the next 3 decades to reserve more volume for decades 12 to 20 where the transition from old to second growth occurs. Rise to LTHL delayed by 2 decades, but LTHL otherwise unchanged.

- **Silvicultural Systems**

Most of the THLB is currently managed under a clearcut harvesting system. (Participants at the district working session indicated almost all cut-over areas are planted.) Some harvesting planned as clearcut with reserves. CF notes potential for this to decrease short term harvests. (rationale, 20)

- **Estimates of Timber Volumes**

VDYP used for all existing stands. TIPSY used for regenerated stands. OAF1 - 15%, OAF2 - 5% (analysis, 58) (Participants at the district working session felt an OAF1 of 15% to be appropriate as are many small voids in stands due to either rock or swampy terrain).

Existing stand volumes: Sensitivity test for ± 10% and ± 20% in volume. (analysis, 34-35) Highly sensitive to both in short and mid terms. Long term insensitive as is affected by regenerated volumes, not existing volumes.

Increase: (+10%) **Highly sensitive**. Harvest levels 16% - 20% above base case, for 1st 6th decades (visual estimate from chart), reaching the base case mid term shortfall level 2 decades later than base case.

(+20%) **Highly sensitive**. Harvest levels 16% - 20% above base case, for 1st 6th decades (visual estimate from chart). **Base case trough below LTHL eliminated**.

Decrease: (-10%) **Highly sensitive**. Initial volumes reduced 14% below base case for 1st 5 decades and 6% below base case mid term shortfall.

(-20%) **Highly sensitive**. Alternative 1 - short and early mid term reductions below base case slightly less than that of a 10% decrease, mid term trough 20% lower than base case (160 000 m3 vs. 205 000 m3).

(At the district working session, district and licensee staff indicated they suspect existing mature stand volumes are underestimated.)

Regenerated stand volumes: Sensitivity test for ± 20% in volume. Short term insensitive to either. Highly sensitive to both in long term. (analysis, 36-38)

Increase: (+20%) Slight mid term raise. LTHL 21% higher than base case, starting to rise from mid term shortfall 160 years from now. [This increases the magnitude of the mid-term dip below LTHL - potential for commercial thinning?] When combined with a 10 yr

	decrease in min. harvest ages, raises **mid term 7%**[1] above the base case (analysis, 37-38). Decrease: (-20%) LTHL 21% lower than base case. Same as trough in base case.
♦ Deer Browsing	Deer browsing of cedar seedlings is a significant problem, creating extraordinary regeneration expense for licensees. (At the district working session, licensees indicated they are pursuing some incremental silviculture funding support on the basis that deer are an introduced species to the Queen Charlottes.)
♦ Site Productivity	District staff expect site productivity has been underestimated, especially regarding site indexes for Sitka spruce. However, CF finds that if this proves true it would not influence short term harvest levels. (rationale, 17) Early indications are that site indices of some spruce and cedar sites may be underestimated by 10-15%. More samples are required before conclusions may be reached regarding hemlock site indices. (District working session).
♦ Increased Land Base	The addition of 13 000 ha for low volume cedar stands (see "Quality," above) increases the THLB. Another 1 300 ha of timber licences will revert to the THLB after 25 years from now, which **the CF considers to represent and increase in timber supply in the medium and long terms of approx. 5 000 m3/yr**. (rationale, 14) Together, these represent a 24% increase in the THLB. Because the cedar sites are of low productivity, the effect on future harvest levels will be less than proportional. A sensitivity test in the analysis report indicates that a 20% increase in the THLB would result in a 20% increase to both the mid and long term timber supply. (analysis, 38-39) (The cedar sites would increase harvest levels over all periods, because they presently contain timber volumes. The timber licence area will increase levels only in the longer term, because they hold no harvestable timber when they revert to the THLB.)

Summary of Issues by Period

Short Term: 1-20 years

A very high proportion of mature timber makes this TSA insensitive in the short term to most factors other than:

- a 20 year increase in minimum harvest ages, resulting in an immediate 6% decrease in harvests (however, there is only a minor sensitivity to a 10 year increase); and
- a 10% increase or decrease in existing stand volumes, which result in immediate ± 14% corresponding changes in harvest levels.

Mid Term: 21 - 180 years

The Queen Charlotte TSA has a preponderance of old growth (70% aged 121+) and a dearth of middle-aged stands (8% aged 21-120 years). The shortage of younger existing stands coupled with high minimum harvest ages for regenerated stands (110 - 150 yrs) results in an extraordinarily long mid term period at a level below the long term harvest level. This is because of the need to ration the available older timber across this period until regenerated stands become available.

Ordinarily, the combination of a shortage of younger existing age classes coupled with high minimum harvest ages would result in a high sensitivity to minimum harvest ages, but this is not the case in this TSA. This may be due to the large amount of poor site land having low volumes. When lower minimum harvest ages are combined with 20% higher regenerated stand volumes, a 4% increase in mid term volumes results.

[1] Analysis report notes the effect to be "4% higher than in the case of increasing yield estimates alone." No mid term figure for increasing yield estimates alone is given. Estimated at 3% for a total of 7%.

In the Queen Charlotte TSA, the same sensitivities exist in the mid term as in the short term. Generally, these only have an influence over the first 50 or so years of the mid term period, except that a 20% increase in existing stand volumes eliminates the mid term shortfall over the period 60 to 180 years from now.

Long Term: 181+ years

The long term is only sensitive to increases or decreases in regenerated stand volumes. A 20% increase or decrease in regenerated stand volumes results in a corresponding 21% increase or decrease to the long term harvest level.

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.

Incremental Silviculture History

Approximately 800 ha are harvested annually. (QCFD[2])

Treatment	Incorporated in Timber Supply Analysis	Not Incorporated in Timber Supply Analysis
♦ Backlog	70 ha restocked in next 2 years.	
♦ Conversion		
♦ Commercial Thin		
♦ Space	45 - 50% of harvested areas are spaced (rationale, 20). CF satisfied this is reflected in timber supply analysis. No additional opportunity suggested in the analysis.	
♦ Prune		None indicated in timber supply analysis. Recent level approx. 150 ha/yr, mostly a single 5m lift (QCFD).
♦ Fertilize		None indicated in timber supply analysis. Periodic fertilization undertaken (QCFD).
♦ Space/ Prune		Only spaced stands are pruned.

[2] QCFD - Queen Charlotte 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.

Since the TSR 1 analysis report for the Queen Charlotte TSA, the chief forester created a partitioned AAC for marginal cedar stands. Thus, while the sensitivity analyses shown below may indicate certain potential results from silvicultural actions, they are not directly comparable with the TSR1 AAC.

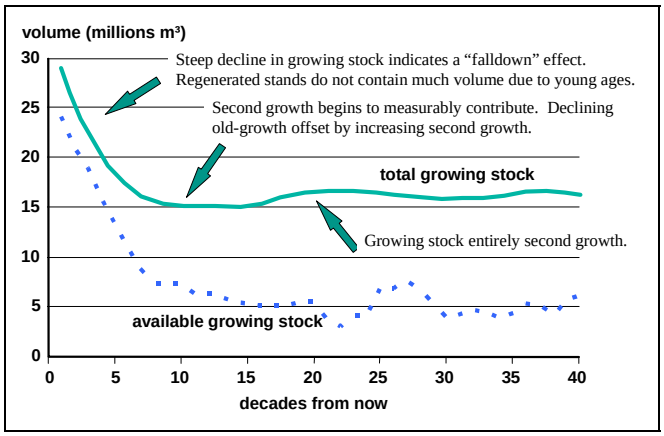


Figure 1. Changes in growing stock over time, Queen Charlotte TSA

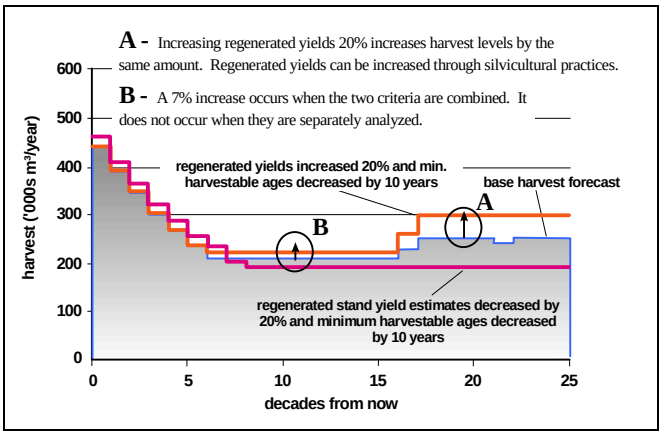


Figure 3. Effects of increasing regenerated stand volumes and reducing minimum harvest ages, Queen Charlotte TSA

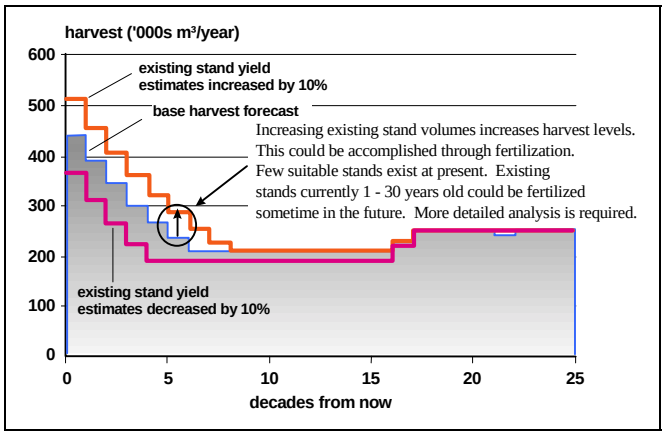


Figure 2. Opportunity to increase harvest levels by increasing existing stand volumes, Queen Charlotte TSA

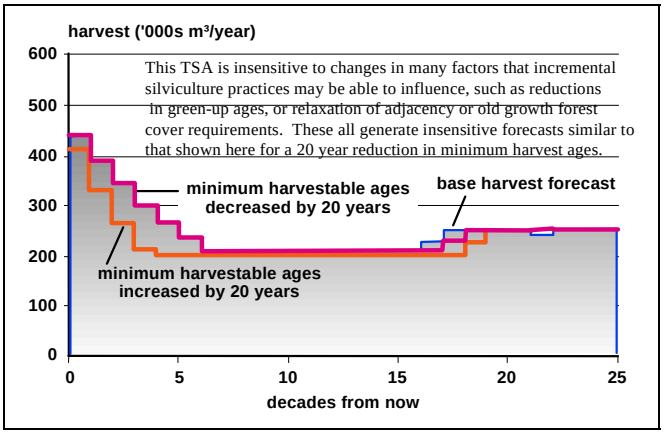


Figure 4. Insensitivity of the Queen Charlotte TSA to many factors

Preliminary Identification of Silviculture Opportunities

Information in the previous sections indicates the following silvicultural strategies may have potential to increase future timber supply. The general insensitivity of the TSA to most factors indicates comparatively few opportunities to increase timber supply. Each of the potential strategies 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 18.

♦ Short Term (1 - 20 yrs)

ST 1 No short term strategies were identified.

♦ Mid Term (21 - 180 yrs)

MT 1: Fertilize older existing immature stands to increase their yields.

MT 2: Use spacing / CT / fertilization regimes commencing in about 50 years to bring forward volumes from the long term.

MT 3: Increase regenerated stand volumes 20% and reduce minimum harvest ages 10 years through a variety of silvicultural practices.

♦ Long Term (181+ yrs)

LT 1: increase regenerated stand volumes 20% as above.

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
♦ Spacing	District records indicate 300 - 600 ha/yr were spaced over the last 10 years. % of stands spaced by age group as of 1998: Age / % spaced 1 - 10 / 60 11 - 20 / 70 21 - 30 / 40 31 - 40 / 5 With the recent raising of the basic spacing requirement to 10 000 stems/ha, most spacing in future is likely to be post free-growing and therefore incremental.	Virtually all treatable area is currently being spaced.
♦ Fertilization	**Cedar.** Results from the SCHIRP project on northern Vancouver Island indicate a significant response in salal/cedar stands to an early fertilization, the object of which is to give the cedar an early boost and obtain crown closure over the salal. Timing of treatment is important. This appears to also be the case in the Charlottes. **Hemlock**. There is some debate as to the response of Hemlock	**Cedar**. A significant amount of treatable young cedar exists. The partitioned AAC for cedar types will add more treatable area.

Treatment	Comment	Treatable Area
	stands to fertilization. **More trials are needed to confirm**. **Spruce**. Sitka spruce responds favourably to fertilization, except for the richest sites. The district working session examined the opportunity to increase existing stand volumes through fertilization. It was concluded that there were few suitable stands available due to the age class structure of the TSA. There is only about 1 000 ha in stands currently aged 40 - 100 yrs. Approximately 8 000 ha are currently aged 120 to 140 yrs and have good access and are suitable for fertilization. Unfortunately, their position in the harvest queue (a significant proportion of older stands will be harvested before them) means they won't be harvested for another 50 - 80 years, making them too old for effective treatment.	
♦ Commercial Thinning	No CT to date. May be possible to partially offset age class problem which causes mid term harvest levels to drop below long term levels. High risk of damage to residual stems in hemlock. Currently there is no market for CT material - cost to get it to the mainland is too high for the value of the material. Would likely have to be a local demand before it could be profitable.	Currently few suitable timber types on accessible terrain.
♦ Backlog NSR	All backlog NSR has been treated. Approx. 120 ha of brushing is required to ensure backlog areas reach free-growing.	None.
♦ Problem Forest Types	Approximately 142 000 ha of low site stands, pine and alder-dominated stands were removed from the THLB as non-merchantable, with 13 000 ha of cedar subsequently added back in on a partitioned AAC basis by the chief forester. At this time there appears to be little additional opportunity for increasing the THLB by silviculturally treating any of this area.	129 000 ha.

Potential Strategies by Response Time Frame

This section documents the discussions and outcomes of the district working session.

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 indicated strategies would serve to mitigate their effects rather than increase timber supply.

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 of Silviculture Opportunities," page 9. Items followed by an * were added during the district working session.
3	Information in this column is largely from the district working session, combined with information presented earlier in this document. Potential treatment regimes are highlighted in bold print.
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 and the TSR1 base case reduction between the first and second decades. Mid and long term harvest forecasts take the base case levels from TSR1 as the starting levels. The harvest forecast for these periods contains a 20% adjustment to reflect the increases in the THLB associated with the partitioned AAC for 13 000 ha of low-volume cedar and additional reversion of timber licences that are not accounted for in the base case (see "Increased Land Base" under "Individual Issue Analysis," page 3). The harvest forecast column was not thoroughly reviewed during the district meeting. *Results are largely conjecture and are meant to illustrate the potential of the strategies.*

Response Time Frame	Potential Strategy/Action	Discussion / Current Status	Anticipated Result	Potential Harvest Forecast (000s m3/yr)
♦ Short Term (1 - 20 yrs)	1. No direct silviculture actions are proposed for the short term. 2. Complete the inventory audit to determine if existing stand volumes are underestimated.*	1. The preponderance of old age stands limits potential to increase short term harvest levels. 2. An inventory audit is underway. Existing volumes are thought to be underestimated. If this proves the case, harvest levels could be higher than the base case but will still undergo a significant reduction over time.	1. Reduction of short term harvest levels as per base case forecast. 2. This is not factored into this harvest forecast as doing so would be purely speculative.	475 - 1st dec. - 57 - 12% 418 - 2nd dec.
♦ Mid Term (21 - 180 yrs)	1. Fertilize older existing immature stands to increase their yields. 2. Reduce shortfall below LTHL by using spacing/CT/fertilizing regimes commencing in about 50 years to bring forward volumes from the long term. 3. Increase regenerated stand volumes 20% and reduce minimum harvest ages by 10 years by: (a) reducing time to regeneration; (b) using A class seed or better;	1. Not an option. There is very little area aged 50 - 100 years. See "Fertilization" under "Available Information Regarding Potential Treatments and Treatable Area," page 9. 2. Would not commence until 50 yrs from now. Has implications for current spacing densities to enable CT at the appropriate time. **All treatable stands are being spaced**. H stands have high risk of disease & fert response is variable. See "Available Information Regarding Potential Treatments and Treatable Area." 3. Sensitivity analysis indicates this combination could increase MT harvest levels by 7%. 3. (a) Current regen delays are 3 - 6 years and could be reduced. However, this is a basic silviculture responsibility and may not change without funding assistance as free-growing can be met within these delays. (b) All sitka is A seed, some other is A. Cedar currently indicated to have low gain. Latest estimates of yield gains are (%):[3] Species / 1st gen / 2nd gen Hemlock 3 20 Cedar 3 10 Spruce 3 15	1. N/A 2. Requires modelling. Benefit likely to accrue to decades 14 - 17 as this is when vol's can be brought forward from long term. 3. (a) could gain possibly a 2 yr reduction in min ages. (b) probably 3% vol gain for now, but 20% possible. Assume ⇒ 10%. Will also reduce min ages. Assume 5 yrs.	205 - base case 41 - THLB incr 246 12 - 5% rgn vol 258 ≅ 260

[3] Source: participants at Chilliwack district meeting.

Response Time Frame	Potential Strategy/Action	Discussion / Current Status	Anticipated Result	Potential Harvest Forecast (000s m3/yr)
♦ Mid Term (cont'd)	3. (c) using large planting stock; (d) fertilizing regenerated stands where efficacy is proven. (e) reduce voids to 10% of stand area. 4. Complete site index estimation studies.*	3. (c) Trend is towards larger stock because of free growing and adjacency concerns. Larger stock is more costly to transport. Some 615d and 1 gal Cw planted. (d) about ½ of plantations fertilized w tea bags. Little other fert at present. Hemlock fert possible but need to have better understanding of response. Costs can be prohibitive. Some opportunity to fertilize cedar-salal sites. **Approx 200 ha/yr could be treated**. (e) consensus that the present TIPSY OAF1 factor is appropriate. 4. Underway. Will have mid term effect if site indices prove underestimated.	3. (c) volume impact unknown. Assume ⇒ 1%. Could reduce min ages 2 yrs. (d) assume 2/3rd's of cedar is cedar-salal requiring a single fert = approx 20% of THLB. If 10% vol gain = .1 X .2 ⇒ 2% (e) none. In total, indications are a 10 yr min age reduction and 15% regen vol. gain is possible = 3/4's of sensitivity test vol ∴ = (.75 X 7%) ⇒ 5%. 4. N/A - Increased site productivity may compound some effects.	See above.
♦ Long Term (181+ yrs)	1. Increase regenerated stand yields 20% as above.	As above.	As above. ⇒ 15%	248 - base case 50 - THLB incr 298 45 - 15% rgn 343 ≅ 340

Potential Harvest Forecast

Figure 5 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. Modeling may also indicate more precise timing, targeting and program levels associated with incremental silviculture activities than could be developed in this interim strategy.

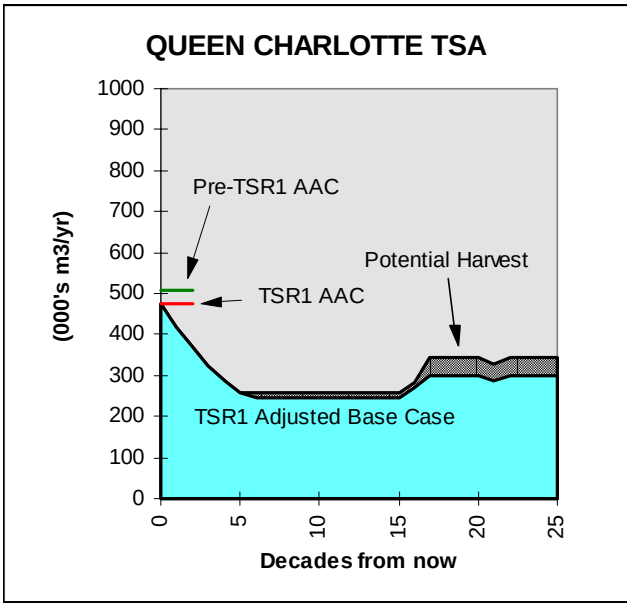


Figure 5. Potential harvest forecast, Queen Charlotte TSA

TSR 1 base case adjusted as follows:

- initial harvest level set at TSR 1 AAC;
- next 4 decades decreased at 12%/decade, same rate as TSR 1 base case;
- mid-term trough & long term increased 20% in recognition of a 25% increase in THLB associated with adding poor site cedar and reverted temporary tenures (not previously included in the base case). Because mostly poor site, a 20% factor was used rather than 25%.

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. OAF 1 factor of 15% appears appropriate but requires confirmation. Survey techniques are available. Requires statistical validity at the management unit level if to be used for AAC determination.
2. 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. A program of screening trials to determine the extent of treatment opportunities is required.

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 Queen Charlotte TSA.

Premium Log: Pine pole ..... 30+ cm min dia over 15 m, few knots (pole).

Cedar pole..... as above but younger age class.

Cedar large timber ..... minimum 45 cm & low taper for 10 m, mature wood.

Spruce/Hemlock clear..... clear for 2.5 m log, diameter not as important.

Sawlog: Minimum average 45 cm DBH and stand vol. of 350 m3/ha.

Available Information Regarding Potential Treatments and Treatable Area

Treatment	Comment/ Potential Treatment Regimes	Treatable Area
♦ Spacing	Spacing can be used to control species selection. Density management can affect sizes and average diameters of stands at harvest. Spacing is a prerequisite for pruning.	60 - 70% of harvested area is currently being spaced.
♦ Commercial Thinning	Commercial thinning is not currently practiced in this TSA. It may have a role in the distant future. Not relevant to present day practices for managing timber quality.	Currently few suitable timber types on accessible terrain.
♦ Pruning	Pruning is done primarily on spaced zonal hemlock and spruce stands. High-site spruce will respond with epicormic branching, however, there is not much of this area, so it is included in the pruning program. Cedar is not currently pruned, much of it being on poorer site and not many stands are ready. Cedar tends to establish at lower densities, thus having large branches. There is thus some potential for a pruning program - more with the objective of eliminating large knots than to create clears. Because of costs associated with remote stands, a single pruning lift of 5.5 m is the normal practice.	Substantial.
♦ Fertilization	Currently fertilization is seen as more of a treatment for creating additional volume as opposed to additional value.	Substantial.

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 - 180 yrs)	1. Prune 150 ha/yr to 5.5 m.	1. Because of cost, a single pruning lift is normal practice. **Spacing is a pre-requisite to pruning.**	1. 150 ha is approx 20% of annual area harvested. Assume 5.5 m log is 25% of tree vol. (.25 X .20) ⇒ 5%.	1. 5% 2. 3% Total: 8%
	2. Manage selected stands to higher densities to yield pole-sized trees.	2.	2. No estimate available. Assume 3% of future harvests will be poles.	
	3. Unmanaged.	3. 6% of stands must be maintained at ages of 150 + years. However, min harv ages for poor sites are 150 yrs. Stands that are held to meet the old age requirement will therefore likely meet sawlog but not premium criteria. Spacing may result in longer limb retention and is not conducive to generating clear logs. 60-70% of stands are spaced.	3. Not expected to generate clear logs without pruning.	
	4. Space 400 ha/yr to increase avg. piece sizes.	4. The TSA has high harvesting and transportation costs. Spacing concentrates volume on fewer, larger logs, thus reducing future costs. Also brings harvest ages forward.	4. Sawlog oriented but pre-requisite to pruning. No premium log effect on its own.	
♦ Long Term (181 + yrs)	As above.	As above.	As above.	8%

Timber Quality Forecast

The foregoing analysis indicates future premium log content forecast for the mid and long term will be lower than today's levels (8% forecast vs. current estimate of 15%). A higher level of pruning program than planned would serve to improve future timber quality.

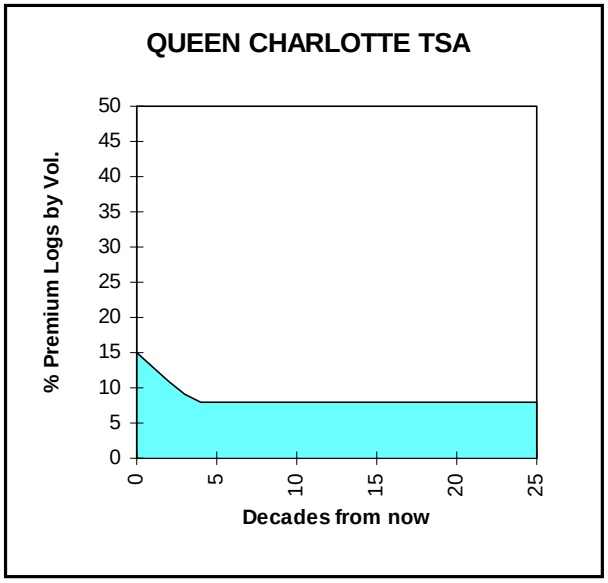


Figure 6. Potential Quality Forecast, Queen Charlotte TSA

Incremental Silviculture Strategy

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

General Strategy

The Queen Charlotte TSA has limited ability to overcome forecast reductions in timber supply. Central to increasing future timber supply is the use of 2nd generation or better improved seedlings. Ensuring future timber quality is particularly important. Spacing is needed to increase piece size and reduce future harvesting costs. Pruning is needed to ensure a reasonable level of premium logs in the future.

Working Targets

The preceding analysis indicates the following working targets are attainable. Figure 7 illustrates these.

WT 1 (Quantity): Manage mid-term timber supplies to yield a harvest of 260 000 m3/yr and long term supplies to yield 340 000 m3/yr.

WT 2 (Quality): Manage regenerated stands to yield 8% premium logs by volume, with the majority of the remainder being of sawlog quality.

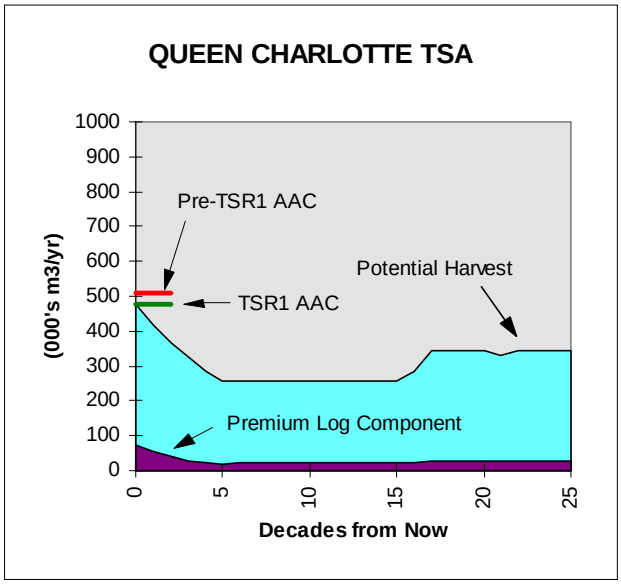


Figure 7. Combined Potential Quantity and Quality Harvest Forecasts, Queen Charlotte TSA

Log Product Objectives

The following are product objectives at the log level for the Queen Charlotte TSA.

Premium Log: Pine pole ..... 30+ cm min dia over 15 m, few knots (pole).
Cedar pole..... as above but younger age class.
Cedar large timber ..... minimum 45 cm & low taper for 10 m, mature wood.
Spruce/Hemlock clear..... clear for 2.5 m log, diameter not as important.

Sawlog: Minimum average 45 cm DBH and stand vol. of 350 m3/ha.

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 Queen Charlotte TSA. (Strategy numbers correspond with those recorded earlier.)

No.	Strategy
MT3	Increase regenerated stand volumes 15% and reduce minimum harvest ages by 10 years by: (a) reducing time to regeneration; (b) using (2nd generation) A class seed or better; (c) using large planting stock; and (d) tea-bagging plantation seedlings and fertilizing 200 ha/yr of cedar-salal sites for early crown closure. (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.)
LT1	Increase regenerated stand volumes 15% by continuing MT3 above.

♦ 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	Prune 150 ha/yr to 5.5 m.
Q2	Manage selected stands to higher densities to yield pole-sized trees.
Q3	Space 400 ha/yr to increase avg. piece sizes and prepare stands for pruning.

♦ 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. The discussion was not documented, so is presented here without prior reference.)

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

No.	Strategy
H1	Rehabilitate 60 ha/yr of riparian habitat through conifer release, spacing and planting.

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, Queen Charlotte TSA, July 1998

Regimes	Strategy	Opportunity Area (Ha/Yr)	Timber Supply Effects Short	Medium	Long	Quality	Direct Silv. Jobs Days/ha	Direct Cost $/ha	Habi-tat	Rank
1 **Backlog Brushing**		120 (1 year only)			A+	0	5.50	2300		1
Riparian Rehabilitation										
2 (includes conifer release, spacing, planting)	H1	60					7.50	1000	+++	3
Spacing										
3 M sites(some P, G) to 600-1000 sph	Q1, Q2, Q3	400		A+	A++	+	4.00	1500		2
Pruning										
4 M-G (best of spaced stands) to 5.5 m	Q1	150				+++	7.50	2000		2
Fertilization										
5 Cedar-salal sites	MT3	200		B+	B++	0	0.01	600		1

Notes
A-type timber supply effects are incorporated in the TSR base case
B-type timber supply effects are incremental to the TSR base case

Incremental Silviculture Program

The following annualized program will achieve the above goals and strategies. It is based on the regime table and scheduling information provided by participants at the district working session.

Program Table - Hectares Treated, Queen Charlotte TSA, July 1998

Year	Surveys	Backlog Brushing	Riparian Rehab	Space	Prune	Fertilize	Total
1	2,000	120	60	400	150	200	2,930
2	2,000	-	60	400	150	200	2,810
3	2,000	-	60	400	150	200	2,810
4	2,000	-	-	400	150	200	2,750
5	2,000	-	-	400	150	200	2,750
Subtot Yr 1 - 5	10,000	120	180	2,000	750	1,000	14,050
6 - 10	10,000	-	-	2,000	750	1,000	13,750
Total Yr 1 - 10	20,000	120	180	4,000	1,500	2,000	27,800
Unit Cost ($/ha)	90	2,300	1,000	1,500	2,000	600	

Program Table - $ 000s, Queen Charlotte TSA, July 1998

Year	Surveys	Backlog Brushing	Riparian Rehab	Space	Prune	Fertilize	Total
1	180	276	60	600	300	120	1,536
2	180	-	60	600	300	120	1,260
3	180	-	60	600	300	120	1,260
4	180	-	-	600	300	120	1,200
5	180	-	-	600	300	120	1,200
Subtot Yr 1 - 5	900	276	180	3,000	1,500	600	6,456
6 - 10	900	-	-	3,000	1,500	600	6,000
Total Yr 1 - 10	1,800	276	180	6,000	3,000	1,200	12,456

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, Queen Charlotte TSA, July 1998

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

Year	Surveys	Backlog Brushing	Riparian Rehab	Space	Prune	Fertilize	Total Silv. Jobs
PDs/ha	0.1	5.5	7.5	4	7.5	0.01	
Year							
1	1.1	3.7	2.5	8.9	6.3	0.0	22.4
2	1.1	-	2.5	8.9	6.3	0.0	18.8
3	1.1	-	2.5	8.9	6.3	0.0	18.8
4	1.1	-	-	8.9	6.3	0.0	16.3
5	1.1	-	-	8.9	6.3	0.0	16.3
Subtot Yr 1 - 5	5.6	3.7	7.5	44.4	31.3	0.1	92.5
6 - 10	5.6	-	-	44.4	31.3	0.1	81.3
Total Yr 1 - 10	11.1	3.7	7.5	88.9	62.5	0.1	173.8

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

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

Decade	Harvest Increment ('000 m3)	Incremental Jobs per year by decade TSA[2]	Incremental Jobs per year by decade Prov[3]	Incremental Jobs Total by decade TSA[2]	Incremental Jobs Total by decade Prov[3]
1	0.0	0.0	0.0	0.0	0.0
2	0.0	0.0	0.0	0.0	0.0
3	0.0	0.0	0.0	0.0	0.0
4	0.0	0.0	0.0	0.0	0.0
5	0.0	0.0	0.0	0.0	0.0
6	12.3	3.6	16.0	35.7	159.9
7	12.3	3.6	16.0	35.7	159.9
8	12.3	3.6	16.0	35.7	159.9
9	12.3	3.6	16.0	35.7	159.9
10	12.3	3.6	16.0	35.7	159.9
11	12.3	3.6	16.0	35.7	159.9
12	12.3	3.6	16.0	35.7	159.9
13	12.3	3.6	16.0	35.7	159.9
14	12.3	3.6	16.0	35.7	159.9
15	12.3	3.6	16.0	35.7	159.9
16	13.5	3.9	17.6	39.2	175.5
17	44.6	12.9	58.0	129.5	580.3
18	44.6	12.9	58.0	129.5	580.3
19	44.6	12.9	58.0	129.5	580.3
20	44.6	12.9	58.0	129.5	580.3
21	42.8	12.4	55.7	124.2	556.9
22	44.6	12.9	58.0	129.5	580.3
23	44.6	12.9	58.0	129.5	580.3
24	44.6	12.9	58.0	129.5	580.3
25	44.6	12.9	58.0	129.5	580.3
Total				1555.7	6974.0

1 - Assumes continuation of the incremental silviculture program beyond the first 10 years, in accordance with the strategy.
The total harvest increment is associated with all 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.

2 - Assumes 0.29 TSA level harvesting and processing jobs (PYs) per 1000 cubic metre (Source: Queen Charlotte Islands SEA)

3 - Assumes 1.3 Provincial level harvesting and processing jobs (PYs) per 1000 cubic metre (Source: Queen Charlotte Islands SEA)

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