Forest Practices Board

Harvesting of Young Stands in BC

SPECIAL INVESTIGATION

MAY 2018

FPB/SIR/48

TABLE OF CONTENTS

GLOSSARY OF TERMS[1]

Allowable Annual Cut is the volume of timber harvest permitted each year from a specified area of land determined by the chief forester for the province of BC, usually expressed as cubic metres of wood per year.

Mean Annual Increment is the stand volume divided by stand age or the average growth per year of a tree or stand of trees.

Minimum Harvest Criteria (MHC) are modelling assumptions that are designed to reflect the minimum development conditions that stands must meet in order to be eligible for harvesting in the timber supply model. The conditions are generally based on current practices observed in the TSA at the time of modelling. Criteria most often used include minimum age, volume of wood per hectare, or minimum tree diameter.

Timber Harvesting Land Base is the Crown forest land within the timber supply area where timber harvesting is considered both acceptable and economically feasible, given objectives for all relevant forest values, including existing timber quality, market values and applicable technology.

Timber Supply Review is a process, initiated in 1992, to regularly review the timber supply and the Allowable Annual Cut in each of the province's 37 timber supply areas and 34 tree farm licences. Each review includes an estimate of the area's long-term sustainable harvesting level and an analysis of projected timber supplies for the short term (20 years), medium term (21–100 years), and long term (200 years or more). Alternative Allowable Annual Cut scenarios are investigated in terms of their timber supply, and environmental, economic, and social implications. The chief forester uses this information to determine the Allowable Annual Cuts for each management unit.

However, because of the uncertainty surrounding the information and because forest management objectives change through time, the estimated sustainable harvest level projections for the short, medium or long term should not be viewed as static. They remain relevant only as long as the information upon which they are based remains relevant. Thus, it is important that re-analysis occur regularly, using new information and knowledge to update the timber supply picture. This allows close monitoring of the timber supply and of the implications for the Allowable Annual Cut stemming from changes in management practices and objectives.

[1] Ministry of Forests and Range Glossary of Forestry Terms in British Columbia, March 2008 *https://www.for.gov.bc.ca/hfd/library/documents/glossary/Glossary.pdf*

Timber Supply Analysis is a process that explores the effects on timber supply of existing or potential forest management strategies and alternative timber harvesting levels. The process typically uses a computer model to forecast the development of a forest over time given specific schedules of management activity. The timber supply analysis is used in the timber supply review process.

Timber Supply Area (TSA) is a geographically based administrative area designated under the *Forest Act* (Section 7). It has an allowable annual cut set by the Chief Forester to provide a sustainable flow of timber to both replaceable and non-replaceable forms of volume-based tenures.

Volume-based tenure grants licensees the right to harvest a set volume (cubic metres) of timber within a specified timber supply area each year, for the term of the licence; several licensees operate in the same TSA.

Young Stands, in this report, are stands below the age minimum harvest criteria defined in the timber supply analysis.

EXECUTIVE SUMMARY

The Board received a complaint about harvesting a young stand of trees that had been treated to increase the volume and value of the trees. The complainant was concerned that harvesting this young stand may impact timber supply and was not consistent with good forest stewardship or sound ecological principles. To answer the complainant's concerns, the Board determined that it would have to look at how extensive the practice of harvesting young stands is, so it decided to carry out a special investigation looking at the issue across five coastal timber supply areas (TSAs): the Arrowsmith, Fraser, Soo, Strathcona and Sunshine Coast. The investigation examined the extent of young stand harvesting and the amount of harvesting in treated stands.

Government and industry use computer models to calculate the sustainable harvest levels from the forest land base. Each timber supply area establishes a set of minimum harvest criteria for age and/or volume that the model uses when scheduling stands for harvest. However, in reality, government and licensees use factors in addition to age and volume when determining which stands to harvest. In some instances, harvesting may occur before the minimum harvest criteria are reached.

The investigation involved interviews and field visits with licensees, district staff and branch staff involved in forest analysis, growth and yield, and resource management. Reviews were also completed of existing government policies, reports and other information for each TSA to confirm the minimum harvest criteria. Finally, government databases were analyzed to determine the extent of harvesting in young stands and stands that have had stand tending treatments.

Two sources of data were used to evaluate the extent of harvesting below minimum harvest criteria: forest inventory data and timber cruise data.

The investigation found the following:

- Based on examining forest inventory data, not a lot of stands are being harvested below the age or volume criteria, and those that are fall only slightly below the criteria.
- A sample of these stands were then compared to cruise data, which is more detailed than inventory data. This analysis showed that the volume per hectare of the stands harvested was actually higher than the minimum harvest criteria on 97 percent of the polygons.

- About 20 percent of the harvesting from 2007 to 2014 was from stands that had received some type of silviculture stand treatment.

In conclusion, the Board found that there is no evidence to suggest that sound ecological principles are not being followed because some young stands are being harvested. Licensees determine when a stand will be harvested and must meet the same statutory obligations and address the risk of their operations to other resource values regardless of the age of the stand proposed for harvesting. However, government should monitor when treated stands are harvested to ensure the anticipated growth gains have been achieved.

INTRODUCTION

The Board received a complaint about the harvesting of a 38-year-old stand of timber in the Soo timber supply area (TSA). The stand had been spaced and pruned to increase the value of the trees and the complainant expected it to be harvested at an older age. The complainant was concerned that harvesting such young stands:

- does not represent good stewardship practices, based on sound ecological principles,
- is not consistent with the allowable annual cut determination for TSAs and challenges the government's ability to meet timber objectives, and
- does not realize benefits of stand tending treatments.

Stand tending is the process of modifying vegetation to improve health and vigour of stands, which may improve commercial traits such as the volume, quality and value of the stand.

The complainant had contacted the Ministry of Forests, Lands, Natural Resource Operations and Rural Development (FLNRO) about his concern. FLNRO responded that harvesting the stand would have negligible impact on timber supply, the stand was economically viable to harvest, doing so did not conflict with legislation and alternative areas were not available to harvest. Not satisfied with this response, the complainant then contacted the Board and filed the complaint.

The Board reviewed the complaint and determined that one cutblock by itself will have negligible impact on forest management or timber supply. However, if the practice of harvesting younger stands is extensive, the impact could be substantial. In order to assess the complainant's concern on a broader scale, the Board decided to carry out a special investigation of the harvesting of young stands over five coastal TSAs—the Arrowsmith, Fraser, Soo, Strathcona and Sunshine Coast (Figure 1)—between 2007 and 2014. The complainant agreed this broader approach would better address his concerns.

This special investigation explores the extent of young stand harvesting in five coastal TSAs and comments on issues related to harvesting of young stands.

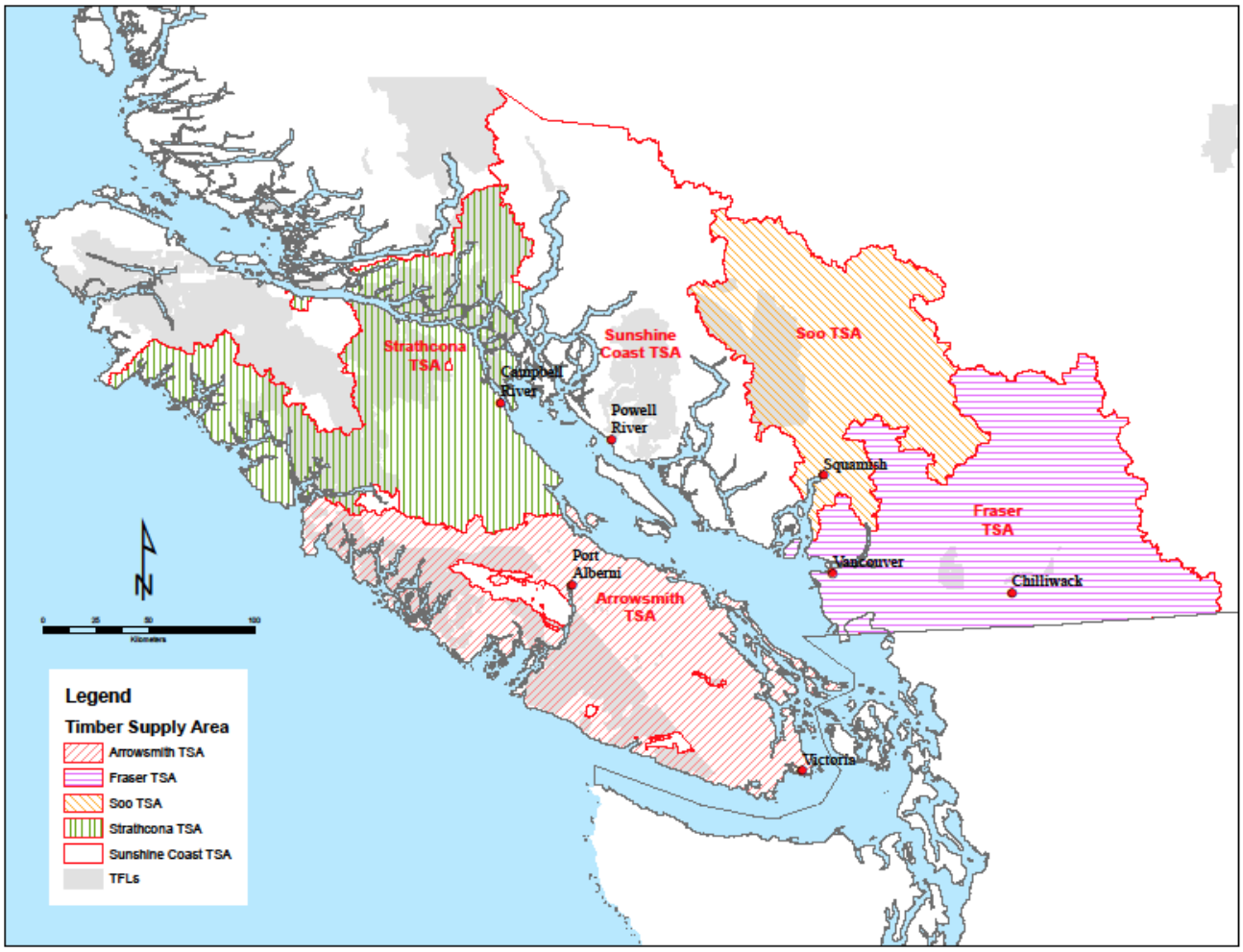


Figure 1. The five coastal timber supply areas.

BACKGROUND

How are minimum harvest criteria determined?

One of government's objectives is to maintain an economically valuable supply of timber from British Columbia's forests. Government determines the economic supply of timber through a timber supply review.[2] Under Section 8 of the *Forest Act* the chief forester must conduct a timber supply review for each timber supply area (TSA) at least once every 10 years.[3]

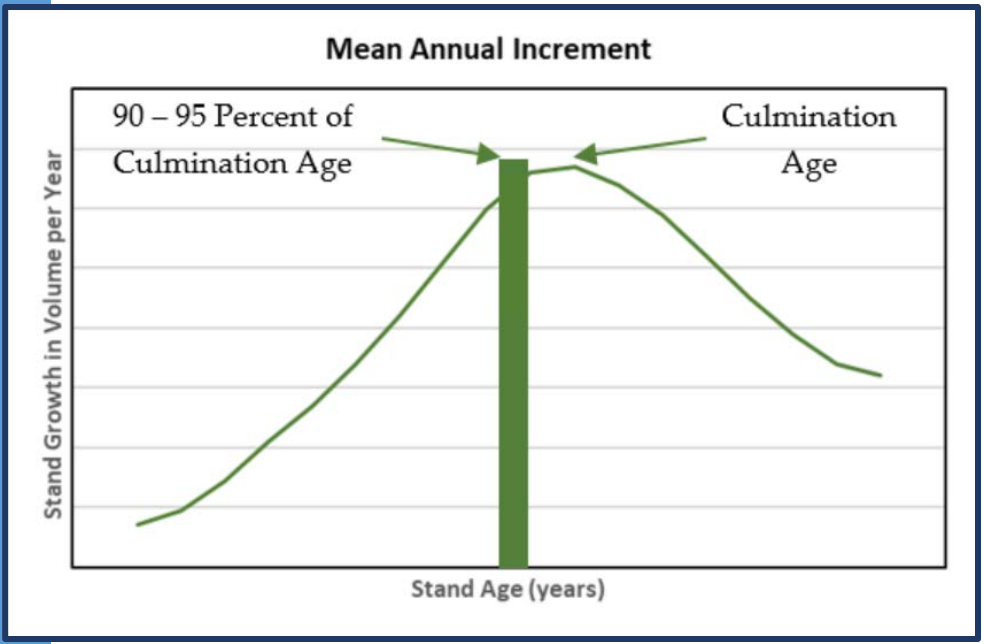
[2] https://www2.gov.bc.ca/assets/gov/farming-natural-resources-and-industry/forestry/stewardship/forest-analysis-inventory/tsr-annual-allowable-cut/tsr_backgrounder2.pdf

[3] The chief forester may also postpone a determination to a date that is up to 15 years after the last determination if the current timber supply is stable and any new developments would be unlikely to change the Allowable Annual Cut.

Minimum Harvest Criteria (MHC)

MHC are modelling assumptions that are designed to reflect the minimum development conditions that stands must meet in order to be eligible for harvesting in the timber supply model. The conditions are generally based on current practices observed in the TSA at the time of modelling. Criteria most often used include minimum age, volume of wood per hectare, or minimum tree diameter.

The chief forester determines the allowable annual cut within each TSA through a timber supply review, which includes a timber supply analysis. This analysis relies on growth and yield models to provide an estimate of the volume that can be sustainably harvested in the short, medium and long term. Each timber supply analysis establishes minimum harvest criteria (MHC); some established age MHC, and all established volume MHC (refer to Appendix 1).



The volume MHC is the volume assumed at the time of the timber supply review to be economical to harvest. The biological rotation or culmination age is the age when the mean annual increment[4] is maximized. The age MHC is the age when a forest polygon[5] reaches 90 to 95 percent of its culmination age. Harvesting all stands in a forest at this age results in a maximum harvest volume over the long term.

Why are young stands harvested?

Licensees and BCTS have the responsibility to select stands for harvesting. There is no legal obligation to follow the MHC assumptions in the timber supply analysis and there are no restrictions specific to harvesting below

[4] The stand volume divided by stand age or the average growth per year of a tree or stand of trees.

[5] A polygon is a defined mapped area with similar attributes such as species, height and volume. Several polygons usually make up a cutblock.

the MHC. Government cannot deny a cutting permit as long as statutory obligations are met, nor can it withhold the issuance of a cutting permit based only on the age or volume of the stand proposed for harvesting.

Stand attributes, such as the stand structural characteristics and species composition, and individual tree size are also important from a forest management perspective. These attributes determine whether a stand is suitable for harvesting or if it meets specific ecological or biological functionality. These attributes may be reached sooner than the model predicts, and therefore, some stands may be harvested earlier than the age MHC.

Foresters employed by licensees must consider social, biological, environmental and economic objectives when determining whether to harvest a stand. For example, socially, the optimum time to harvest the stand may be when the wood is required to sustain local mills and economies. Biologically, the optimal time to harvest the stand is when the mean annual increment is maximized. Environmentally, stand attributes required to address non-timber resource values, such as snow interception in an ungulate winter range, may determine when to harvest a stand. Economically, maximizing financial profitability dictates the optimum time to harvest the stand. Due to the different objectives that must be considered when determining when the stand is harvested, it is likely that some stands below the MHC will be harvested.

Foresters employed by licensees must consider social, biological, environmental and economic objectives when determining whether to harvest a stand.

The TSA itself may also be a factor. A TSA is a geographically-based administrative area with an allowable annual cut set by the chief forester. Government issues more than one forest tenure within each TSA, each with a portion of the allowable annual cut. District offices may assign operating areas to each tenure holder in order to streamline forestry planning and avoid conflicts between tenure holders. However, operating areas can be revised to address economic and timber imbalances between tenure holders, and operating areas are not legally binding. When several licensees operate in the same area, it is reasonable to expect that individually, each will be concerned with their own economic interests and, at times, there may be conflict with the forest management plans of other licensees. In some cases, a young stand deferred by one licensee may be a candidate for another licensee if harvesting the stand is economically viable and statutory obligations are met.

There are also some older stands in the timber harvesting land base that are not being harvested, even though they could be (e.g., stands with high development costs and low value, or situations where there may be pressure to conserve stands for ecological or social values). Timber supply analysis assumes all unconstrained timber in the timber harvesting land base contributes to the allowable annual cut, and will be harvested. Models

generally assume harvest of the older stands first, and these stands may have a higher volume associated with them than young stands. If older stands are not being harvested, then licensees need to look elsewhere for volume, some of which will come from younger stands.

APPROACH

Scope

This investigation considers harvesting between 2007 and 2014 on five coastal TSAs: Arrowsmith, Fraser, Soo, Strathcona and Sunshine Coast (Figure 1). The Board chose this period because it overlapped with the most current timber supply review period for each TSA used in this analysis, and the start and end years coincided with the spatial data used in the analysis. This period also coincided with a downturn in the BC forest sector. During this period, licensees were trying to minimize costs to remain economically viable. TFLs were not included in this report because their inventory data was not readily available.

Methodology

The investigation included interviews and field visits with licensees, district staff and branch staff involved in forest analysis, growth and yield, and resource management. The interviews and field visits were to inform them of the project and to obtain information and suggested direction from them regarding the project in general. Existing government policies, reports and other information for each TSA were reviewed to confirm the minimum harvest criteria for each TSA.

The Board identified cutblocks harvested from 2007 to 2014 using a combination of information from government databases. The consolidated cutblock layer for 2015, which combines openings from RESULTS,[6] vegetation resource inventory[7] (VRI) and satellite imagery, provided a comprehensive set of cutblocks that were harvested up to the end of 2014. In addition, the 2007 - 2014 period overlapped the most current timber supply review period for each TSA, and the start and end years coincided with the spatial data used in the analysis.

[6] The RESULTS (Reporting Silviculture Updates and Land status Tracking System) application tracks silviculture information by managing the submission of openings, disturbances, silviculture activities and obligation declarations as required by the *Forest and Range Practices Act* and regulations.

[7] The vegetation resources inventory identifies where the resource is located and how much of a given vegetation resource (for example, timber or coarse woody debris) is within an inventory unit.

The Board used two sources of data to evaluate the extent of harvesting below MHC, these being the VRI data and timber cruise data. The VRI is a strategic inventory of the province's vegetation, and is comprised of polygons that represent forest stand attributes. Aerial photographs are used to establish VRI polygons based on tone and texture observable from the aerial photograph. Base data for the polygon is established by estimating the species composition, height and volume of the stand in the polygon. There is very little ground sampling to confirm the estimates.

Consequently, actual stand attributes and ground conditions under the forest canopy in a polygon may vary. For example, a VRI polygon may include pockets of timber within the polygon that may have higher or lower volumes than the average of polygon as a whole. The VRI polygons and data are used strategically at a TSA level for timber supply analysis purposes, and not for operational planning. The overall accuracy of the VRI data improves as the polygons are aggregated at the TSA level. VRI is updated regularly by a computer model that projects the polygon attributes from the base data to the current year, thereby providing up-to-date attribute data. Analysis of the VRI data provided a coarse filter for areas harvested above and below MHC.

A sample of the areas identified through the VRI analysis as being below the MHC were then analyzed using cruise data. Cruise data are specific to each harvested area and are determined from detailed ground surveys completed prior to harvesting. Surveys for timber cruising have a much greater sampling intensity than for VRI polygons and provide more accurate estimates about the trees in a cutblock, especially volume. MHC was compared to cruise[8] data on 210 VRI polygons that were identified as being below the MHC.

Finally, RESULTS data were analyzed to determine the extent of harvesting of stands that had undergone stand-tending treatments. Stand tending is the process of modifying vegetation to improve the vigour and health of stands, which may improve commercial traits such as the volume, quality and value of the stand. These practices affect the incidence of competition-induced mortality, size and quality of individual trees, and stand species composition and volume. Some stand tending treatments may produce a merchantable crop of trees in a shorter time frame than if the stand was left to grow unmanaged, while other treatments, such as pruning, increase the economic value of individual trees.

[8] The objective of the timber cruise is to obtain an unbiased estimate of the volume and quality of timber on a cutting authority area to a specified confidence interval or sampling intensity. Data collected include species, diameter, age and height. https://www2.gov.bc.ca/gov/content/industry/forestry/competitive-forest-industry/timber-pricing/timber-cruising/timber-cruising-manual

DATA ANALYSIS & DISCUSSION

Harvesting above and below the MHC from 2007 to 2014 based on VRI data only

From 2007 to 2014, a total of 43 723 hectares in 3 258 cutblocks and 16 712 polygons was harvested in the 5 coastal TSAs. Of the area harvested, 24 percent, or 10 507 hectares in 5 716 polygons, did not meet the age or volume MHC. There is a lot of variation in the area harvested below MHC between TSAs. For example, the area harvested below the MHC ranged from 293 hectares for the Soo TSA to 5 341 hectares for the Fraser TSA (Table 1).

Table 1. Area (hectares) and Percent Harvested Above and Below MHC by TSA – 2014 - 2017

TSA	ABOVE AGE & VOLUME MHC		BELOW AGE ONLY MHC		BELOW VOLUME ONLY MHC		BELOW AGE & VOLUME MHC		TOTAL BELOW AGE &/OR VOLUME MHC		TOTAL
	Area (ha)	% of TSA	Area (ha)	% of TSA	Area (ha)	% of TSA	Area (ha)	% of TSA	Area (ha)	% of TSA	Area (ha)
Arrowsmith	2,798	77%	148	4%	472	13%	220	6%	840	23%	3,638
Fraser	9,838	65%	1,533	10%	1,551	10%	2,256	15%	5,340	35%	15,178
Soo	2,649	90%	N/A	N/A	293	10%	N/A	N/A	293	10%	2,942
Strathcona	10,089	76%	723	5%	922	7%	1,572	12%	3,217	24%	13,306
Sunshine Coast	7,842	91%	N/A	N/A	817	9%	N/A	N/A	817	9%	8,659
Total All TSAs	**33,216**	**76%**	**2,404**	**7%**	**4,055**	**9%**	**4,048**	**9%**	**10,507**	**24%**	**43,723**

The Board compared VRI ages to the age MHC for areas harvested in the Arrowsmith, Fraser and Strathcona TSAs, since these timber supply reviews specified age MHC.[9] Within these three TSAs, 32 057 hectares in 12 500 polygons were harvested between 2007 and 2014. VRI data shows that 84 percent of the area harvested was above the age MHC. Most of the area harvested below the age MHC was close to the age MHC. However, age and volume attributes in the VRI data are estimated to be within plus or minus 10 percent due to the variability within the polygon[10] (see red line on Figure 2). When ages less than 10 percent below the MHC are included, the area harvested above the age MHC increases to 89 percent.

[9] The Sunshine Coast and Soo TSAs do not use an Age MHC.

[10] Personal communication with Forest Analysis and Inventory Branch.

The Board then compared the VRI polygon volumes to the volume MHC for all five TSAs. Eighty-one percent of the area harvested was above the volume MHC. Similar to the age MHC, most of the area harvested below the volume MHC was close to the volume MHC. When volumes less than 10 percent below the MHC are included, the area harvested above the volume MHC increases to 85 percent (see red line on Figure 3).

About 24 percent of the area harvested is below the MHC based on the VRI data. However, there is variability in ages and volumes within a VRI polygon. When this variability is considered, there are not a lot of stands being harvested below the age or volume criteria, and those that are, are only slightly below the criteria.

...there are not a lot of stands being harvested below the age or volume criteria, and those that are, are only slightly below the criteria.

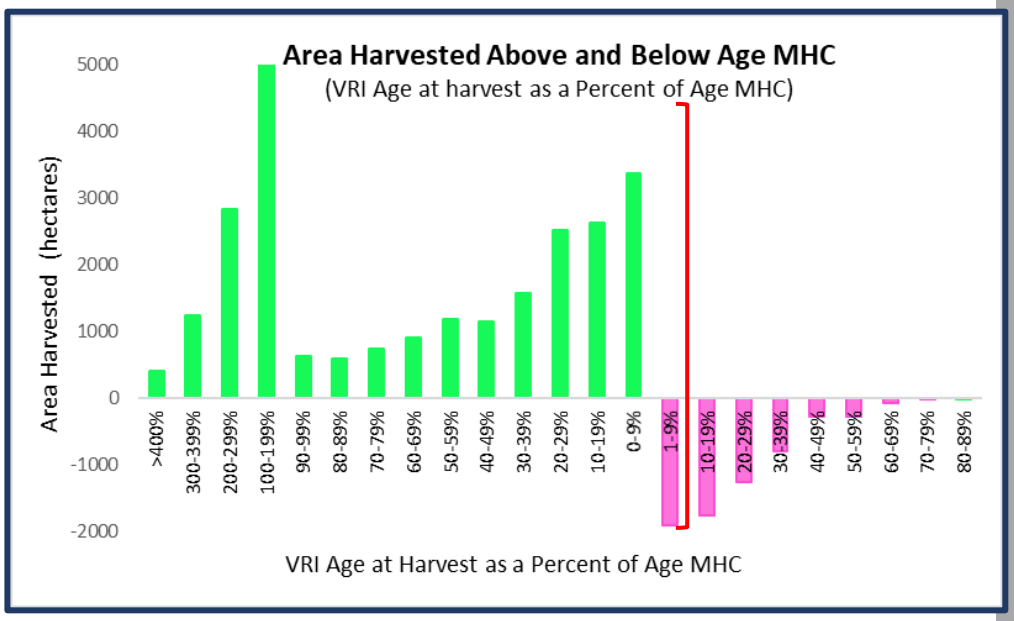


Figure 2. The graph shows the area harvested above and below AGE MHC using VRI data. Each bar represents the area harvested grouped by the age at harvest as a percent of the age MHC. The green bars are areas harvested that are above the age MHC and the pink bars are areas harvested below the age MHC. The areas to the left of the red line represent areas harvested above the age MHC accounting for the variability in the VRI data.

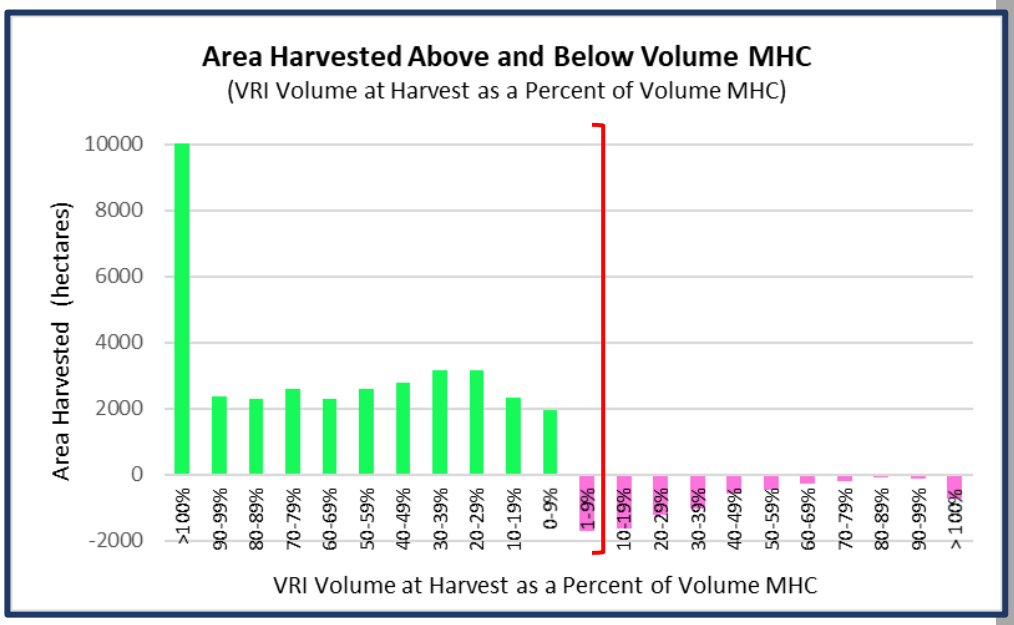


Figure 3. The graph shows the area harvested above and below VOLUME MHC using VRI data. Each bar represents the area harvested grouped by the volume per hectare at harvest as a percent of the volume MHC. The green bars are areas harvested that are above the volume MHC and the pink bars are areas harvested below the volume MHC. The areas to the left of the red line represent areas harvested above the volume MHC accounting for the variability in the VRI data.

MHC based on Cruise Data

The VRI uses growth and yield models to project initial VRI data to the stand condition at harvest, but are not considered an accurate representation of reality. The previous section identified the difficulty in determining if the findings based on VRI data are significant due to the variability within VRI polygons. Therefore, the Board compared the MHC with cruise data, which is an operational inventory and provides a more accurate estimate of stand volumes and, to a lesser extent, ages.

The population of stands used in the analysis of VRI data as being below the MHC was reduced by removing cutblocks where less than 25 percent of the cutblock was below MHC or where stand age was greater than 99 years. The Board determined that it would be difficult to compare VRI data with cruise data where less than 25 percent of the cutblock was below the MHC because the VRI polygons within the cutblock may be very small, and VRI polygons greater than 99 years were not considered young. The reduced population contained 568 cutblocks, which overlapped with 2 186 polygons below the MHC. The Board randomly selected 210 VRI polygons from this population to compare against cruise data. The Board recognizes this is a worst-case scenario since the Board only compared polygons identified in the VRI data as being below the MHC to cruise data.

Cruise ages are used primarily for appraisal purposes to establish the decay, waste and breakage[11] factors assigned to the stand. There are 3 critical ages for appraisal purposes; less than 80 years old; 80 to 120 years old; and greater than 120 years old. Although an age is required for each plot and should be reasonably accurate, the critical aspect of the age is which of the three categories the age falls into. For example, whether the age of the stand is 58, 62 or 70 is not as critical as the fact the age of the stand is less than 80 years old. Finally, cruise ages are for the age class that has 90 percent of the volume of the stand. Consequently, cruise age is a reasonable approximation of stand age, but is not accurate.

[11] "Decay, Waste and Breakage (DWB)" means factors to reduce the gross merchantable volume to a net merchantable volume and to approximate the volume depletion due to decay, firmwood waste and breakage due to harvesting. (BC Timber Cruising Manual.)

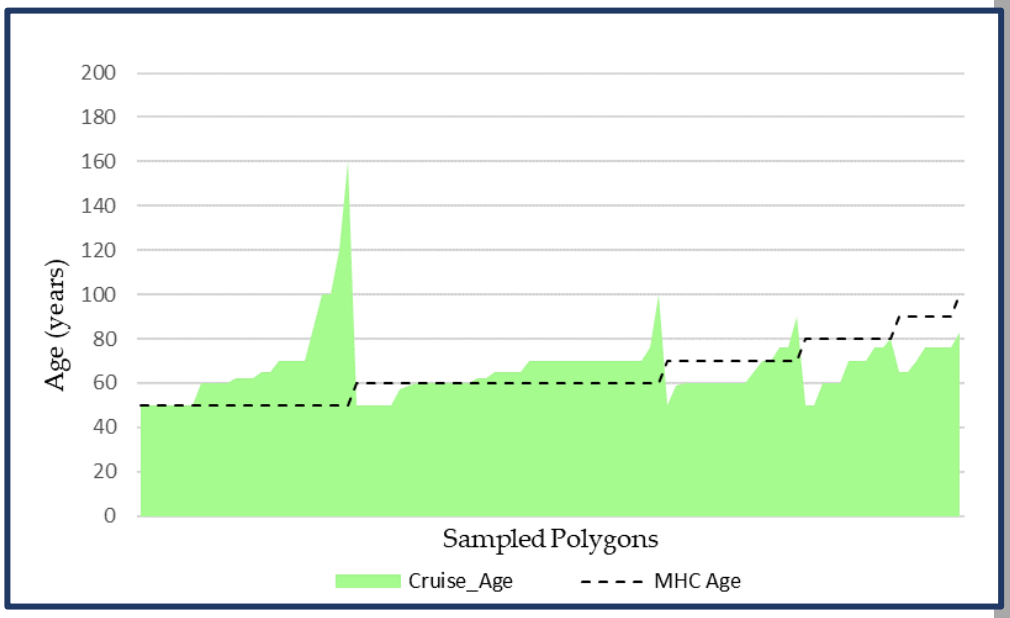


Figure 4. Comparison of AGES at harvest: MHC vs Cruise.

As the age MHC increases, the site index or site productivity decreases because it takes longer for the stand to grow to the volume MHC. This figure shows that most of the harvesting below the age MHC is from the lower productivity sites.

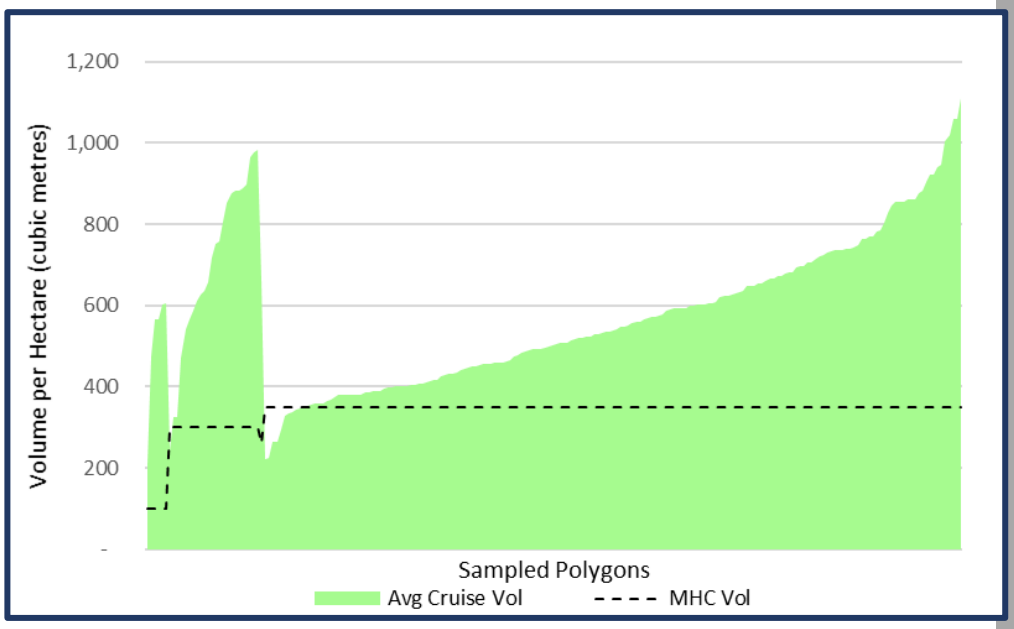


Figure 5. Comparison of VOLUMES at harvest: MHC vs Cruise.

Cruise volume is always greater than the volume MHC and the VRI volume. This figure shows that there is no strong correlation between VRI volume and cruise volume.

The Board also compared ages for 96 polygons in the Arrowsmith, Fraser and Strathcona TSAs where the VRI ages were below the age MHC. Cruise ages were higher than the age MHC on 62 percent of the polygons (Figure 4). Cruise ages averaged 3 years younger than the age MHC. Most of the harvesting below the age MHC is on low productivity sites.

Average cruise volumes were compared to the volume MHC. Cruise volumes were above the volume MHC on 97 percent of the area sampled (Figure 5). On average, cruise volumes were 75 percent or 247 cubic metres per hectare greater than the MHC.

The volume per hectare of the stands harvested contained higher volume than the volume MHC on 97% of the area harvested.

The Board found that the volume per hectare of the stands harvested contained higher volume than the volume MHC on 97 percent of the area harvested. The Board did not determine if the age at harvest is an issue due to the inaccuracy of the cruise ages.

The extent of harvesting stands that have had stand tending treatments.[12]

Part of the original complaint was also that some stands that had stand tending treatments applied were harvested before the benefits of the treatment were realized.

Foresters prescribe some stand tending treatments to mitigate timber supply deficits identified through growth and yield modelling, especially in the short term. Currently, fertilization and spacing are the most common strategies to increase stand volume and size of individual trees to address a potential short-term timber supply deficit. Fertilized stands should not be harvested within five years of treatment and harvesting spaced stands should be generally consistent with timber supply review assumptions. Pruning is done to increase the value of the individual tree by increasing the amount of clear wood.

However, the future value of a stand is difficult to forecast, and is largely determined by product supply and demand. For example, there is no certainty that the highest value of a pruned stand in the future will be due to the amount of clear wood for saw log or peeler log, or whether it will have higher value as a pulp log or a biofuel source. Regardless, government directly or indirectly funds these treatments, even though it has little control over when the treated stands are harvested.

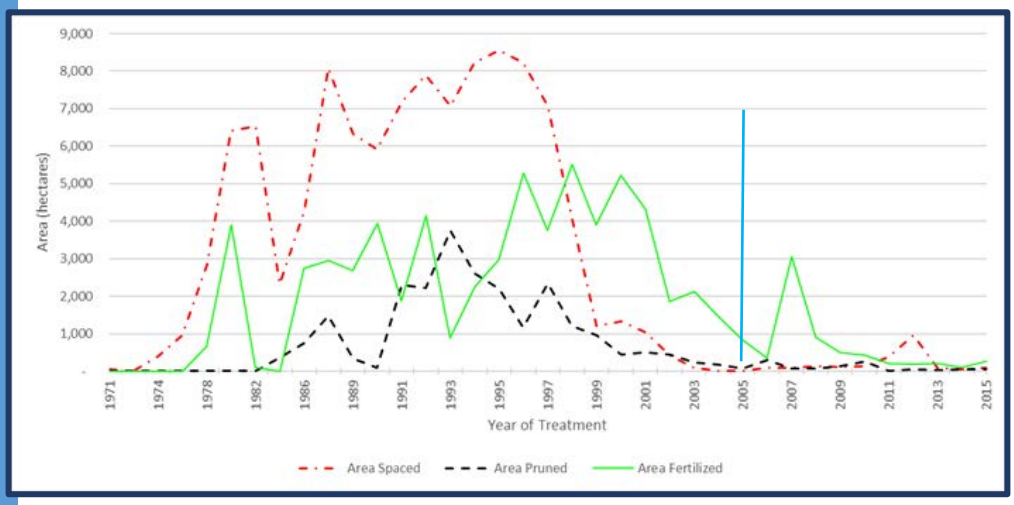


Figure 6. Silviculture Treatments on the Five Coastal TSAs 1971 – 2015.

Note – prior to 2005 (blue line on above graph) detailed spatial information was not linked to the RESULTS data. Consequently, there are instances where the entire cutblock shows as having been treated, when only a portion was.

[12] Stand tending treatments include juvenile spacing / thinning, pruning, fertilization, brushing, conifer release and sanitation cutting. In this special investigation only spacing, pruning and fertilization are considered stand treatment activities since the brushing and conifer release are silviculture activities associated with free to grow obligations.

Between 1971 and 2015 approximately 180 000 hectares in the five TSAs had one or more stand treatments applied. Silviculture treatments peaked in the late 1990s and have steadily declined since then (Figure 6).

From 2007 to 2014 about 20 percent or 8 740 hectares of the area harvested had one or more types of stand treatment (Table 2 & 3). Ninety-four percent of the spacing and 91 percent of the pruning occurred more than 10 years before harvesting.

Table 2. Number of Years After Stand Treatment that the Stand Was Harvested

HARVEST (Years After Treatment)	AREA (ha)			% OF TREATMENT AREA HARVESTED			% OF TOTAL AREA HARVESTED		
	Spaced	Fertilized	Pruned	Spaced	Fertilized	Pruned	Spaced	Fertilized	Pruned
<6	244		50	2.8%	0.0%	3.0%	0.6%	0.0%	0.1%
6-10	237	5	108	2.7%	21.7%	6.4%	0.5%	0.0%	0.2%
11-15	845	12	346	9.7%	52.2%	20.6%	1.9%	0.0%	0.8%
16-20	1,136	3	593	13.1%	13.0%	35.3%	2.6%	0.0%	1.4%
21-25	1,602	1	488	18.5%	4.3%	29.0%	3.7%	0.0%	1.1%
26-30	2,578	2	95	29.7%	8.7%	5.7%	5.9%	0.0%	0.2%
30+	2,025			23.4%	0.0%	0.0%	4.6%	0.0%	0.0%
Total Treatment	**8,667**	**23**	**1,680**				**19.8%**	**0.1%**	**3.8%**
Not Treated	**35,055**	**43,698**	**42,043**				**80.2%**	**99.9%**	**96.2%**

NOTE: Some areas had more than one stand treatment: 7126 hectares had 1 treament, 1602 hectares had 2 treatments, and 14 hectares had 3 treatments.

Table 3. Area and Percent Harvested by Stand Treatment – 2007- 2014

TSA	SPACED		PRUNED		FERTILIZED		TOTAL HARVEST
	ha	%	ha	%	ha	%	
Arrowsmith	1,042	29%	169	5%		0%	3,634
Fraser	3,434	23%	705	5%	17	0%	15,160
Soo	369	13%	117	4%		0%	2,938
Strathcona	2,879	22%	444	3%	5	0%	13,263
Sunshine Coast	943	11%	245	3%		0%	8,728
Grand Total	**8,667**	**20%**	**1,680**	**4%**	**23**	**0%**	**43,723**

NOTE: Of the area harvested, 1607 hectares were spaced and pruned.

CONCLUSIONS

Harvesting is not always consistent with timber supply analysis assumptions. VRI and cruise data both show that some stands below MHC are being harvested. The VRI data indicates that about 24 percent of the harvesting from 2007 to 2014 was below the MHC specified in the timber supply review for each TSA. However, VRI data is a strategic inventory and has limited value when analyzing whether the harvesting is consistent with timber supply review assumptions. Cruise data provides a more accurate estimate of how consistent harvesting is with timber supply analysis assumptions, especially volume MHC. Cruise data was used to assess the area identified through analysis of VRI data as being below the MHC.

Cruise data indicated that the volume per hectare of the stands at harvest exceeded the volume MHC on 97 percent of the area sampled (by an average of 75 percent greater than the volume MHC). Cruise ages were higher than the age MHC on 62 percent of the polygons, and most of the harvesting below the age MHC is on low productivity sites. The Board did not determine if the age at harvest is an issue due to the inaccuracy of the cruise ages. However, it is likely that some stands are harvested before culmination age, which may affect timber supply over the long term. Government will have to continue to monitor the trends and determine the impact of short and medium term timber supply during the timber supply review process.

There is no evidence to suggest that sound ecological principles are not being followed because some young stands are being harvested. Licensees determine when a stand will be harvested and must meet the same statutory obligations and address the risk of their operations to other resource values regardless of the age of the stand proposed for harvesting.

About 20 percent of the harvesting from 2007 to 2014 was from stands that had some type of silviculture stand treatment. The Board is concerned where harvesting of stands treated to mitigate timber supply deficits is not consistent with timber supply review assumptions. The Board did not identify the “best” time to harvest treated stands from a financial perspective, due to the complexities involved. However, harvesting stands treated to increase the value of individual stems before the value is realized may affect government’s future willingness to invest in these treatments, since the anticipated return may not be realized.

APPENDIX 1: Minimum Harvest Criteria by TSA

TSA	Age MHC	Volume MHC
Arrowsmith	The minimum harvestable age for stands in each analysis unit* is the age at which the stand is predicted to reach the minimum harvestable volume	Conventional Landbase ➢ 350 m3 per hectare. Helicopter Landbase ➢ 450 m3 per hectare.
Fraser	The minimum harvestable age for stands in each analysis unit will be defined as: a) the estimated age at which the stand is predicted to reach a required minimum volume; and b) the age at which the stand's mean annual increment (MAI) achieves a value of 95 percent of the maximum (culmination).	All Landbase ➢ 150 m3 per hectare for alder analysis units ➢ 300 m3 per hectare for pine/larch analysis units ➢ 350 m3 per hectare for all other analysis units
Soo	N/A The criteria used to define minimum harvestable ages for this analysis are a specified volume based on species and harvesting method	Conventional Landbase ➢ 350 m3 per hectare for all analysis units except pine. ➢ 300 m3 per hectare for pine analysis units Helicopter Landbase ➢ 400 m3 per hectare for all analysis untis except pine. ➢ 350 m3 per hectare for pine analysis units.
Strathcona	50 to 280 years depending on analysis unit.	All Landbase ➢ 350 m3 per hectare for all analysis units
Sunshine Coast	N/A The criteria used to define minimum harvestable age for each stand in this analysis is minimum volume per hectare determined by analysis unit.	All Landbase ➢ 250 m3 per hectare for alder and pine analysis units ➢ 300 m3 per hectare for all other analysis units

**There are many VRI polygons so it is not possible for the model to run projections for each polygon. Rather, the model amalgamates polygons into analysis units (AU) of similar attributes and models at the AU level.*

PO Box 9905 Stn Prov Govt
Victoria, BC V8X 9R1 Canada
Tel. 250.213.4700 | Fax 250.213.4725 | Toll Free 1.800.994.5899
For more information on the Board, please visit our website at: www.bcfpb.ca