Mid Coast Timber Supply Area
Timber Supply Review #3

Analysis Report

Version 2.1

May 10, 2010

Prepared For:

Mid Coast TSA Licensee/Agency Group:

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Mid Coast TSR3
Timber Supply Analysis Report

PROFESSIONAL FORESTER CERTIFICATION

This Report was prepared by:

An original, master hardcopy is signed, stamped and archived at the office of the Forest Analysis and Inventory Branch, Ministry of Forests and Range, Victoria, B.C.

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More Information on the Timber Supply Review Process

This document was prepared to support an allowable annual cut determination by British Columbia's Chief Forester. To learn more about this process please visit the following website:

http://www.for.gov.bc.ca/hts/

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Comments and Questions

Input from First Nations and public is an important part of the Timber Supply Review process and you are encouraged to review the information in this document and forward any comments to Cam Brown, RPF at Forsite in Salmon Arm by **May 18, 2010**.

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Additional copies of this document are available on the web at: http://www.forsite.ca/MidcoastTSR3/

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Executive Summary

This document contains a timber supply analysis specific to the Mid Coast Timber Supply Area (TSA). It is an important part of the provincial Timber Supply Review (TSR) process. The purpose of the review is to examine the short- and long-term effects of current forest management practices on the availability of timber for harvesting in the TSA. A review of this type is completed at least once every ten years in order to capture changes in data, practices, policy, or legislation influencing forest management in the TSA.

The previous Timber Supply Review (TSR2) was completed in June 1999 with a final Annual Allowable Cut (AAC) determination on June 1, 2000 establishing an AAC of 998,000 m^3/yr. In July of 2002 and September 2006, the Chief Forester set out orders that decreased the AAC because of new Designated Areas (conservancy and biodiversity areas). The AAC has been set at 768,000 m^3/yr since September 2006.

The current Mid Coast TSA Timber Supply Data Package provides the detailed technical information and assumptions regarding current forest management practices, policy, and legislation which were used in this analysis. Based on the details in the Data Package, the TSA covers approximately 2.7 million hectares (1.03 million forested hectares) on the coast of British Columbia. The portion of this area considered available for timber production and harvesting under current management practices is called the timber harvesting land base (THLB). The THLB has been estimated through the analysis of spatial map layers and assumptions detailed in the Data Package report. Based on these inputs, the current THLB is estimated to be 123,162 hectares (12% of the TSA).

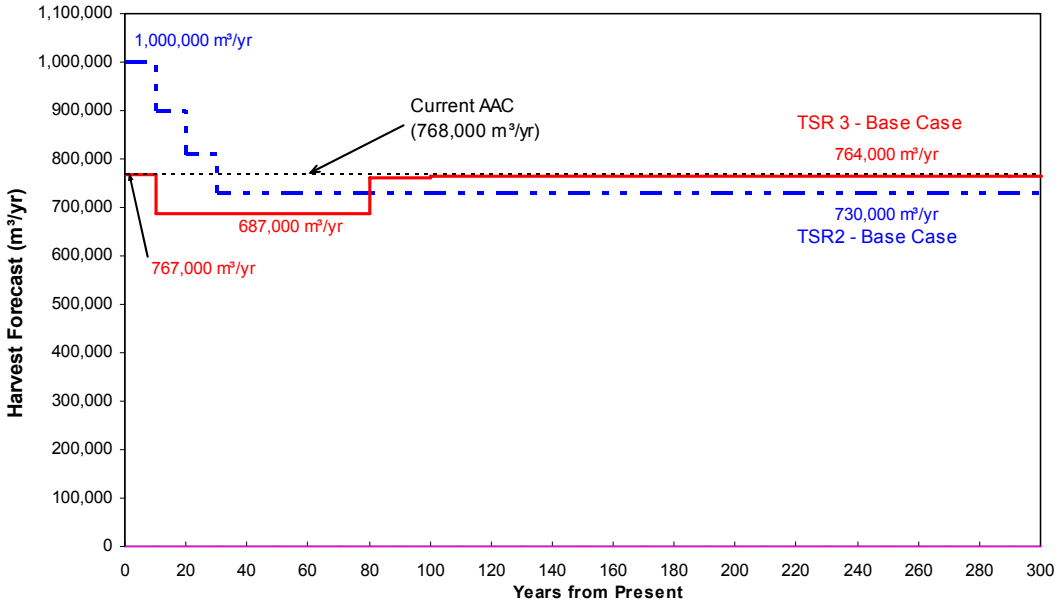
The release of this Analysis Report is the next step in the Mid Coast TSR3 process. Its purpose is to summarize the results of the timber supply analysis and provide a focus for public discussion. The contents of this Analysis Report will provide British Columbia's Chief Forester with a large portion of the information that is needed to make an informed AAC determination.

This report focuses on the Base Case scenario, which represents current management practices in the Mid Coast TSA. **The TSR3 Base Case harvest flow shows an initial harvest level slightly below that of the current AAC for 10 years (767,000 m^3/yr) before declining to an average of 687,000 m^3/yr for the next 70 years and then rising to a long term harvest level 1% lower than the current AAC (764,000 m^3/yr).** The short term harvest level is able to remain very close to the current AAC even with the implementation of EBM because of the upward pressure from the revised operable landbase, increased contributions from outer coast and helicopter harvest stands, adjusted site indices, and recognition of volume gains from select seed.

The short and mid term harvest levels in the TSR3 base case are heavily influenced by a pinch point that exists 55-65 years into the future. This is the point where natural stands are no longer dominating the harvest and managed stands are just beginning to come online in a substantial way. It should also be noted that short-mid term harvest forecast is dependant on 20% poor-low hembal volume, 30-35% helicopter harvest volume, and 14-18% outer coast volume. Note that a single stand can fit into all three of these profiles so the percentages can overlap.

The base case flow is substantially different from TSR2 results (figure below) because of changes in assumptions and data used. For example, large areas of new parks and conservancies have been established, two Community Forests have been established, Ecosystem Based Management objectives have been implemented, and new wildlife management strategies are in place. These combine to significantly reduce the short term harvest from that published in TSR2 (998,000 m^3/yr). The TSR3 long term harvest flow is just above the TSR2 projection, even with a substantially reduced landbase, because of the much higher yields projected from managed stands (site index adjustments, use of select seed).

TSR2 vs TSR3 Base Case Harvest Projections



Sensitivity analyses revealed that the short term harvest level is highly dependant on the amount of existing natural stand volume and on achieving merchantable managed stand volumes in a timely manner. Any factors that could delay managed stands from becoming eligible for harvest or any reduction in the amount of natural stand volume on the land base will impact short term harvest levels.

The Pre EBM scenarios revealed that the implementation of the EBM Land Use Orders alone results in a 5-13% timber supply impact in the short term (13% in the long term). When EBM is combined with the parks and conservancies that have been created since 2004, the total impact is a 28-41% timber supply impact in the short to midterm and a 52% impact in the long term.

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1.0 Introduction

Timber supply is the amount of timber that is available for harvest over time. Assessing timber supply involves consideration of a wide range of physical, biological, social, and economic factors that can influence the acceptable rate of timber harvesting within a management unit. These factors encompass both the timber and non-timber values found in our forests and ensure that timber harvesting objectives are balanced against social and ecological values such as wildlife, biodiversity, watershed health, recreational opportunities, etc.

This document contains a timber supply analysis specific to the Mid Coast Timber Supply Area (TSA 19). The general objective of the analysis is to examine the short and long term effects of current forest management practices on the availability of timber for harvesting in the TSA. A review of the projected timber supply is typically completed once every five to ten years in order to capture changes in data, practices, policy, or legislation influencing forest management in the TSA. The previous Timber Supply Review (TSR2) was completed in June 1999 with a final Annual Allowable Cut (AAC) determination on June 1, 2000 establishing an AAC of 998,000m^3/yr. In July of 2002 and September 2006, the Chief Forester set out orders that decreased the AAC because of new designated areas (conservancy and biodiversity areas). The AAC has been set at 768,000m^3/yr since September 2006. The current TSR process will work towards having all work completed by May 15, 2010 so that a new AAC determination can be in place by June 2010.

The Mid Coast TSR3 Data Package, a document providing detailed technical information and assumptions regarding current forest management practices, policy and legislation for use in this analysis, was released on October 20, 2009 and was accepted by the Forest Analysis and Inventory Branch on November 5, 2009. The release of this Analysis Report is the next step in the timber supply analysis process. Its purpose is to summarize the results of the timber supply analysis, provide a focus for public discussion, and provide British Columbia's Chief Forester with much of the information that is needed to make an informed AAC determination. **This report does not define a new AAC – it is intended only to provide insight into the likely future timber supply of the TSA.** The final harvest level will be determined by the Chief Forester and published along with his rationale in an AAC Determination document.

This report focuses on a forest management scenario that reflects current management practices in the TSA. The "Base Case Scenario" becomes the basis for sensitivity analyses that assessed how results might be affected by uncertainties in data or assumptions. Together these analyses form a solid foundation for discussions with the government and stakeholders in the determination of an appropriate timber harvesting level.

2.0 Description of Mid Coast TSA

2.1 Location

The Mid Coast TSA is located on the central coast of British Columbia and covers approximately 2.7 million ha. The Mid Coast TSA is administered by the North Island – Central Coast Forest District and extends from Cape Caution in the south to Sheep Passage in the north and is bordered by the Pacific Ocean to the west and Tweedsmuir Park to the East (Figure 1). The northern boundary is made up of Tree Farm License (TFL) 25, the Fiordland Recreation Area, and the Kitlope Heritage Conservancy Protected Area.

The Mid Coast TSA exhibits high levels of diversity in landscape, wildlife, and culture. Diverse populations of both marine and terrestrial wildlife exist in the TSA. The TSA's forests are also culturally rich and diverse. Archaeological work has yielded evidence of some of the oldest First Nation's habitations on the BC coast.

The Mid Coast TSA is remote and sparsely populated, with the majority of the population living in the Bella Coola valley. Other populated areas include small isolated communities along the outer coast.

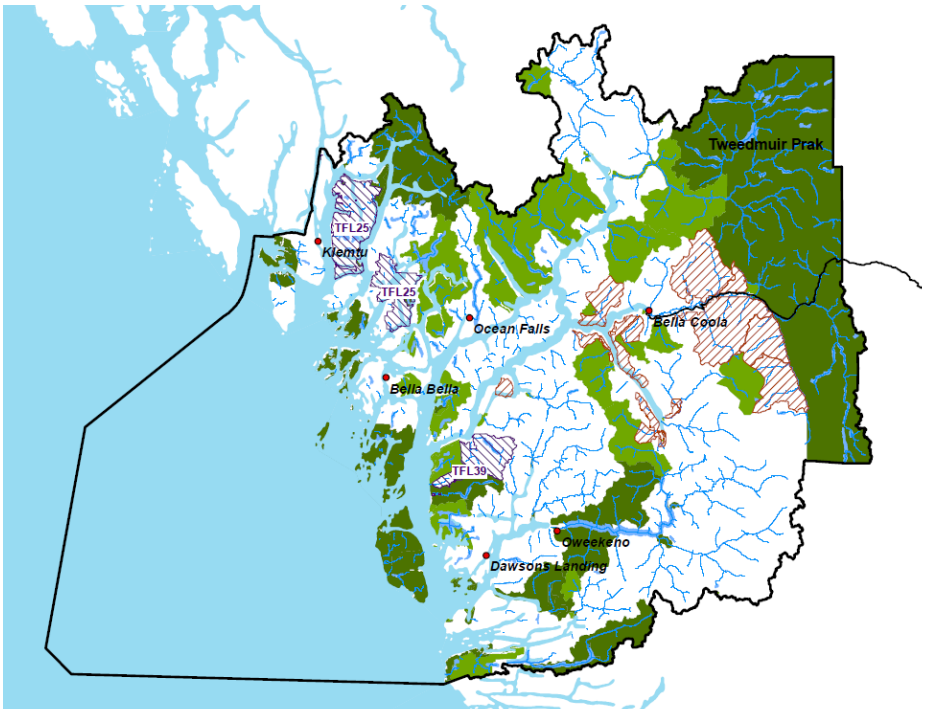


Figure 1. Mid Coast TSA Landbase Overview Map (note: portions of the TFL's are now in the Pacific TSA)

The terrain is rugged and variable including low lying islands, outlying coastal mainland areas, inland mountainous regions, high elevation non-forested areas, and productive valley bottom steep sided inlets. The forests of the Mid Coast are dominated by four main biogeoclimatic zones as illustrated in Figure 2 below and include Coastal Western Hemlock (CWH), Mountain Hemlock (MH), Engelmann Spruce Subalpine Fir (ESSF), and alpine (CMA). Other zones such as IDF, MS, SBPS, and SBS exist in the transition zone to the interior ecosystems that is contained entirely within Tweedsmuir Park.

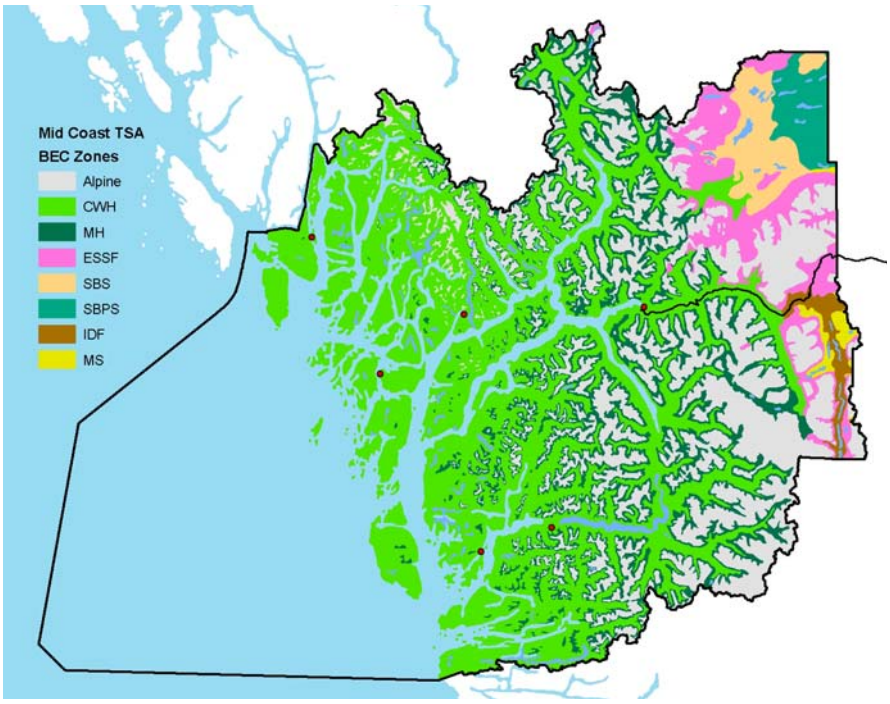


Figure 2. BEC Zones present in Mid Coast TSA

Only a small portion of the total TSA area is forested (38%) and an even smaller portion is suitable for timber harvesting (12%). Most harvesting is confined to valley bottoms and sidewalls. Most of the remaining areas are either protected areas or "high country" areas too rugged to support marketable timber.

The ruggedness has minimized human use; hence there are few settlements and little private land (9,305 ha). There is only one highway (Hwy 20) on the east side that connect Bella Coola to the BC Interior. The rest of the TSA is only accessed using marine routes.

2.2 Wildlife

The Mid Coast TSA exhibits high levels of diversity in wildlife. Grizzly bears, black tailed deer, mountain goat, sandhill crane, marbled murrelet, tailed frog, and goshawk are some of the most important species found in the area. These species have become a very important management issue and they are an integrated component of the current analysis.

The Province has identified a number of wildlife species that might be at risk due to declining populations across the province that occur or have the potential to occur in the TSA. There are several red-listed species (Endangered or Threatened) and blue-listed species (Species of Concern) including vertebrate animals and vascular plants (Appendix 2 – Red and Blue listed species that occur or have the potential to occur in Mid Coast TSA.

2.3 First Nations

The following First Nations have traditional territory within the Midcoast timber supply area.

Gwa'Sala-Nakwaxda'xw First Nation

The Gwa'Sala-Nakwaxda'xw Nation (GNN) traditional territory straddles the southern boundary of the Mid Coast Timber Supply Area and includes the watersheds draining into Smith Inlet. The GNN people primarily live on North Vancouver Island on the Tsulquate reserve at Port Hardy. The current population of the Nation is 692 people (www.aboriginalcanada.gc.ca). The GNN have a Forest Agreement with the Province which provides rights to harvest 188,000 m^3 over a five year period from the Kingcome TSA. This agreement expires in 2010.

Heiltsuk First Nation

The Heiltsuk Nation is based at Bella Bella on Campbell Island. With a current population of 2,017 (www.aboriginalcanada.gc.ca) the Heiltsuk is the largest First Nation in the Mid Coast. Similarly, their territory is expansive reaching from the Dean River in the north-east to Rivers Inlet in the south and Fraser Reach in the north-west. The Heiltsuk are very active in forestry and their Forest Agreement, which is due to expire in 2010, accesses a total of 485,000 m^3. Of this volume, 100,000 m^3 would be sourced from block 7 of TFL #39 (now Pacific TSA).

Kitasoo-Xai'xais First Nation

The village of Klemtu on Swindle Island is the home to the Kitasoo-Xai'xais First Nation. The current Kitasoo population is 483 people (www.aboriginalcanada.gc.ca). Similar to the Heiltsuk, the Kitasoo's Forest Agreement is due to expire in 2010. Their Forest Agreement was for a total of 115,000 m^3, of which 40,000 m^3 was available from TFL #25.

Nuxalk First Nation

The Nuxalk Nation is based in Bella Coola and their ancestral territory spans the inner coast and includes the watersheds draining into Burke and Dean Channels and North and South Bentinck Arms. Their population is 1,315 (www.aboriginalcanada.gc.ca) and they recently started forestry operations on their Probationary Community Forest Agreement (PCFA) licence. In 2007, the Nuxalk signed a Forest Agreement with the Province which provides harvesting rights to 311,000 m^3 over a five year period in the Mid Coast TSA.

Ulkatcho First Nation

The Ulkatcho Nation is based at Anahim Lake. Despite much of their traditional territory being located outside of the North Island – Central Coast Forest District, a portion of it does overlap with the Mid Coast TSA. The majority of this overlap is located in the Kimsquit area - which is to the east and north of the head of the Dean Channel. The Ulkatcho population is 927 (www.aboriginalcanada.gc.ca) and they have a Forest Agreement to harvest 232,000 m^3 in the Williams Lake TSA over a 5 year period that began in 2006.

Wuikinuxv Nation

The Wuikinuxv Nation territory encompasses the central part of the Mid Coast TSA and includes the watersheds draining into Oweekeno Lake and Rivers Inlet and the associated outer islands. Most of the 250 band members live outside the territory while approximately 50 people (www.aboriginalcanada.gc.ca) live in Wuikinuxv village at the head of Rivers Inlet. The Wuikinuxv have been actively harvesting timber since the 1990's in a variety of joint venture arrangements and through the opportunities created by their Forest Agreement. This agreement is due to expire in 2010. The Forest Agreement provides them with a total of 60,000 m^3 over a five year period from the Mid Coast TSA. The Wuikinuxv Nation also has an Interim Measures Agreement with the Province that provides them an additional 200,000 m^3 from the Mid Coast TSA over a five year period.

2.4 The Environment

The TSA contains seven biogeoclimatic zones: Coastal Western Hemlock (CWH), Engelmann Spruce - Subalpine Fir (ESSF), Interior Douglas-Fir (IDF), Mountain Hemlock (MH), Montane Spruce (MS), Sub-Boreal Pine – Spruce (SBPS), and Sub-Boreal Spruce (SBS). The majority of the TSA's timber harvesting occurs in the CWH with the following variant level distribution: CWH vh2 (31%), CWH vm1 (30%), CWH ms2 (16%), CWH ws2 (9%), and CWH vm2 (7%). Most of the THLB (75%) occurs in the Natural Disturbance Type 1 (NDT1) and the rest in NDT2 (Figure 3) although this classification was replaced by the Range of Natural variation (RONV) concepts developed as part of the coastal Ecosystem Based Management (EBM) process. This is discussed in more detail in 3.4.2 and in Appendix 3 – Data Inputs and Modeling Assumptions.

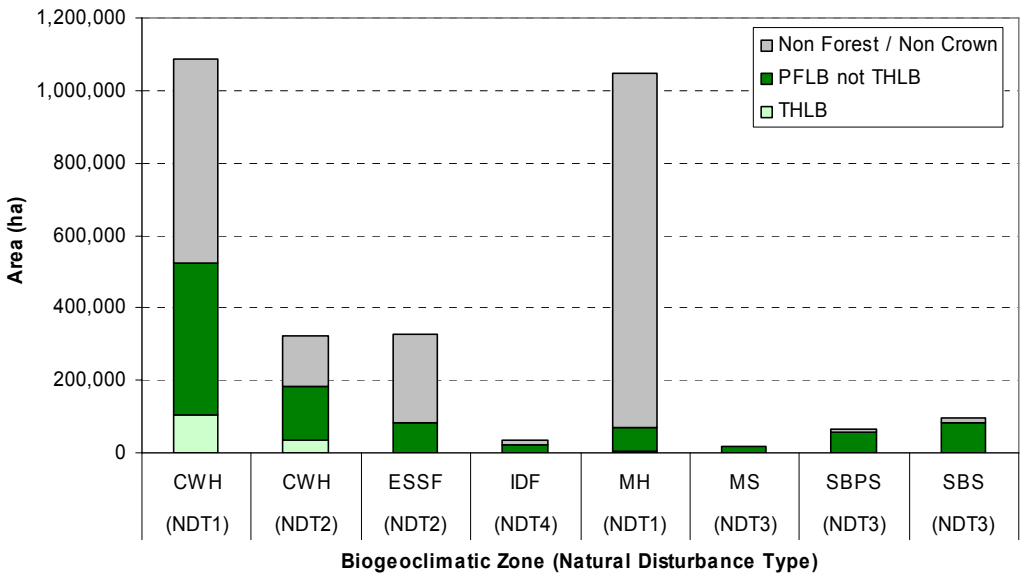


Figure 3. Biogeoclimatic Zone and Natural Disturbance Type by landbase classification

2.5 Integrated Resource Management Considerations

Integrated resource management is a basic premise for the practice of forestry in the TSA. Timber harvesting is planned and managed in such a way that allows a wide range of other values to co-exist on the landbase. The manner in which each value is considered is dictated by federal or provincial legislation or BC Government policy. Much of this direction for the Mid Coast TSA comes from the recent Land Use Orders (EBM Orders) that became legal in March of 2009, and from the Forest and Range Practices Act (FRPA) and its regulations.

These documents address the legislated requirements for a wide range of non-timber issues. The most significant issues influencing forest management in the Mid Coast TSA are:

- Biodiversity (old forests and forest structure)
- Water and Fisheries issues (Riparian / Fish Habitat / Watershed Health)
- Rare and Endangered Species Habitats
- Wildlife Habitat (Grizzly Bear, Black Tailed Deer, Mountain Goat)
- First Nation Values (cultural and traditional uses of the forest)
- Visually Sensitive Areas
- Recreation Values

The areas affected by these non-timber resource values and the specific forest management practices required to address them are discussed in Section 3.3.1 and in Appendix 3 – Data Inputs and Modeling Assumptions.

2.6 Current Attributes of Mid Coast TSA

This section of the document describes the current state of the TSA and provides descriptions and statistics useful for understanding the timber supply analyses presented later in the document. The Timber Harvesting Land Base (THLB) and the Productive Forest Land Base (PFLB) are referenced in this section and defined in detail in Section 3.1.

Approximately 34% of the total area of the TSA is considered productive forest land (Figure 5). The remaining area is made up of non productive land (56%) such as rock and ice, and 10% non TSA land (e.g. private, Indian Reserve, TFL's, Community Forests, unreverted Timber License's, etc.). Within the TSA's productive forest land base, 48% of currently in parks and protected areas, while only 12% (4% of the total TSA area) is considered available for timber harvesting (Figure 4). A detailed area summary of the landbase can be found in Table 1 in section 3.1. A coarse map illustrating the locations of PFLB and THLB in the TSA is shown in Figure 5.

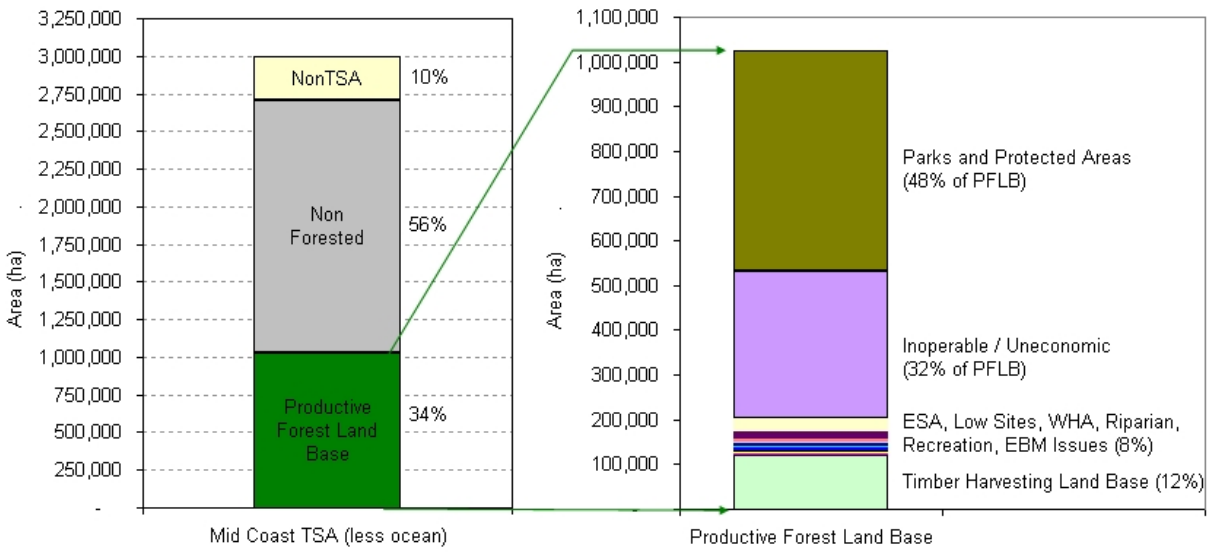


Figure 4. TSA Land base Breakdown

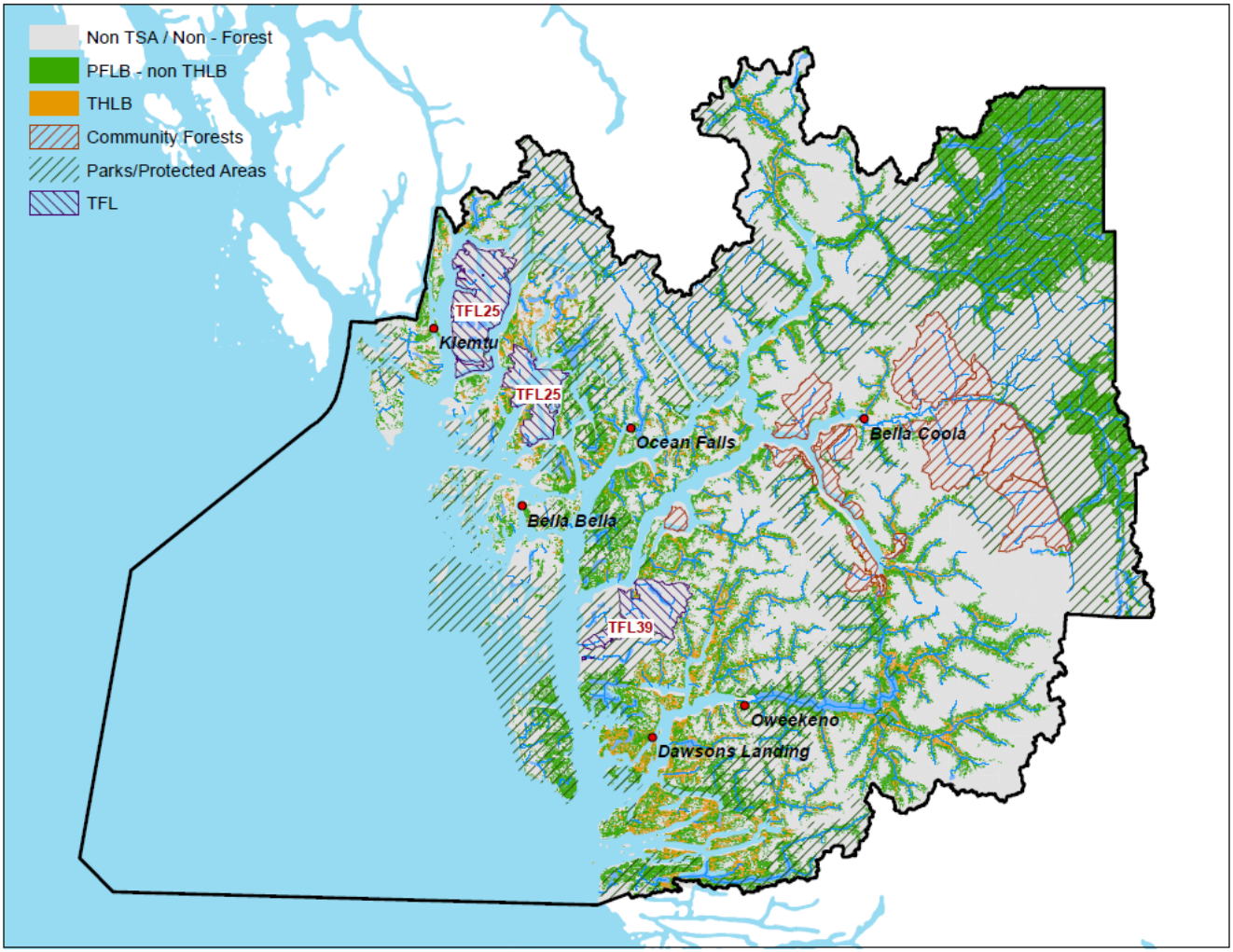
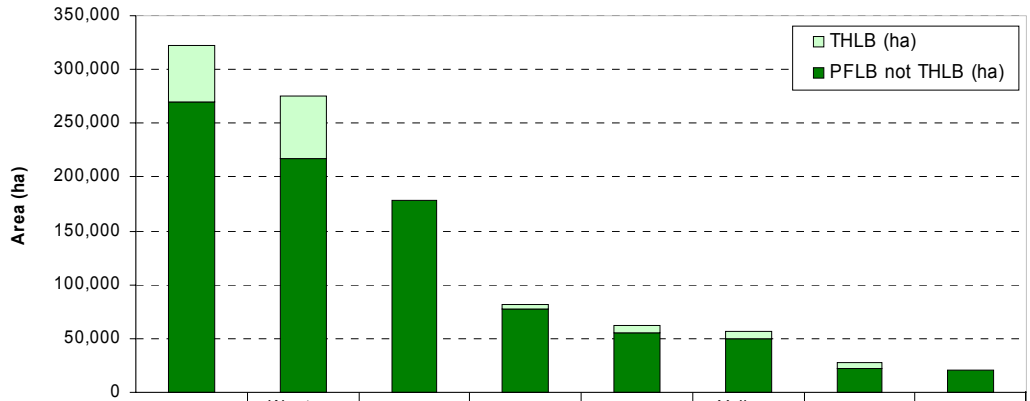


Figure 5. Mid Coast TSA Land Base Classification Map (note: portions of the TFL's are now in the Pacific TSA)



	Hemlock	Western redcedar	Pine	Spruce	Balsam	Yellow-cedar	Douglas-fir	Deciduous	Total
THLB (ha)	53,141	59,077	0	4,017	6,664	6,584	5,859	0	135,343
PFLB not THLB (ha)	269,789	216,667	178,073	78,021	55,040	49,644	22,174	21,082	890,489

Leading Species

Figure 6. Mid Coast TSA area by leading species and land base classification (Spatial THLB)

The forests of the TSA are dominated by hemlock and red cedar leading stands, followed by pine, spruce, balsam, yellow-cedar, Douglas-fir, and deciduous leading stands. An overview of the area by leading species for the TSA in 2009 is provided in Figure 6.

The age class structure over the entire productive land base is shown in Figure 7. The x-axis shows the upper limit of the age class (e.g. 20 summarizes ages between 11 and 20 inclusive). The PFLB area is distributed across a wide range of age classes, but the subset of the landbase where forestry is practiced (THLB) tends to have areas clumped into young (0-50 years) or old (>300 year) stands. The PFLB has a wider range of age classes because the diversity of ecosystems within Tweedsmuir Park contains stands which are naturally disturbed more frequently than the coastal CWH/MH ecosystems that make up the THLB.

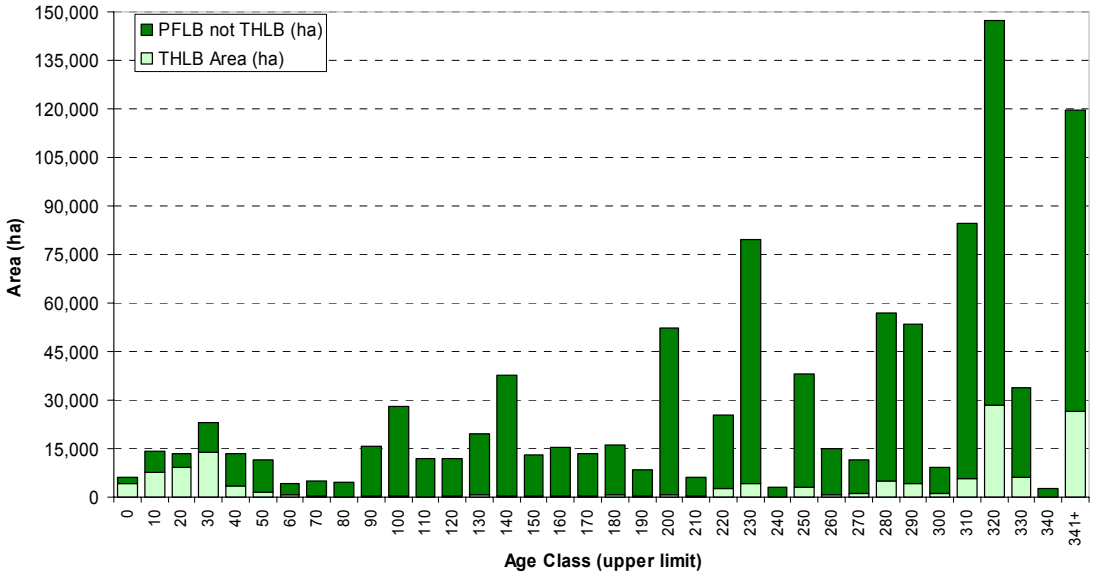


Figure 7. Mid Coast TSA age class distribution in 2009 (Spatial THLB).

The THLB area is broken down by species and age in Figure 8. It shows that stands established 20-40 years ago were dominantly hemlock leading, while more recent stands have a larger component of cedar.

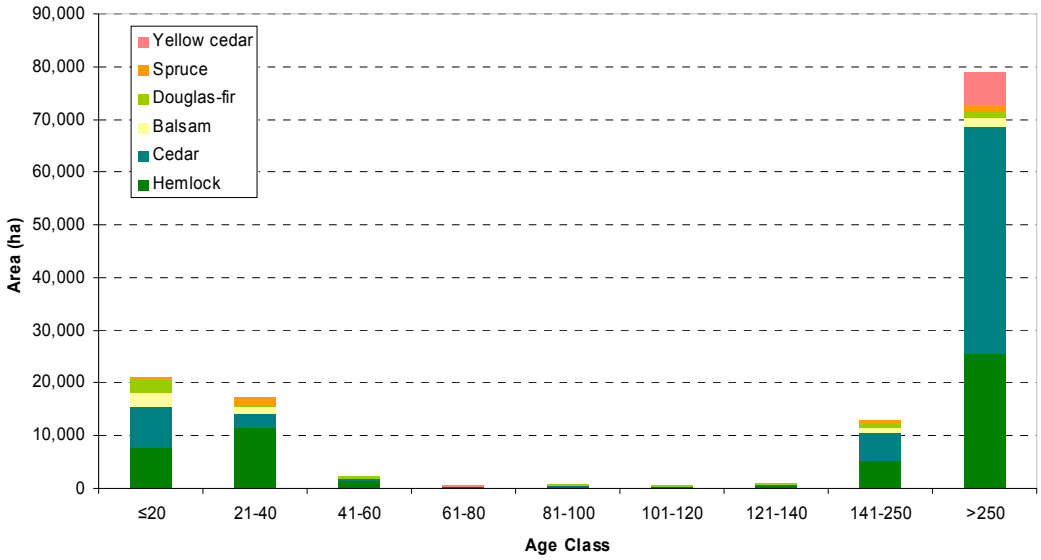


Figure 8. Spatial THLB area by age class and leading species

Figure 9 shows the THLB area by leading species relative to the minimum harvest age (MHA). Due to the high concentration of old seral stands, 68% of the area is above the minimum harvest age (i.e. eligible for harvest). Western red cedar and yellow cedar leading stands have the highest proportion of area older than the MHA, with 80% and 97%, respectively. Hemlock leading stands have only 60% of their area older than their MHA, indicating that hemlock leading stands make up a higher proportion of regenerating stands.

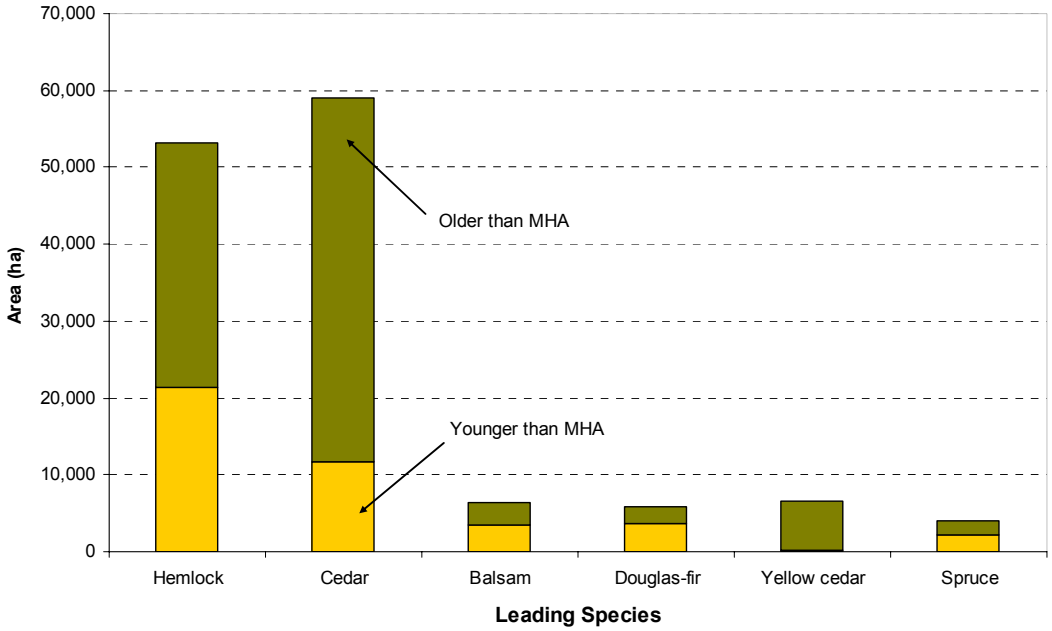


Figure 9. Spatial THLB area by leading species relative to the minimum harvest age (MHA)

Growth and yield practitioners in BC generally agree that site index estimates from photo-interpreted height and age of old natural stands under-estimate the height growth observed in post-harvest regenerated stands growing on the same sites. Thus, the inventory site index distribution shown in Figure 10 was adjusted in a Site Index Adjustment project (SIA) done by Timberline Natural Resource Group and is shown in Figure 11. Overall, the weighted average inventory site index on the THLB is 17.2m. This increases by

5.3m to 22.5m when adjusted SI's are used for managed stands (note: adjustments only applied to cedar and hemlock leading stands). This adjusted SI is only relevant once all stands have transitioned to managed stand yield curves post harvesting.

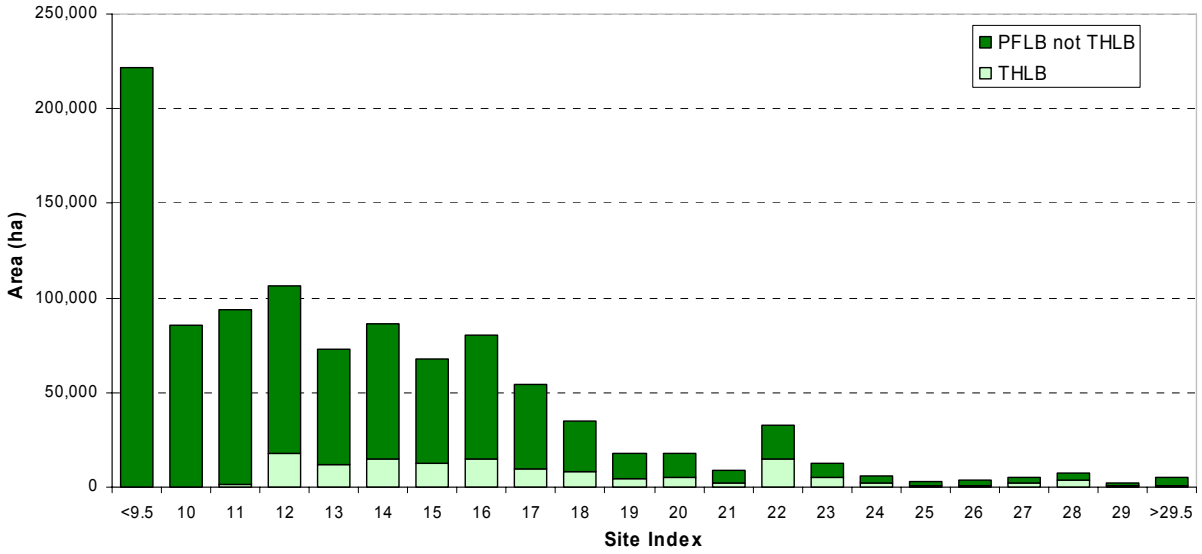


Figure 10. Site index distribution (inventory) for the Mid Coast TSA (Spatial THLB)

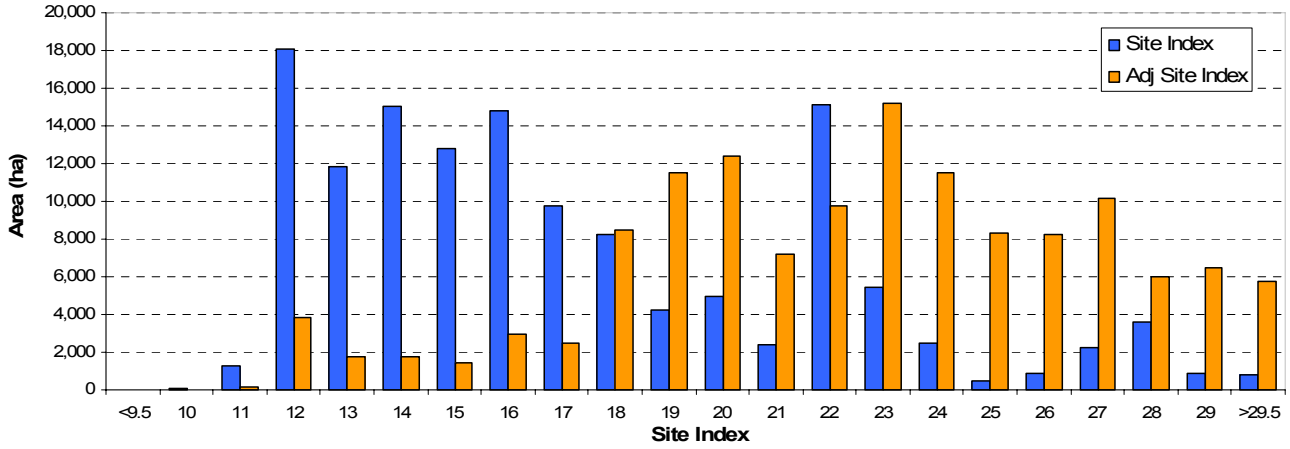


Figure 11. Inventory and adjusted site index distributions for the Mid Coast Spatial THLB

3.0 Timber Supply Analysis Methods

A large amount of information is required to complete a timber supply analysis. Information must be obtained in four broad categories: land base, forest inventory, management practices, and forest dynamics. This information is then translated into a model formulation that can explore sustainable rates of harvest in the context of integrated resource management. This section provides a brief summary of the data inputs, assumptions, and modeling procedures fully described in Appendix 3.

3.1 Land Base Definition

The Productive Forest Land Base (PFLB) is the subset of the TSA that is considered forested and able to contribute towards non timber values such as forest based biodiversity. The non forested portion of the landbase also supports a wide variety important ecosystems and values but is not discussed here because it is not impacted by forestry practices. The PFLB excludes non-crown land, tree farm license areas, community forests, First Nation Reserves, non-forest / non-productive areas, etc. Any Timber Licenses that have not yet been harvested are excluded from the TSA until they are harvested or the license expires. The areas that were formerly TFL39 Block 7 and the Yeo Island portion of TFL 25 Block 5 are now within the Pacific TSA[1].

The Timber Harvesting Land Base (THLB) is the subset of the TSA's land base where timber harvesting is expected to occur in the future[2]. The THLB modeled here is only an estimate of the actual THLB that will be established in the field. It excludes areas that are inoperable or uneconomic for timber harvesting and areas that are reserved for non-timber values. The THLB is entirely contained within the PFLB. Table 1 summarizes the land base for Mid Coast TSA.

[1] Source: http://www.for.gov.bc.ca/hth/timten/pacific-tsa.htm.

[2] The THLB used in this analysis excludes 10,499 ha of previously harvested area (presently young and mid seral) that did not appear to meet economic harvest criteria but only 7,875 ha were outside of other netdowns. Thus, only 83% of previously logged areas in the TSA were considered operable in the future. The inclusion of this area is explored in a sensitivity analysis later in this document because it is uncertain whether these stands should be included/excluded.

Table 1. Land base area netdown summary

Land Base Element	Base Case			
	Total Area (ha)	**Effective* Area (ha)**	**% Total**	**% PFLB**
Total area (Mid Coast TSA Bdy – less ocean)	**2,994,120**	**2,994,120**		
Less:				
Private Land, Indian Reserves	14,365	14,365		
TFL's, CFA's, Misc Leases, Etc	263,393	263,393		
Timber License's (unreverted)**	5,279	5,279		
Total TSA Area	**2,711,083**	**2,711,083**	100.0%	
Non forest / Non-productive forest	1,681,250	1,681,250	61.6%	
Non-Commercial Brush	480	480	0.4%	
Existing Roads, Trails and Landings	4,937	3,521	0.1%	
Total Productive Forest Land Base* (PFLB)**	**1,025,831**	**1,025,831**	37.8%	100%
Less:				
Parks and Ecological Reserves	495,133	495,133	18.3%	48.3%
Inoperable/Inaccessible	819,219	327,229	12.1%	31.9%
Environmentally Sensitive Areas (ESA's)	261,632	28,977	1.1%	2.8%
Non-Merchantable or Problem Forest Types	196,865	33	0.0%	0.0%
Low Productivity Sites	177,662	17,819	0.7%	1.7%
Grizzly Wildlife Habitat Areas (WHA's)	13,661	3,755	0.1%	0.4%
Mountain Goat Winter Range	29,985	65	0.0%	0.0%
FRPA Riparian (not including S6's)	17,433	6,240	0.2%	0.6%
Recreation Values	10,470	3,466	0.1%	0.3%
EBM – High Valve Fish Habitat (Obj. 9)	5,782	1,603	0.1%	0.2%
EBM – Non High Value Aquatic Habitat (Obj. 10)	6,630	2,094	0.1%	0.2%
EBM – HVFH Kimsquit River (Obj. 9)	5,693	1,150	0.0%	0.1%
EBM – Active Fluvial Units (Obj. 13)	1,133	264	0.0%	0.0%
EBM – Grizzly Bear Habitat (Obj. 17)	42,420	2,662	0.1%	0.3%
Spatial Timber Harvesting Land Base (ha)		**135,343**	5.0%	**13.2%**
Non Spatial Netdowns Applied to Each THLB Polygon:				
FRPA Riparian – S6's = 0.3%		406	0.0%	0.0%
EBM – Arch/FN (Obj. 4-7) = 1.3%		1,759	0.1%	0.2%
EBM – Red and Blue (Obj. 15) = 3.0%		4,060	0.1%	0.4%
EBM – Stand Level Retention (Obj. 16) = 4.4%		5,955	0.2%	0.6%
Effective Timber Harvesting Land Base (ha)		**123,162**	4.5%	**12.0%**
Future Reductions:				
Future roads, trails and landings		-2,713	0.1%	0.3%
Future Gains:				
TL Reversions ****		+5,279	0.2%	0.5%
Long Term Timber Harvesting Land Base (ha)		**125,728**	4.6%	**12.3%**

* Effective netdown area represents the area that was actually removed as a result of a given factor. Removals are applied in the order shown above, thus areas removed lower on the list do not contain areas that overlap with factors that occur higher on the list. For example, the ESA netdown only removes area from the crown, operable forested land base.

** The total unreverted TL's area is 19,791 ha

*** Productive forest in this context denotes the forest area that contributes to forest management objectives, such as landscape-level biodiversity, wildlife habitat and visual quality. It does not include alpine forest or Non productive areas with tree species.

**** The THLB was underestimated by 476 hectares for the first period of the planning horizon because TL's 994, 990, and 462 were treated as not reverted when in fact they have already reverted to the TSA. Once the TL's have all reverted to the TSA (period 2) the issue no longer exists but stands are ~10yr younger than they should be.

3.2 Forest Cover Inventory

The forest cover inventory is a key component to the timber supply review of the TSA. The history of the current forest cover inventory in the Mid Coast TSA can be summarized briefly as follows:

- The inventory data was originally prepared in 1988-1990 from 1977-79 photography and is currently in a Vegetation Resources Inventory (VRI) Forest Inventory Planning (FIP) Rollover format. There are several mapsheets of full VRI format data in the NE corner of the TSA (portion of Tweedsmuir Park).
- A single flat file was obtained from Forest Analysis and Inventory Branch (James Wang) that included only Rank 1 stand information. Attributes were projected to January 1, 2008 using VDYP 6.
- Disturbances from harvesting and fire will be updated in the GIS resultant to March 2008 using data compiled from licensees and RESULTS. Fires from 2001-2007 were provided by the MFR FAIB.
- An inventory audit was carried out in 1994 (published 1995) and indicated that the inventory was statistically reliable for some strategic planning purposes at a broad management unit level.
- No ground sampling (Phase 2 work) has been completed to support adjustments to inventory attributes so no adjustments have been applied.
- Site index adjustments have been developed for regenerating managed stands (Timberline's 2008 SIA project[3]) and were used to develop managed stand yield curves. Existing inventory site indices were used for natural (unmanaged) stand yield curves.

It should be noted that planners and practitioners using the forest inventory at a sub-unit or polygon level have found the attributes quite unreliable.[4] The extra demands of EBM (e.g. Site Series Surrogate status reporting) emphasizes the need for more dependable information. To that end a multi year, multi million dollar project to create a new VRI inventory to replace the current forest cover information was initiated in 2008 but will not be completed in time for inclusion in this analysis. In lieu of access to any better forest information the FIP-based data is employed in this TSR.

3.3 Management Practices

Management practice assumptions can be grouped into three broad categories: Integrated Resource Management, Silviculture, and Harvesting.

3.3.1 Integrated Resource Management

Forest cover requirements are applied within the timber supply model to address timber and non-timber resource objectives that are present on the THLB. These requirements maintain appropriate levels of specific forest types needed to satisfy the objectives for wildlife habitat, biological diversity, etc. Forest cover requirements are used by the model to limit harvesting within the THLB. If the issue was addressed through spatial landbase removals (netdowns), it is shown in Table 1 above (grizzly, mountain goat, recreation, fish habitat etc). These constraints and removals are applied to address habitat requirements and prevent species decline.

The type of objectives modeled and the size of the land base affected by each objective are summarized in Figure 12 and Table 2. The specific forest cover requirements modeled for each objective are provided in Appendix 3 – Section 8.0.

[3] Site Index Adjustment of the Mid Coast Timber Supply Area (Project # BC0108405), January 2009, Timberline Natural Resource Consultants, Victoria, BC.

[4] Central Coast LRMP Area Vegetation Resources Inventory Strategic Inventory Plan, February 2008, page 7.

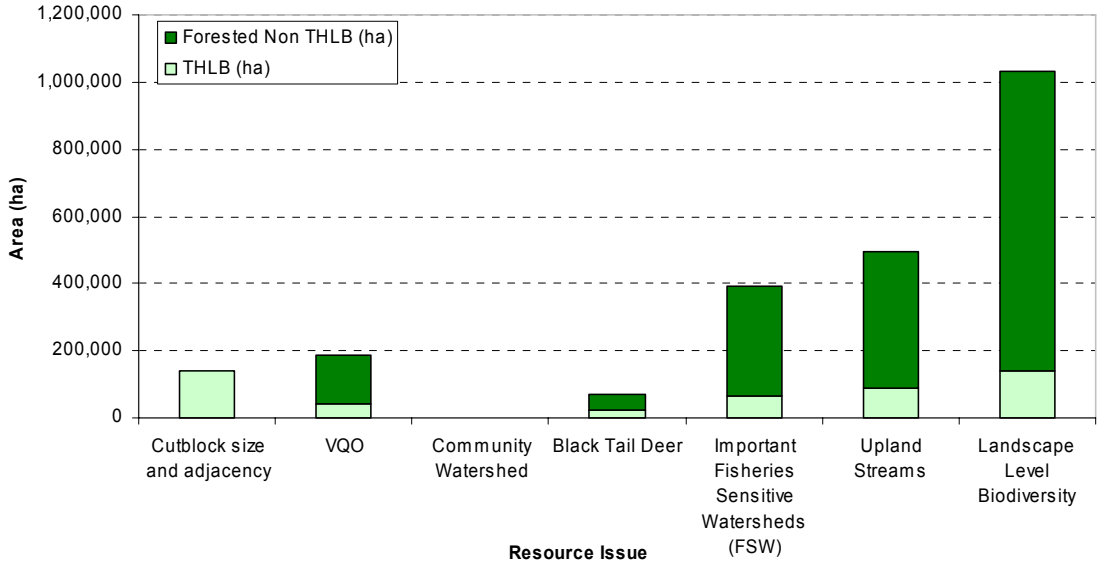


Figure 12. Areas by land base type where forest cover constraints were applied (Spatial THLB)

A summary of the areas over which various non-timber resource values occur is provided in Table 2. These areas cannot be summed to determine the total area affected because some overlapping occurs.

Table 2. Areas by land base type where forest cover constraints were applied

Integrated Resources Value	PFLB Area (ha)	Forested Non THLB (ha)	% of Non – THLB	THLB (ha)	% of THLB	Description
Cutblock size and adjacency	140,622	0	0 %	140,622*	100 %	Max 25% of THLB in each LU can be < 3m tall
VQO	187,520	145,886	16 %	41,634	30 %	Preservation and Retention areas addressed with Dispersed Retention harvesting. Partial Retention and Modification addressed by limiting the amount of young forest present over time.
Community Watershed	2,163	1,868	0.2%	295	0.2%	Harvesting limited to 1% of the forested area per year.
Black Tail Deer	67,890	46,067	5 %	21,823	16 %	Min of 25% of the forested areas in a unit must be >141 yrs. (exceptions allowed in first 80 yrs)
Important Fisheries Sensitive Watersheds (FSW)	390,737	323,601	36 %	67,136	48 %	Maximum equivalent clearcut area of 20% of the forested areas allowed in each watershed.
Upland Streams	495,469	406,386	46 %	89,083	63 %	Upland stream areas in specific watersheds limited to a maximum of 30%<9m tall (i.e. hydrologically recovered)
Landscape Level Biodiversity	1,030,923	890,300	100 %	140,622*	100 %	Defines the amount of old and mid seral forest that must be retained in each site series surrogate (SSS) combination

* THLB in this table includes non reverted TL's areas

3.3.2 Silviculture

Historical and current silvicultural practices in the TSA have been included in the model. These include:

1. Two silvicultural systems: Clearcut with reserves is the dominant system while dispersed retention is planned for use in highly constrained visual areas. Historical use of dispersed retention was also modeled and is described in Appendix 3 – Section 5.1
2. Regeneration assumptions such as establishment method, species distribution, and establishment density, described in Appendix 3 – Section 5.2
3. Regeneration delay (time between harvesting and when the site becomes stocked with crop trees), described in Appendix 3 – Section 5.3 and
4. Use of select seed, described in Appendix 3 – Section 5.4.

3.3.3 Timber Harvesting

Assumptions around timber harvesting practices have also been included in the model and include:

- Minimum harvest ages that ensure a viable log is produced and long term volume production is not compromised (Appendix 3 – Section 6.1).
- Minimum economic criteria for log size and stand volumes (Appendix 3 – Section 6.1).
- Physical and economic operability (unstable slopes, inoperable areas, low sites, high cost areas, etc.). These assumptions are outlined in detail in Appendix 3 - Section 3.0.
- Harvest partitions for outer coast, heli harvest, and low-poor productivity hembal stands (SI<17). Limits were placed on outer coast harvest (20%) and low-poor hemlock balsam harvest (19%) in each 10 year period to ensure the harvest volumes coming from each of these stratums were operationally realistic (see Appendix 3 – Section 6.3). The harvest volume from helicopter harvest stands was monitored but not constrained.

3.4 Forest Dynamics

Forest dynamics refers to the changing state of the forest through time. Changes occur as the forest ages, or when natural or human caused disturbances occur. The way in which the model addresses these issues is described below.

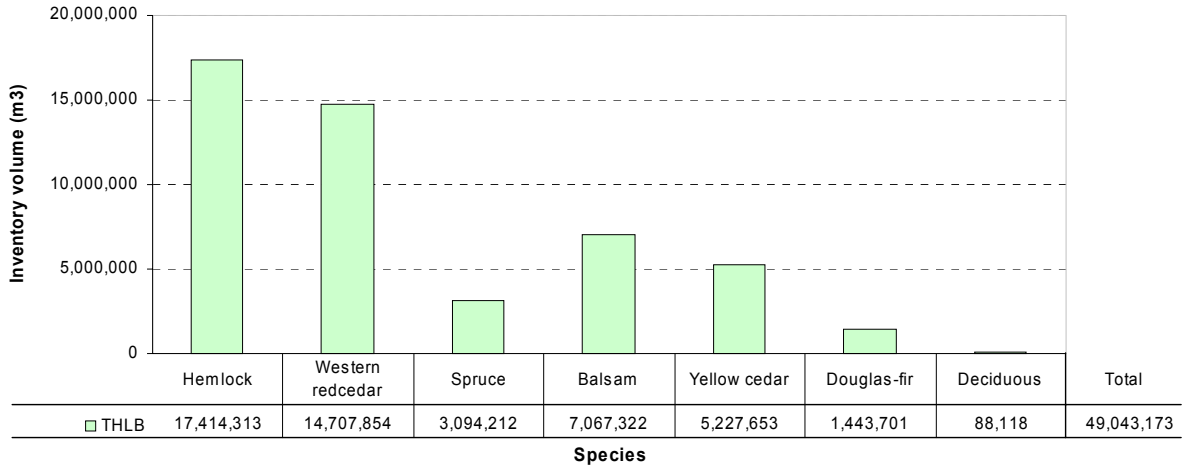
3.4.1 Growth and Yield

Timber growth and yield refers to the prediction of the growth and development of forest stands over time, and of particular interest, the volume and size of trees that would occur at the time of harvest. For modeling purposes, stands of similar characteristics, growth rates, and management are grouped together into Analysis Units (AU's). Analysis Units are described in Appendix 3 – Section 4.0.

Each analysis unit is associated with its own yield curve, which is a prediction of the net volume per hectare at various stand ages. Minimum harvest ages are determined by comparing the yield curves to merchantability criteria, such as the minimum volume per hectare, minimum stand diameter or within minimum percentage of the culmination age that must be reached before the stand will be eligible for harvest. The minimum age is selected based on the maximum age of these three criteria (i.e. a stand has to meet all the criteria before being eligible for harvest).

Two growth and yield models were used to derive the yield curves used in the Mid Coast TSA analysis. The Variable Density Yield Prediction (BatchVDYP 6.6d) model, supported by the Forest Analysis and Inventory Branch, was used for estimating timber volumes for all existing natural stands. The Table Interpolation Program for Stand Yields (BatchTIPSY 4.1c - Feb 8, 2007), developed by the Research Branch was used to estimate timber volumes for both existing and future managed stands. Existing managed stands are those that are currently under 25 years of age (established after 1983) for Fd, Hw and Ba stands and under 19 years of age (established after 1989) for Cw/Yc stands. Future managed stands are stands that will regenerate after they are harvested by the model during the planning horizon.

Based on timber volume estimates, the *effective* growing stock on the timber harvesting land base is approximately 49 million cubic meters. The natural growing stock (48.8 million m^3) differs from the 54 million cubic meters originally shown in the data package because of a) the modelling approach –polygon level versus block level– and b) because of the non spatial netdowns, were not originally reflected and c) because this volume does not include TL volume. Approximately 92% of the total growing stock (45 million m^3) is currently merchantable (i.e. in stands older than their minimum harvest age). The following figure (Figure 13) shows the total –natural and managed– gross inventory volume by species.



	Hemlock	Western redcedar	Spruce	Balsam	Yellow cedar	Douglas-fir	Deciduous	Total
THLB	17,414,313	14,707,854	3,094,212	7,067,322	5,227,653	1,443,701	88,118	49,043,173

Figure 13. Total gross inventory by species in the spatial THLB

3.4.2 Disturbances

Natural disturbances inside the timber harvesting land base:
Each year timber volume is damaged or killed on the THLB and not salvaged or accounted for by other factors. These losses are due to a number of disturbances that cause tree mortality, including insects, disease, blowdown, and wildfires. The non-recoverable loss rates from previous timber supply review (TSR2) were used for this analysis but were factored down to reflect the smaller THLB area. The annual non-recoverable losses applied in this analysis were 4,971 m^3/yr for fire and 9,100 m^3/yr for windthrow (total of 14,071m^3/yr). No additional impacts from insects were considered for this analysis (see Appendix 3 – Section 7.1 for more detail).

Unsalvaged loss estimates address only the loss of merchantable volume from mature stands. The losses associated with damage to immature stands also impacts the rate at which timber becomes available in the THLB but little data is available to estimate the extent or impact of these losses. These disturbances are not explicitly modeled, but may be captured in OAF1 estimates, or else will be captured during periodic inventory updates and therefore reflected in subsequent timber supply analyses.

Natural disturbances outside the timber harvesting land base:
Because stands outside of the THLB contribute toward several forest cover objectives (e.g. landscape level biodiversity), it is important that the age class distributions in these stands are also modeled in a manner that is consistent with natural processes. By simulating natural disturbance in these stands, a more natural age class distribution can be maintained in the model and a realistic contribution toward seral goals ensured.

An area of 1,361 ha is disturbed each year in the analysis to prevent age classes in the non-THLB from becoming unrealistically old during modeling (Appendix 3 – Section 7.2). Disturbance rates were based on the Range of Natural Variation (RONV) research that is incorporated into the EBM orders (2009). This was necessary to keep the rate of natural disturbance consistent with the old seral retention goals imposed by the EBM orders. Using old seral goals based on RONV studies while implementing disturbance regimes from the Natural Disturbance Types defined in the Biodiversity Guidebook would have made it impossible to meet the old seral objectives on the landbase in the long term – even if no harvesting was occurring.

A portion of the TSA (i.e. Tweedsmuir Park) used the traditional Natural Disturbance Types defined in the Biodiversity Guidebook (1995) to identify disturbance intervals because no RONV information was available. The bulk of the disturbance modeled occurred in these ecosystems even though they represent only ~25% of the TSA because the NDT disturbance rates are significantly higher than the RONV. For example, the RONV data indicates that the CWH vh 2/1 (21% of the TSA) has an effective rotation age of almost 8,000 years (1/8000 of the area disturbed each year). Full details can be found in Appendix 3- section 7.2.

3.5 Timber Supply Analysis Methods

Patchworks™ modeling software was used to complete the timber supply analysis. Patchworks™ is a fully spatial forest estate model that can incorporate real world operational considerations into a strategic planning framework. It utilizes a goal seeking approach and an optimization heuristic to schedule activities across time and space in order to find a solution that best balances the targets/goals defined by the user. The end resulted is a block treatment schedule that can guide operational implementation. Targets can be applied to any aspect of the problem formulation. For example, the solution can be influenced by issues such as mature/old forest retention levels, adjacency factors, visual quality objectives, green-up conditions, total harvest volume, non conventional harvest volume, growing stock levels, ECA's, specific mill volumes by species, road building/hauling costs, net present values, etc. Patchworks™ continually generates alternative solutions until a stable solution has been found based on specific performance parameters determined by the modeller. Solutions with attributes that fall outside of specified ranges (do not satisfy the targets) are penalized and the goal seeking algorithm works to minimize these penalties – resulting in a solution that reflects the user objectives and priorities. Weightings on targets are used to define target priorities and to normalize units (targets on percentages over targets on volume). High priority targets (hard constraints) are either met immediately or as soon as possible given the initial conditions and they would probably have a higher relative weighting. Usually the minimum harvest volume has a lower relative weighting because it is a target to be achieved after all the other targets (or most of them) have been met.

The purpose of this analysis is to examine both the short and long term timber harvesting opportunities in the TSA, in light of current forest management practices. Modeling assists the timber supply analyst in assessing the harvest flows associated with various scenarios. Management scenarios are groups of assumptions that define the extent of the timber harvesting land base, timber volumes, and the management regimes. The main scenario in this report is the **base case**, or current management scenario. All the sensitivity analysis was done based on this base case. Modeling was completed for a minimum of 300 years (10-year periods) for each scenario to confirm that the harvest and growing stock levels remain stable.

The results of the analysis are an important part of the annual allowable cut determination process and aim to document future harvest flows that will not restrict future options in the TSA. The results presented here do not define a new AAC – they are intended only to provide insight into the likely future timber supply of Mid Coast TSA. The final harvest level decision will be made by the Chief Forester and published along with his rationale in an AAC Determination document.

3.6 Major Changes from Previous Timber Supply Review (TSR2)

Changes have occurred in both the input data and management assumptions since the last timber supply analysis (TSR2 – Revised Operability Landbase). The major changes or differences from the last analysis are:

Land Base Definition changes:

- Parks and Conservancy areas: New Conservancies, and Biodiversity, Mining and Tourism Areas have been established. Approximately 48% of the TSA's forested area is now in protected areas where commercial timber harvesting is not permitted (20% correspond to the new park and conservancy areas established since 2004).
- Operability map: A new operable area was defined using stand level economic assessments and Patchworks modeling (2008/2009).

- Community Forests: Two new community forest tenures exist and are no longer part of the TSA.
- Low Productivity Sites: Low productivity site netdowns now use lower thresholds (vol/ha and site index).
- Exclusion of WHA's. Wildlife Habitat Areas (WHAs) for grizzly bear have been established since TSR2 and were excluded from the timber harvesting land base.
- First Nations: Culturally Modified Trees (CMT's) are now addressed as part of the First Nations EBM objectives.
- Mountain Goat Winter Range: A GAR order has established mountain goat habitat areas (GAR-#U-5-004) which exclude harvesting over 90% of the area identified.
- Recreation: Recreation netdowns are based on a new inventory and limited to areas outside of the most constraining VQO polygons (Preservation (P), Retention (R), Partial Retention (PR)). This lead to a significantly larger netdown than was considered appropriate in the TSR2 rationale (3466 ha vs 692 ha in TSR2).
- Riparian: Based on typical licensee FSP commitments riparian reserve areas around lakes, wetlands, and streams in the Mid Coast TSA were excluded from the timber harvesting land base.
- EBM considerations: EBM considerations from the North and South Central Coast Orders resulted in exclusions for High Value Fish Habitat (HVFH), Aquatic Non High Value Fish Habitat, Active Fluvial Units (Floodplains), CMT's/Cultural Cw/ Monumental Cw, Grizzly Bear Habitat, Stand Level Retention / Forested Swamps, and Red and Blue List Species.
- Roads, trails and landings: A smaller proportion was discounted for roads, trails and landings compared to the TSR2. A reduction of 7 or 7.8% for existing and future roads depending on the respective stand age class was applied for the TSR2.

The TSR3's short term effective THLB area of 123,162 ha is smaller than the TSR2 'preferred reference' forecast THLB (190,425 ha) by **35.3%**. The majority of this difference comes from the introduction of new parks / protected areas (-), a new operable land base (+), and the introduction of EBM and wildlife requirements (-).

Other Differences include:

- Updated Inventory: The inventory was updated for growth and depletions to January 2008.
- Growth and yield adjustments: Different assumptions were used for this TSR that led into higher volume estimates compared to TSR2. These differences are for example: the improved site index estimates for Cw and Hw stands, a lower minimum utilization level of 12.5 cm (compared to 17.5 cm in the TSR2), and the genetic gains associated with the use of class A seed.
- Important Fisheries Watersheds: Disturbance limits exist in Important Fisheries Watersheds (EBM Objective 8).
- Equivalent Clearcut Areas (ECA): ECA requirements applied in portions of certain watersheds to manage Upland Streams (EBM Objective 12).
- Landscape Level Biodiversity: Old seral retention requirement are now based on RONV research and are typically higher than what was used in TSR2. They were also modeled at a finer spatial resolution on the land base (LU-site series surrogate (SSS) combinations instead of LU-BEC variant combinations). Also, the amount of mid seral forest was limited to 50% within LU-SSS combinations.
- Black Tailed Deer: A new GAR order for black tailed deer exists and requires 20-25% of the habitat in each LU to be >141 yrs old at any time. TSR 2 required 25% > 250 yrs old.
- Dispersed Retention in VQO areas: Dispersed Retention harvesting is modeled in Preservation (P) and Retention (R) VQO areas and no forest cover disturbance constraints are applied in these areas. Dispersed Retention harvesting is also applied in 10% of the Partial Retention VQO areas, along with forest cover disturbance constraints.
- Existing dispersed retention blocks: Existing dispersed retention blocks were modeled by assigning them to a separate analysis unit with reduced volume yields (AU 315).
- Harvest level controls: Limits and were placed on the amount of Outer Coast harvest (<20%) and Low-poor hembal harvest (<19%) in each 10 year period to ensure operationally realistic harvest schedules were produced. No controls were implemented in the TSR2 published base case runs although the final

reference forecast used in the determination limited heli stand contribution and outer coast contribution to (178,000 m^3/yr and 59,000 m^3/yr respectively).

- Disturbance of the non-THLB: TSR2 did not model disturbance on the non-THLB. TSR3 implemented a natural disturbance regime that impacts 1361 ha of the forested non THLB each year (~0.15% per year). The low rates of disturbance were based on the RONV research integrated into the EBM orders.
- Use of Patchworks™: The Patchworks™ modeling software was used for timber supply modeling.

4.0 Base Case Analysis

The base case scenario presented in this report is based on the best information currently available and reflects current management practices in the TSA. The current allowable annual cut (AAC) for Mid Coast TSA is 768,000 m³/yr. This AAC already reflects the establishment of the Central Coast Designated Areas (parks and protected areas). Non-recoverable losses (NRL) in the THLB are estimated to be 14,071 m³/yr and have, except where noted, been subtracted from the graphs, tables, and harvest forecasts in this report. The reported harvest flows are also net of the 1,500 m^3/yr associated with EBM Objective 3, so 15,571 m³/yr were subtracted from all modelled harvest flows.

4.1 Alternative Harvest Flow Scenarios

Numerous alternative harvest forecasts are possible for a given set of modeling assumptions. These alternative flows represent tradeoffs between short, mid, and long term harvest level objectives. Figure 14 shows three potential harvest flows for the Mid Coast TSA base case, as well as the current AAC level.

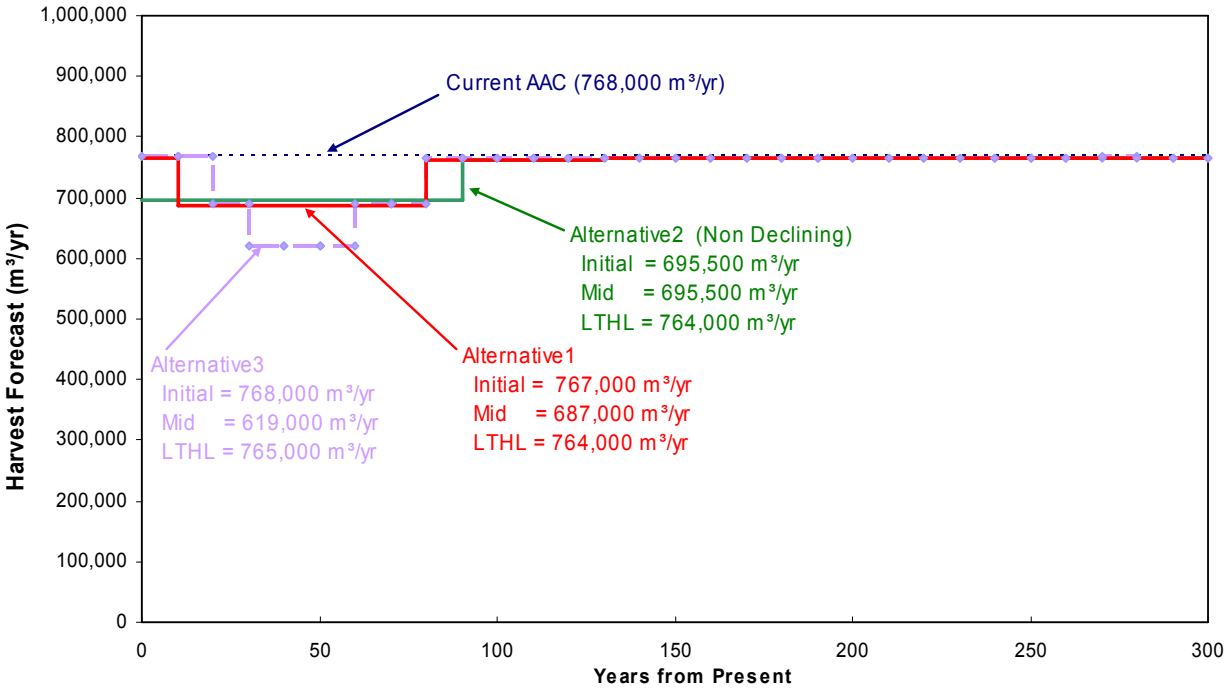


Figure 14. Alternative harvest forecasts for the TSR3 base case assumptions

Alternative 1 shows an initial harvest level of 767,000 m³/yr (1000 m^3 less than the current AAC) for one decade before declining 10% to 687,000 m³/yr during the mid term, and then increasing by 10% after 70 years to a long term harvest level of 764,000 m³/yr.

Alternative 2 shows a non-declining flow that maintains an initial harvest level of 695,500 m³/yr for 90 years before climbing to a long term level of 764,000 m³/yr. Relative to alternative 1, the rise to the long term is postponed by one decade.

Alternative 3 shows an initial harvest level of 767,000 m³/yr (1000 m^3 less than the current AAC) for two decades before declining to a low of 619,000 m³/yr during the mid term (two 10% drops). The mid term trough lasts for three decades before climbing to a long term harvest level of 765,000 m³/yr by the ninth decade.

4.2 Selected Base Case Harvest Flow

Alternative 1 in Figure 14 was selected as the preferred base case flow for the Mid Coast TSA (Figure 15). It was preferred over alternative 2 because dropping immediately to a non declining flow regime provides very little improvement in the mid term and yet forgoes harvest volume in both periods one and nine. Alternative 1 was preferred over Alternative 3 because maintaining the current AAC for 20 years results in a more significant falldown in the mid term.

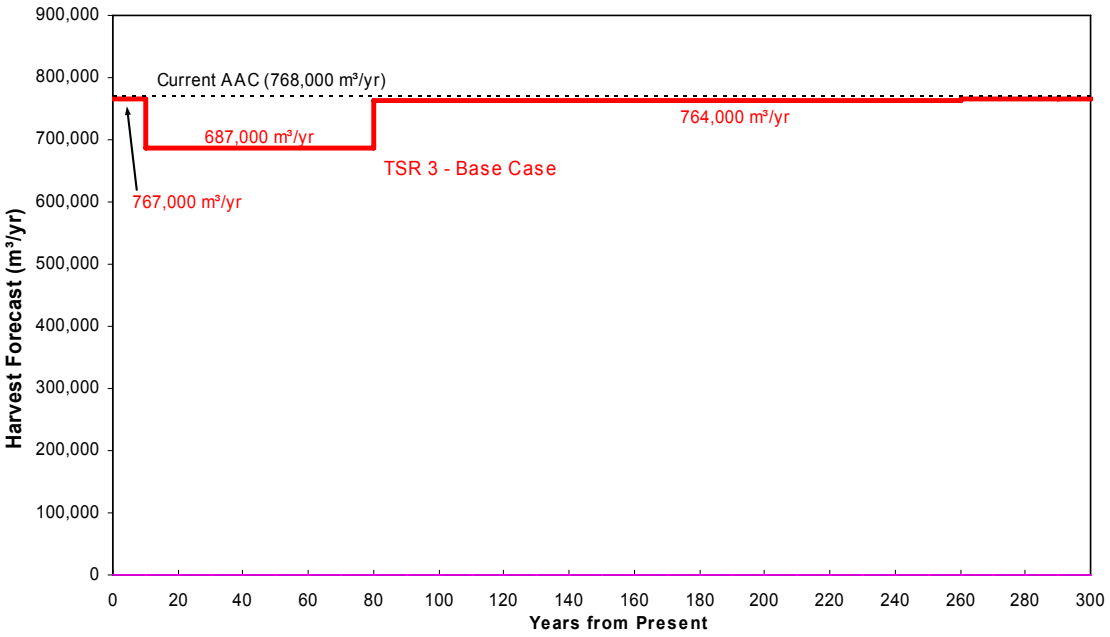


Figure 15. Base case harvest forecast for the Mid Coast TSA relative to the current AAC

The harvest and forest level attributes presented in the section below correspond with this base case harvest forecast. The sensitivity analyses that follow are all compared to this base case harvest forecast.

4.3 Base Case Attributes

In order to understand and evaluate the base case harvest forecast, this section describes the stands being harvested and the state of the forest over time. Numerous forest management assumptions have been modeled in the base case, many of which impact the condition of the forest through time. Using the information presented in this section, it is possible to validate these assumptions and review their impact on the overall composition of the forest.

4.3.1 Growing Stock

The total and merchantable volume on the Timber Harvesting Land Base (THLB) throughout the 300 year planning horizon is shown in Figure 16. The total growing stock is the net volume of all stands based on

minimum tree diameters (i.e. trees >17.5 cm dbh for natural stands and trees >12.5 cm dbh for managed stands). The merchantable growing stock is the subset of the total growing stock that is in stands that are older than their minimum harvest ages. Typically, a flat growing stock on the THLB in the long term is desirable because it signals that the rate of harvest is more or less equal to the rate of forest growth.

The total volume currently on the timber harvesting landbase is nearly 50 million cubic meters (Figure 16). More than 45.1 million cubic meters (92%) is currently merchantable. By comparison, the TSR2 base case showed a total growing stock of around 88 million cubic meters with an almost equal volume classified as merchantable (87 million m^3). These values are difficult to compare because of the 9 years of harvest / growth that has occurred between them, and also because a new land base definition is now in place which is 34.6% smaller.

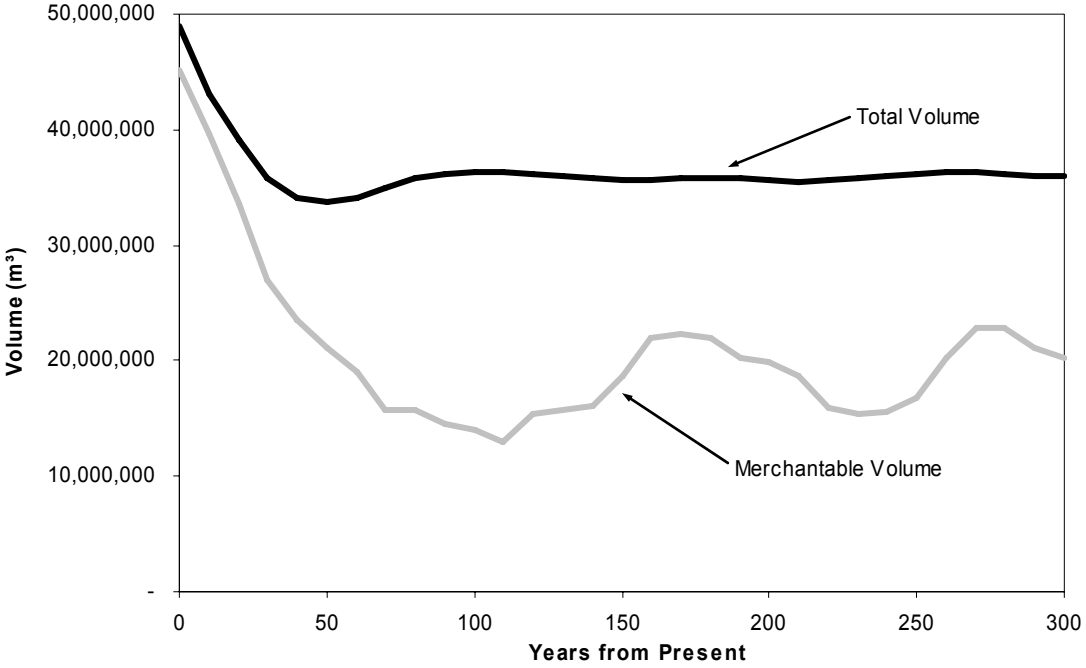


Figure 16. Merchantable and total growing stock on the THLB for the base case harvest flow

Both the total growing stock and the merchantable volume show a steady drop during the first 50 years of the planning horizon as the THLB age class structure is normalized and old high volume stands are replaced with younger thrifty stands. As the managed stands begin to produce volume in merchantable diameter classes, total growing stock begins to rise and stabilizes at around 35.9 million m³ for the long term. The merchantable volume averages ~18 million m³ in the long term.

4.3.2 Harvest Attributes

Figure 17. Natural vs managed stand harvest profile for the base case

shows the transition from harvesting natural stands in the short term to harvesting managed stands (2nd and 3rd growth) sixty years into the planning horizon. The first significant amount of managed stand volume is harvested in years 40-60. By years 70-80, over half of the harvest is coming from managed stands and by year 110 the harvest is coming almost entirely from managed stands. This transition point in the TSA's harvest forecast is critical in defining short term timber supply because the current stock of natural stand volume must be rationed until managed stands come online.

By year 90, managed stands dominate the harvest forecast and allow an increase in harvest level. This occurs because the managed stands are producing volume faster than natural stands as a result of

improved site index estimates for Cw and Hw stands, better site occupancy (fewer gaps), and genetic gains associated with the use of class A seed.
The long term harvest flow of 763,000 m³/yr is below the LRSY calculated for the future managed stands (~929,000 m³/yr). This is an expected result because the landbase is subject to a set of constraints that prevents the harvest of some stands and reduces the rate of harvest for other stands.

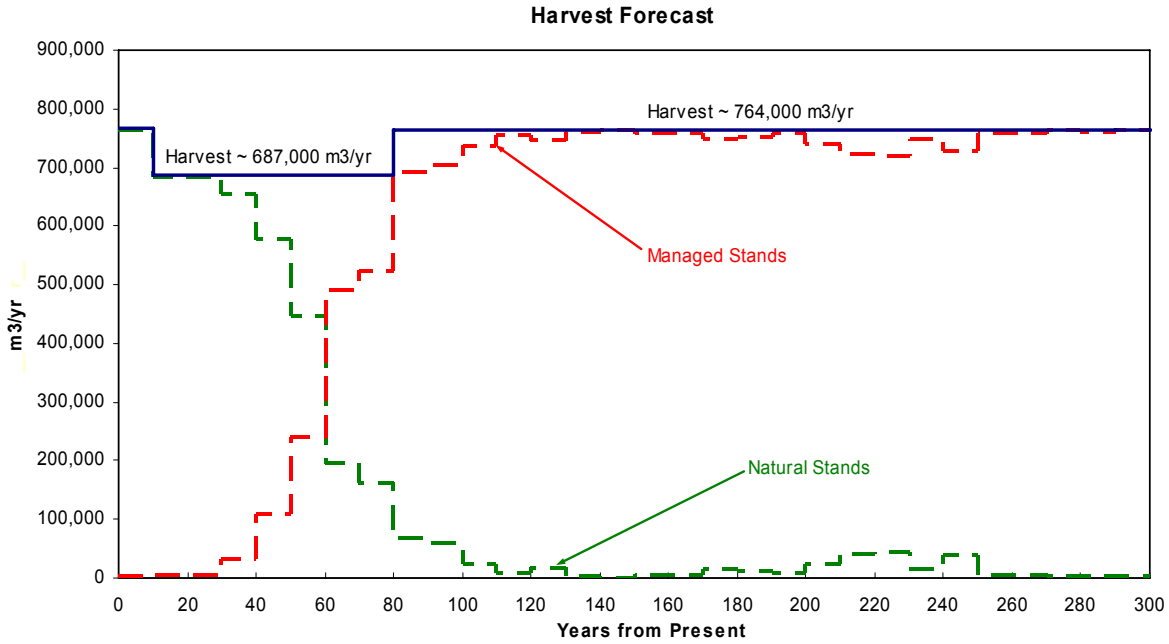


Figure 17. Natural vs managed stand harvest profile for the base case

Figure 18 shows the harvest species profile over the planning horizon and indicates that western red cedar and hemlock/balsam tree species make up the majority of the harvest, while Douglas-fir and spruce make up the remainder. Cedar and hemlock are the most common species in the THLB but spruce is a common secondary species. Spruce harvest is significantly lower after 100 years because the modeled regeneration assumptions rarely contain spruce as a secondary species.

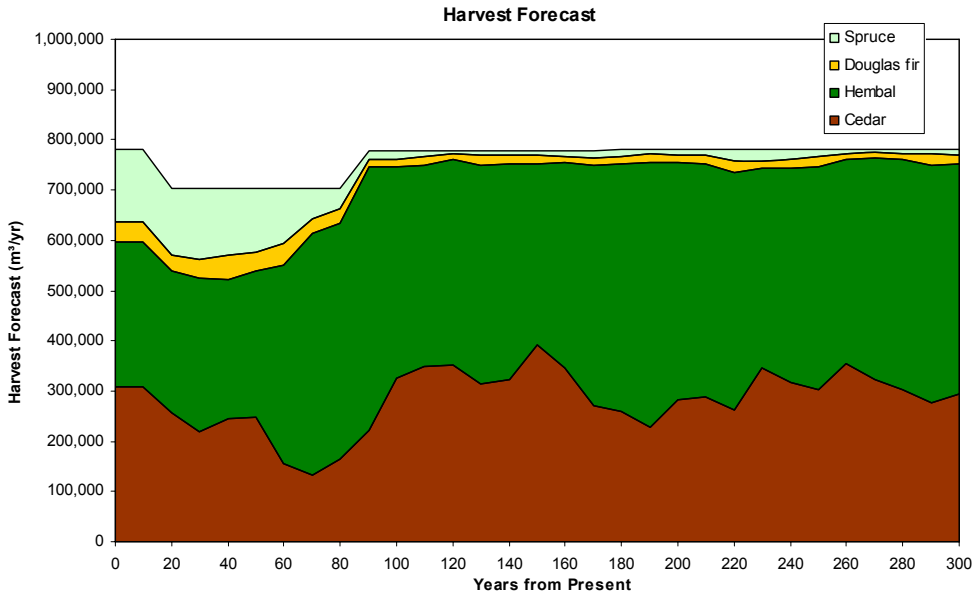


Figure 18. Base case harvest flow by tree species volumes

It should be noted that during the transition to managed stands in years 60-80, an increase in hemlock/balsam harvest occurs while the cedar harvest drops. This occur because much of the early second growth is hemlock leading. This time frame is probably the most complex in terms of achieving the timber supply requirements because natural stands suitable for harvest are becoming scarce and managed stands are just coming online in a significant way.

Figure 19 below shows the average area harvested per year, the average harvest age, and the average harvest volume/ha over time. The area harvested over time is typically between 1,200 ha and 1,400 ha with an average of 1,237 ha/yr across the planning horizon. In periods 4 and 5, the harvest area is increasing as the volume per ha is dropping so that an even volume flow is provided during the mid term. Immediately after these periods, the situation reverses as higher volume managed stands come on line and the area required for harvest become less.

During the beginning of the planning horizon, harvest ages are over 300 years (natural stands) and yield approximately 550 m^3/ha, while in the longer term, managed stands are typically harvested at around 100 years of age and yield 630 m^3/ha.

It should also be noted that the period where the largest amount of area is harvested (with lowest vol/ha) immediately precedes the transition to managed stands (i.e. 40-50 years in the future). This period will be challenging for the TSA because options for harvest will be very constrained (assuming full harvest of the AAC up until then).

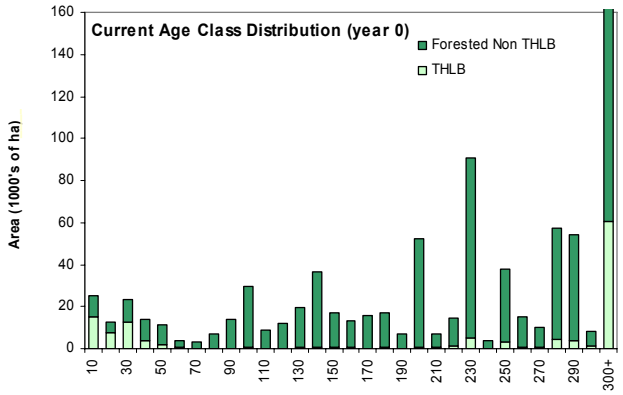
Figure 19. Average harvest age, area, and vol/ha for the base case

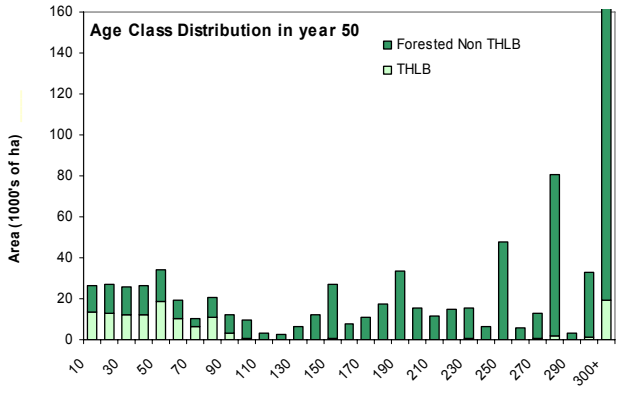
4.3.3 Age Class Distribution

Figure 20 provides age class distributions for the TSA showing both the THLB and non-THLB land bases in four snapshots (years 0, 50, 100, and 200). For the non THLB, the present day stand ages are highly concentrated in older ages - the majority older than 200 years. On the other hand, the THLB tends to be skewed toward younger and older ages, and there is a distinct lack of THLB area the middle age classes. This behaviour is typical for land bases that are under a conversion process from a natural old growth forest to a commercially managed forest.

The figures also demonstrate the natural disturbance succession being modeled in the non-THLB. On average 1,361 ha were disturbed each year and this area continues to show up in the younger age classes as the modeling time frame progresses. A large area of age class 300+ exists at 200 yrs because the natural disturbance rate on this land base are very low and stands reach very old ages.

The 200 yr graph shows a 'regulated' forest structure where stands in the THLB are relatively evenly distributed in age classes between 0-130 years as this is the typical harvest age. The 200 yr graph also shows that some of the THLB remains as old-growth to satisfy old forest requirements.





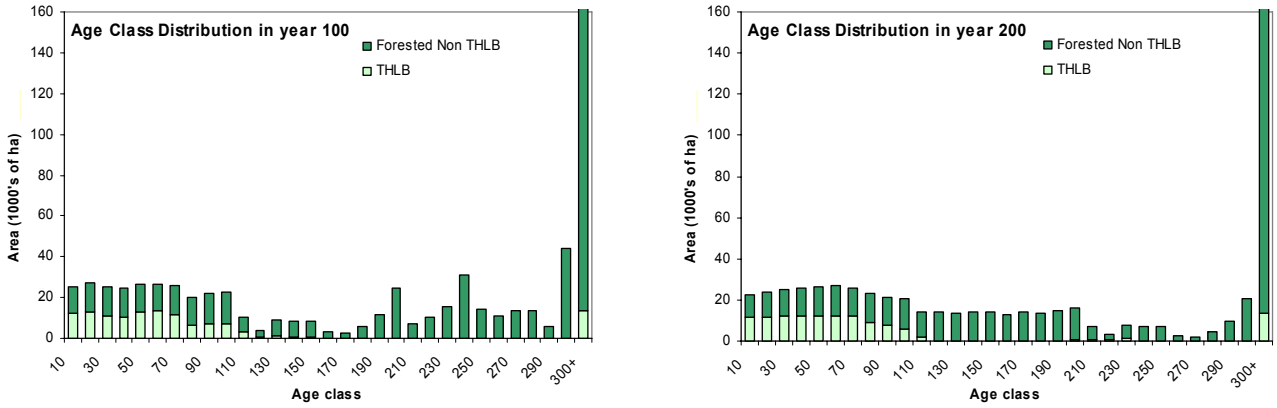


Figure 20. Age class distributions at year 0, 50, 100, and 200 for the base case forecast

4.4 Constraints Analysis

4.4.1 Harvest Profiles

The base case assumptions limited the volume contribution from the outer coast and low site index (SI<17m) old growth hemlock/balsam stands in each period to a level consistent with expected future performance. This was defined as 20% of the harvest for outer coast and 19% for low site index old hemlock/balsam stands (these profiles can and do overlap). Once harvested, poor-low hemlock stands move to managed stand site index and get associated with higher volumes and thus do not belong to the poor-low hemlock profile anymore.

Two other profiles were tracked for reporting purposes. These were the proportion of volume harvested by helicopter and the volume harvested from specific basins in the Owikeno watershed. Specific portions of the Owikeno area were identified by MFR as a concern for short term operability (next 40 years - due to access costs for currently merchantable stands) or for perpetual operability concerns (whole planning horizon). The Owikeno area is a productive area, and the areas modelled for short term deferral are expected to contribute to the harvesting land base once existing second growth stands become merchantable, which is projected to be in about 40 years.

Figure 21 shows the actual harvest profiles achieved in the base case and the associated targets for outer coast and low site index hembal partitions. It can be seen that low site index hembal stands are being limited to their maximum contribution during the first eight decades of the planning horizon when older natural stands are being harvested. After this initial period they drop to an irrelevant level as managed stands dominate the forecast. These low site hembal stands initially make up 17% of the THLB area and 25% of the existing natural stand volume.

Harvest from the outer coast never reaches the maximum allowable 20% but does get close (18%) in periods 4 and 5. Across the planning horizon, outer coast harvest averages 13% of total harvest volume. Outer coast stands make up 19% of the THLB area and 22% of the initial volume on the THLB.

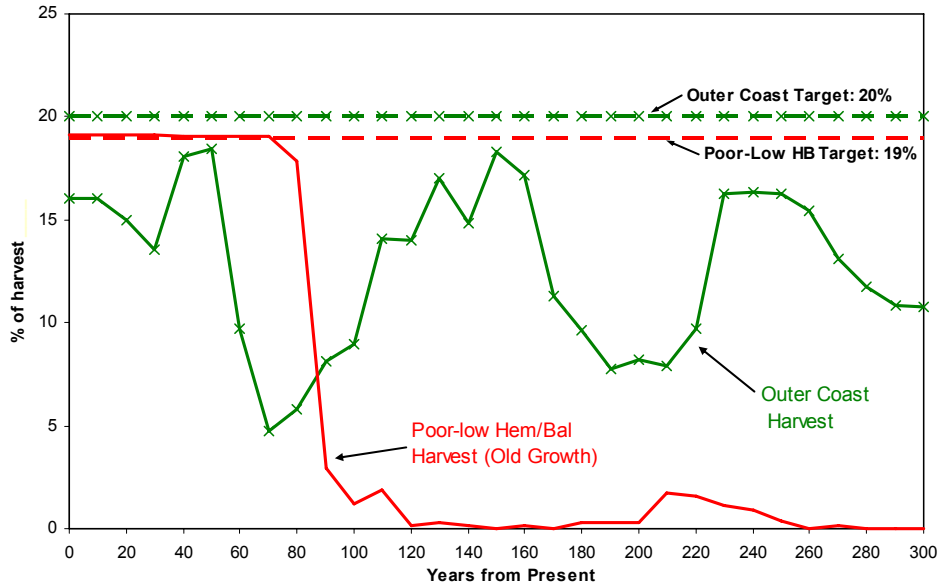


Figure 21. Harvest volume contributions from outer coast and poor-low hemlock/balsam partitions

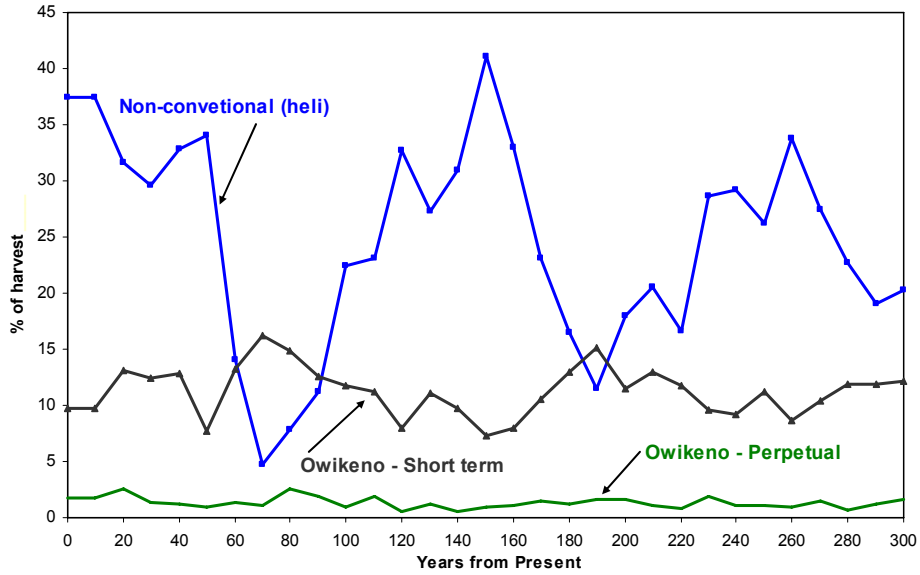


Figure 22. Harvest contribution from helicopter harvest systems and Owikeno watershed areas

Figure 22 shows helicopter harvest fluctuating during the forecast horizon - ranging from 5% to 41% of the harvest volume. It is initially at the high end of the range and then drops sharply during years 50 to 70 as harvest is focused into the first second growth stands that come online in the inner coast (which are conventional harvest). This is also coincident with the drop in cedar harvest presented in Figure 18 because these same early 2nd growth stands are heavy to hemlock regeneration. Helicopter harvest area makes up 30% of the THLB and 34% of the initial volume. It has very little overlap with the low-poor hembal THLB area.

Specific portions of the Owikeno area were identified by MFR as a concern for short term operability (next 40 years) due to the access costs for the currently merchantable stands, or due to potential perpetual operability concerns (whole planning horizon)[5]. The Owikeno area is a productive area, and the areas

[5] Information provided by the North Island – Central Coast (NICC) Forest District.

modelled for short term deferral are expected to contribute to the harvesting land base once existing second growth stands become merchantable, which is projected to be in about 40 years. The short term operability area concern contributes 10-13% of the harvest volume in the first forty years. The potential perpetual operability area contributes only 2-3% of the harvest volume over time. The short term operability areas make up 9% (12,781 ha) of the THLB while the potential perpetual operability areas make up 1% (1,390 ha) of the THLB.

4.4.2 Landscape-level Biodiversity for Old and Mid Seral

A minimum amount of old forest must be maintained within each Landscape Unit (LU) / Site Series Surrogate (SSS) combination in the TSA, while the amount of mid seral must be kept below a maximum target. Figure 23 shows a rolled up result for all of the spatial units (LU/SSS combinations) in the TSA over the planning horizon, indicating the amount of old and mid seral area relative to the required amount (target). In general terms, the minimum old seral constraints and the mid seral constraints appear to never be constraining. Old seral forest exists on ~72% of the PFLB for most periods when only 39% is required by the EBM objectives. Mid seral forests occur on ~8% of the PFLB for most periods when they are allowed to be as high as 50%. These general statistics are only for reference purposes as the targets must be met on individual LU/SSS unit areas.

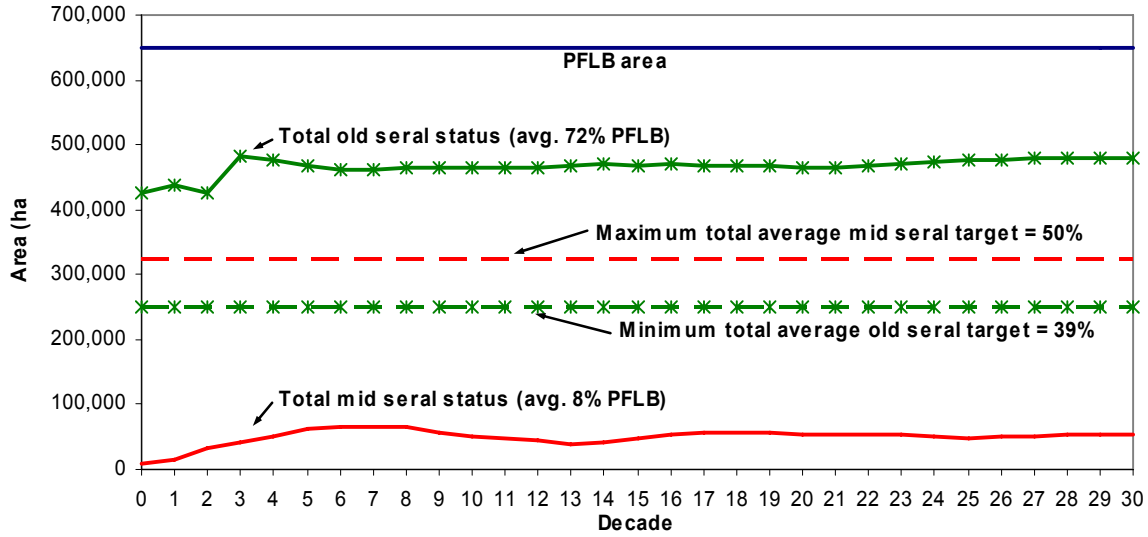


Figure 23. Old growth and mid seral forests relative to aggregated targets (Mid Coast TSA PFLB)

At the LU/SSS level, these constraints prove to be limiting in several situations (Figure 24). As a result of the old seral goals, almost 20% of the THLB is actively constrained across the entire planning horizon (Figure 24). This does not mean that the full 20% of the THLB is unavailable for harvest but that a portion of this area is unavailable because it must be retained to meet old seral objectives.

The mid seral target becomes constraining between years 20 and 80 for up to 6% of the THLB.

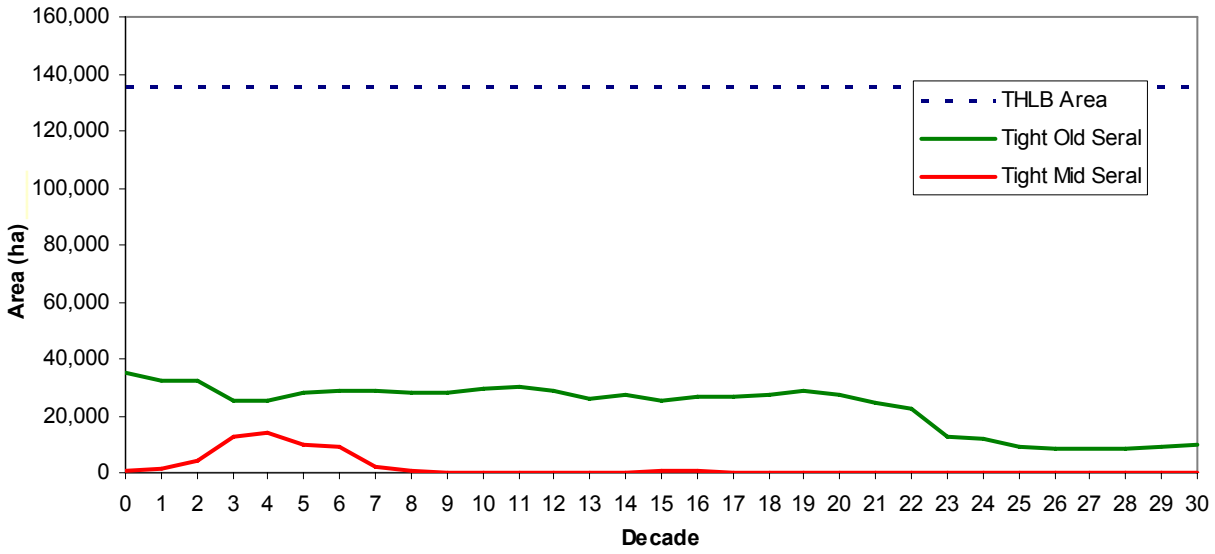


Figure 24. THLB area with tight constraints (actively limiting harvest) from old and mid seral limits

4.4.3 Black Tailed Deer Winter Range

The black tailed deer winter range had three different requirements for three different set of LU's. These three different requirements were:

a) a minimum of 25% of the PFLB older than 140 years over the whole planning horizon,
b) a minimum of 20% of the PFLB older than 140 years for the first four decades, then consistent with (a) for the rest of the planning horizon, and
c) a minimum of 20% of the PFLB older than 120 years for the first four decades, then consistent with (a) for the rest of the planning horizon.

Figure 25 presents the status of the aggregated minimum mature forest cover requirements for black tailed deer. This aggregation of all spatial units suggests requirements are easily satisfied over time and, in this case, a similar trend is seen in the individual Landscape Units. Because of overlapping objectives such as old seral, the requirement to meet 25% mature forest does not appear to limit harvesting in the model. A Landscape Unit example is shown below for Machmell LU.

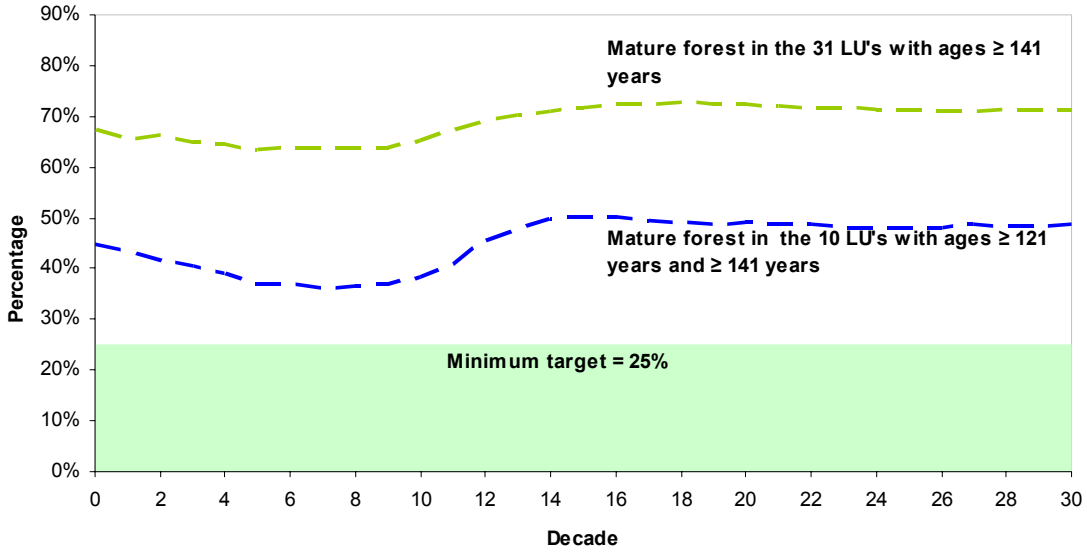


Figure 25. Aggregated forest cover requirements for black tailed deer winter range

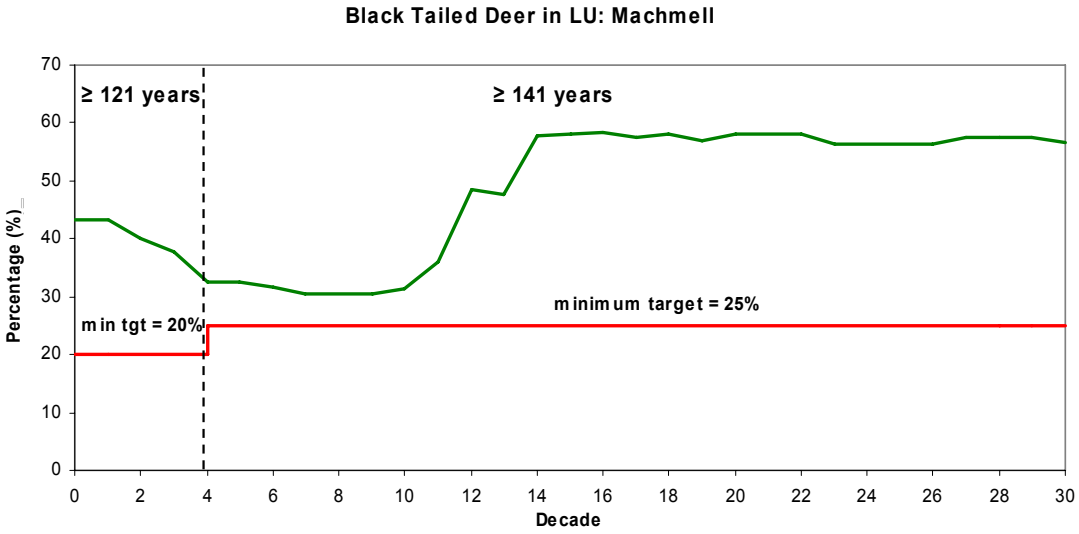


Figure 26. Forest cover requirements for black tailed deer in the Machmell LU

4.4.4 Upland stream

Upland streams were implemented as a maximum disturbance constraint on the upland portion of specific watersheds in order to provide for the maintenance of hydrological and ecological processes. Figure 27 provides an overall summary of the total area under upland stream constraints and the effective area with stands less than 9 m tall. In general terms, this graphs shows a non restricted condition (<30% under 9 m) but since this constraints was applied at a watershed level, individual performance will vary for each specific area.

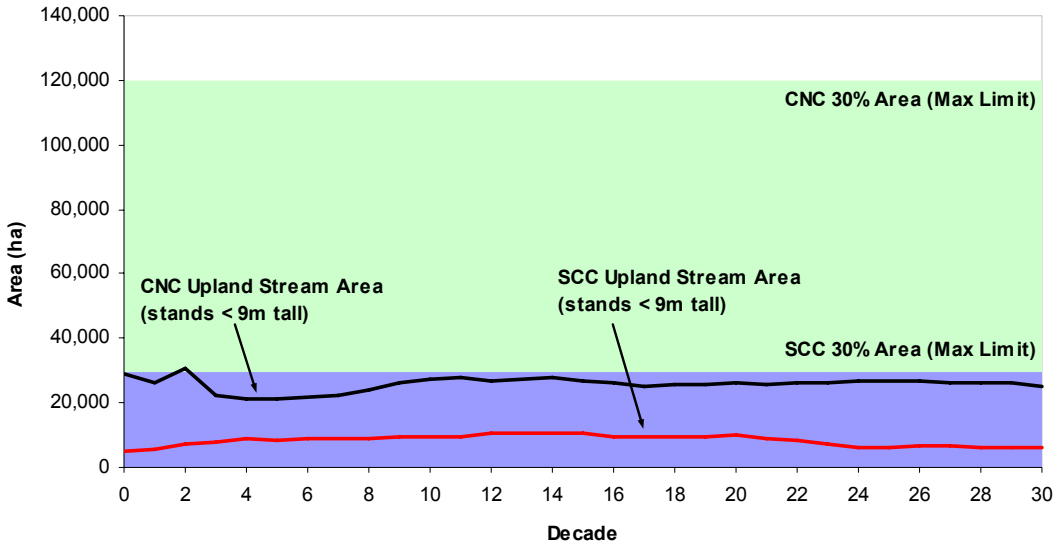
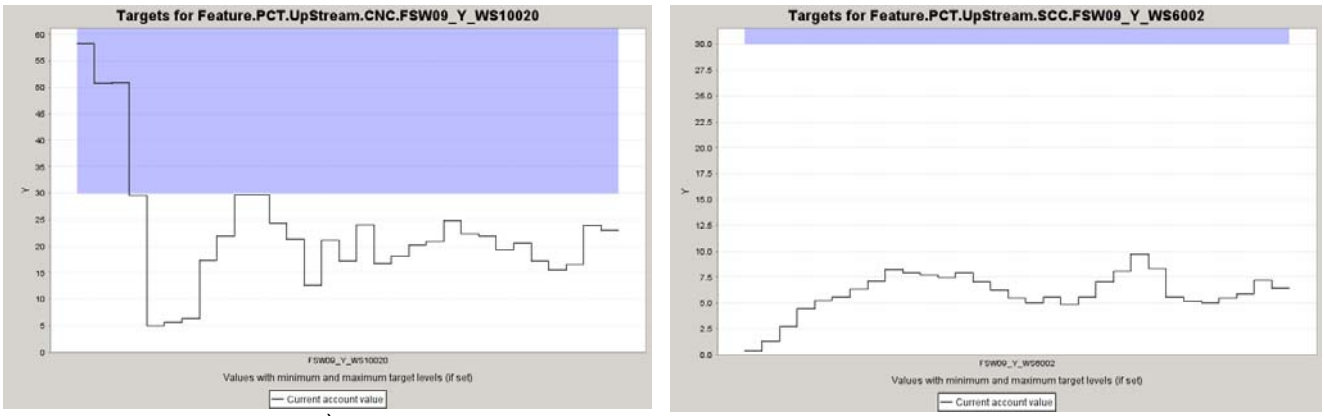


Figure 27. Total upland stream area and area with stands < 9 m tall by Ministerial Order

Figure 28a provides a case where the watershed begins the planning horizon exceeding the maximum requirements for stands under 9m tall, but then as stands grow, a large drop in the proportion of stands under 9m occurs. Once below the maximum, the model does not allow it to exceed 30% again. Figure 28b shows a case where the constraints never became a limiting factor and shows fluctuations around 10% for stands less than 9 m tall.



a) b)

Figure 28. LU level examples of upland stream conditions relative to maximum limits

4.4.5 Visually Sensitive Areas

Visually sensitive area were also seen to be actively limiting harvest in most harvest periods. Several of the hundreds of modeled VQO polygons were at or near their target disturbance limits throughout the planning horizon. The extent of the impact of the VQO constraints would be best understood through sensitivity analysis but limited resources prevented this sensitivity from being run.

5.0 Base Case Differences from TSR2

The 'reference forecast' described in the TSR2 AAC rationale document[6] is presented here as the TSR2 harvest forecast. It used the 'revised operability' landbase (THLB= 190,425 ha) but placed limits on the amount of volume that could come from outer coast (59,000 m^3/yr) and helicopter harvest (178,000 m^3/yr) stands. Without these controls, the harvest forecast was significantly more robust. A decade has been removed from the front end of the documented TSR2 flow because ~9 yrs have past since it was created.

Relative to the TSR2 flow presented below, the TSR3 base case shows a significantly reduced short term harvest but a slightly higher long term harvest forecast. This section summarizes and explains, where possible, the differences between the harvest flows. More details on the different inputs and assumptions included in the two analyses can be found in Section 3.6.

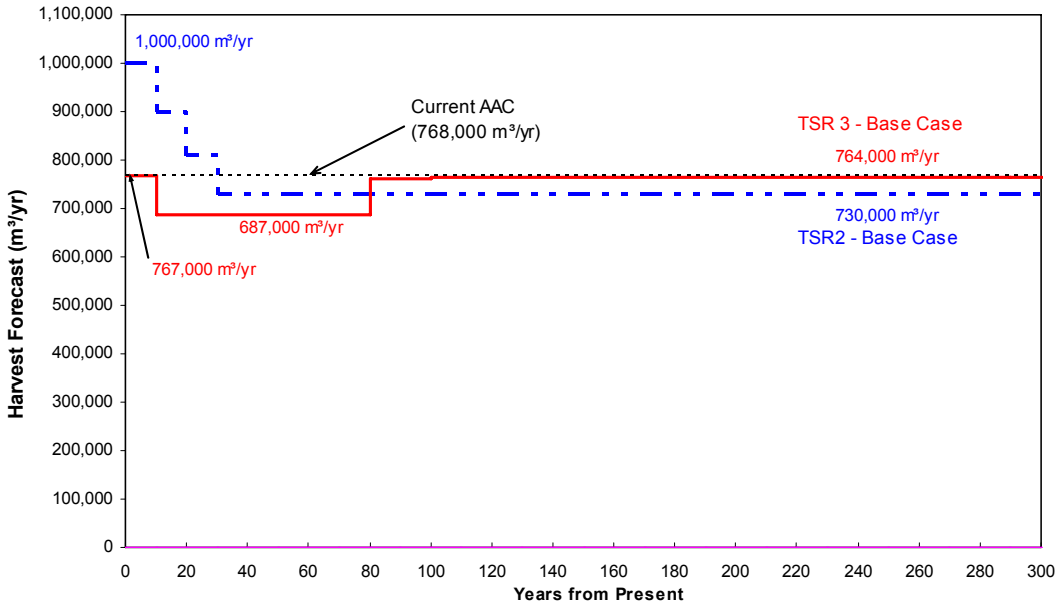


Figure 29. Mid Coast TSA TSR2 and TSR3 base case harvest projections

Downward pressures on TSR3 base case timber supply relative to TSR2

- 34% smaller THLB area (new parks and protected areas, new community forests, EBM objectives (FN's, grizzly, riparian, red/blue, FN values, red/blue listed species, etc). TSR2 THLB was 190,425 ha (preferred reference scenario).
- Ecosystem Based Management (EBM) forest cover requirements – specifically the old seral requirements and the mid seral limits reduced available timber in a number of periods.
- Introduction of wildlife habitat cover constraints (Ungulate Winter Range GAR orders, etc.)
- Modeling of dispersed retention silviculture systems (replaced forest cover constrains in P and R VQO's).
- Natural disturbances implemented in the non THLB.

[6] http://www.for.gov.bc.ca/hts/tsa/tsa19/tsr2/rationale.pdf (top of page 13)

Upward pressures on TSR3 base case timber supply relative to TSR2

- THLB reductions discussed above were partially offset by an expansion of the operable area (based on economic operability assessment), reduced thresholds to define low sites, refined approach to recreation netdowns).
- Site index adjustment (SIA) completed for managed Cw and Hw leading stands. Overall, the weighted average inventory site index on the THLB increases by 5 m, from 17.1 m to 22.5 m, when SIA are used for Cw and Hw leading stands.
- Harvest partitions were altered:
    - Outer coast harvest was limited to 20% of annual harvest volume instead of 5.9% (59,000 /998,000).
    - Heli harvest was not limited here but 'non-conventional inoperable' stands were limited to 178,000 m^3/yr in TSR2. The helicopter landbase used here is not the same area as the non-conventional landbase – they were determined using very different approaches.
    - Low site hemlock limit was kept almost the same (limited to 19% here vs 20% in TSR2).
- Use of improved seed and associated genetic gains increased future managed stand volumes (4.2% for western redcedar and 0.4% for Douglas-fir).

Unknown influence on timber supply relative to MP3

- Use of spatial stream data to do riparian netdowns.
- Updating of regeneration species mixes and densities.

There are other differences between the TSR3 and TSR2 analyses as listed in Section 3.6 but their impact on timber supply is unclear or very small.

6.0 Base Case Sensitivity Analyses

The data and assumptions used in timber supply analysis are often subject to uncertainty. To provide perspective on the impacts of changes to data or assumptions, sensitivity analyses are commonly performed. Usually only one variable (data or assumption) from the information used in the base case is changed in order to explore the sensitivity of that variable. Sensitivity analysis is a key component of any timber supply analysis process as it permits the determinant (the Chief Forester) to gauge the potential impact of uncertainty around assumptions and data that make up the base case. Sensitivity analyses help to frame the potential impacts of uncertainty by analyzing scenarios that are more pessimistic and more optimistic than the base case.

Table 3 provides a list of the sensitivity analyses completed on the TSR3 base case.

Table 3. TSR3 sensitivity analyses completed on the current practice base case

Sensitivity analysis	Analysis Element Change	Description of the Changes in Sensitivity Run
Size of THLB (larger)	Timber Harvesting Land Base	The THLB is increased by 14.9% (+18,957 ha) based on a reduced revenue (stumpage) assumption in the economic operability project (increase operable area with marginal stands).
Size of THLB (smaller)	Timber Harvesting Land Base	The THLB is decreased by 14.3% (-18,246 ha) based on an increased revenue (stumpage) assumption in the economic operability project (decrease operable area – exclude marginal stands).
Size of THLB (existing logged areas all included)	Timber Harvesting Land Base	The THLB is increased by 5.6% (+7,153 ha) based on the inclusion of previously logged stands excluded by the operability definition (increase operable area – all young).
Natural Stand Yields plus 10%	Natural stands	The volume associated with natural stands is increased by 10%.
Natural Stand Yields minus 10%	Natural stands	The volume associated with natural stands is decreased by 10%.
VDYP6 vs VDYP7	Natural stands	Compares growing stock estimates for natural stands using both VDYP6 and VDYP7.
Future dispersed retention modelled at 20% (instead of 10%)	Stands where dispersed retention is expected to occur in future (All R and P VQOs and 10% of PR VQO's)	Total retention is assumed to remain at 30% but be modeled as 10% aggregate and 20% dispersed (instead of 20% aggregate and 10% dispersed as in base case).
Minimum Harvest Ages (MHA) plus 10	All stands	Minimum harvest ages are increased by 10 years.
Minimum Harvest Ages (MHA) minus 10	All stands	Minimum harvest ages are decreased by 10 years.
Manage Cw/Yc Profile	Timber Harvesting Land Base	Ensure a minimum volume of 30% from western red cedar and yellow-cedar leading stands.
Drop Grizzly EBM requirements	Timber Harvesting Land Base	Put the grizzly EBM netdown areas back into the THLB when no other netdown is present.
EBM risk managed old seral targets	Targets for old seral stands	Replace the default EBM old seral targets with the risk managed target values.
Partition: Limit outer coast harvest to 10%	Harvest partitions.	Reduce the amount of harvest allowed from the outer coast from 20% to 10% per decade.
Partition: Limit the harvest in the Owikeno watershed	Harvest partitions	Exclude harvest from the short term concern areas for the first 4 decades and from the perpetual concern areas for the whole planning horizon.
Pre EBM with no changes in Parks	THLB + Constraints	The long term THLB is increased by 10% (+12,745 ha) when the EBM netdown (7,772 ha) are added back to the THLB and the non spatial netdown are dropped from 9% to 5.1%.
Pre EBM + 2004 version of Parks (Tweedsmuir, Hakai, Fiordland)	THLB + Constraints	The long term THLB is increased by 47% (+59,886 ha) when the 2004 Parks and EBM netdown are added back to the THLB and the non spatial netdown are dropped from 9% to 5.1%.

All the sensitivity scenarios present results based on a short, mid and long term perspective (or Initial, Mid and LTHL in the figures, respectively). For this analysis, the initial period generally refers to the first decade, the mid term generally referring to decades 2 to 8, and the long term generally referring to decade 10 and beyond.

All the sensitivity analyses were modelled with the goal of producing a similar harvest flow pattern to the base case harvest flow. This was done to make it easier to compare the impacts of the change relative to the base case while avoiding confusion created by subjective harvest flow decisions.

6.1 Size of Timber Harvesting Land Base

Several factors that determine of the size of the THLB have uncertainty around their definitions (operable area, problem types, low sites, riparian management, impacts from trails and landings, etc). Different market conditions in the future or changes in harvesting or milling technology can also serve to reduce or expand the land base considered to be economical.

It is not known if the THLB used in this analysis is over or under-estimated, so two sensitivity runs have been completed. These runs were based on a change in the operability criteria which resulted in an increase and decrease of the size of the THLB by 14.9% and 14.3%, respectively.

Methodology

Run	How was it Analyzed?
a. Timber harvesting land base +14.9%	An alternative (larger) operable area was used in the landbase netdown. This operable area was developed using a lower average stumpage target in the economic operability assessment[7] - which would have allowed more marginal stands to be included in the operable area. The new netdown resulted in a THLB that was larger by 14.9%. This was modeled by proportionally adjusting block areas using AU specific adjustments. AU specific adjustments were used because they were better able to reflect the types of stands now being included in the THLB. The size of each non-THLB block was reduced by an offsetting proportion that kept the total PFLB area the same.
b. Timber harvesting land base -14.3%	An alternative (smaller) operable area was used in the landbase netdown. This operable area was developed using a higher average stumpage target in the economic operability assessment - which would have pushed the most marginal stands out of the operable area. The new netdown resulted in a THLB that was smaller by 14.3%. Implementation was the same as described in (a) above.
c. Timber harvesting land base +5.6%	The netdown was redone with any previously logged areas that were originally classified as inoperable added into the operable landbase. This new netdown increased the THLB by 5.6%. The area of logged blocks in the THLB was increased proportionately in order to focus the additional area in young age classes. An offsetting reduction was applied to the logged area of the non THLB to keep the total PFLB area the same. This essentially shifted an area of young stands from the nonTHLB to the THLB.

Results are shown in the graph and table below.

[7] http://www.forsite.ca/MidcoastTSR3/files/MC_EconOperability_Report_March31-09.pdf (Forsite 2009).

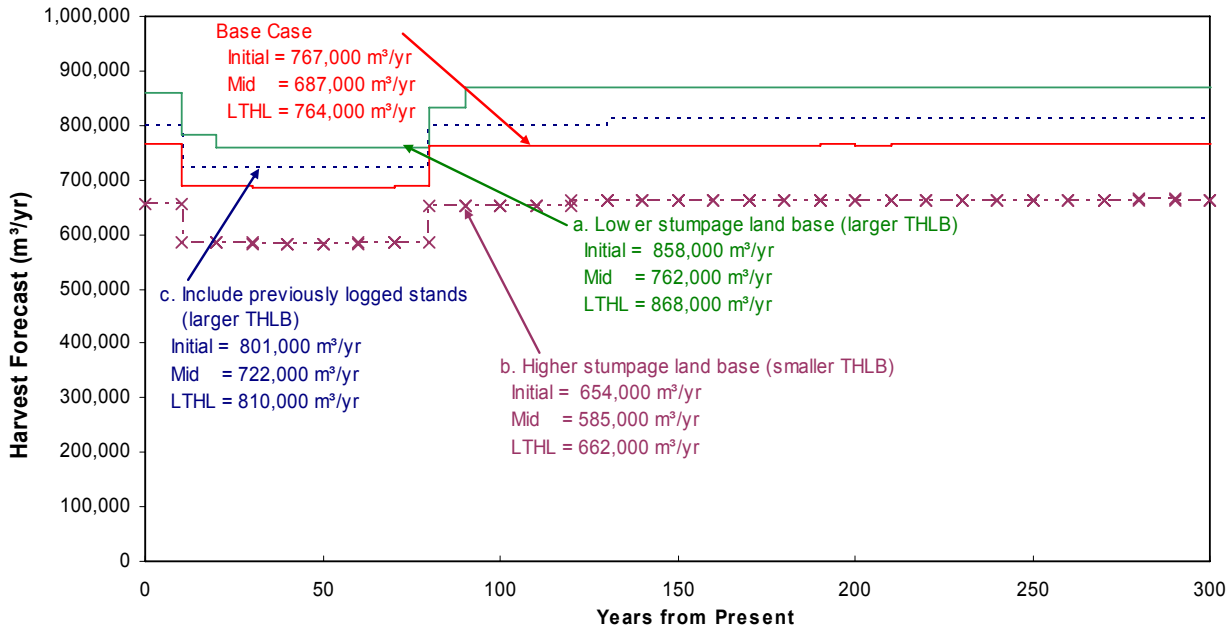


Figure 30. Alternative Timber Harvesting Land Base harvest forecasts

Results

Run	Initial	Mid Term	Long Term
a. Timber Harvesting Land Base +14.9%	Increase in the initial harvest level of 12% to 858,000 m³/yr	Average increase in the mid term harvest level of 11% to 762,000 m³/yr	Average increase in the long term harvest level of 14% to 868,000 m³/yr
b. Timber Harvesting Land Base –14.3%	Decrease in the initial harvest level of 15% to 654,000 m³/yr	Average decrease in the mid term harvest level of 15% to 585,000 m³/yr	Average decrease in the long term harvest level of 13% to 662,000 m³/yr
c. Timber Harvesting Land Base +5.6%	Increase in the initial harvest level of 4% to 801,000 m³/yr	Average increase in the mid term harvest level of 5% to 722,000 m³/yr	Average increase in the long term harvest level of 6% to 810,000 m³/yr

A percentage increase or decrease in the THLB typically has a roughly proportional impact on the harvest flow and the results illustrate this. However, increases in the THLB tend to have a slightly lower proportional increase in the harvest flow and decreases in the THLB tend to have a slightly higher proportional decrease in the harvest flow.

For the scenarios that changed THLB areas by adding/removing marginally economic timber, the disproportionate shifts are partly explained by the types of stands being added/removed. When the least economic stands are removed (THLB shrinks), the average productivity of the remaining stands tends to increase, while the opposite is true when marginal stands are added in (THLB increases).

When only young stands are added to the THLB (previously logged areas), impacts are seen less in the short term and more in the mid and longer term because this is when the extra area is able to contribute to the harvest schedule.

6.2 Natural Stand Yields

Stand yields are a critical input into timber supply analysis. The short and mid term timber supply is heavily influenced by the availability of timber in natural stands that make up the current growing stock. The current

standing and mature timber provide the timber harvesting opportunities before managed stands come online for harvest.

Figure 17. Natural vs managed stand harvest profile for the base case

indicates that the harvest of natural stands diminishes extremely quickly after the 6th decade, at which time managed stands start to become more important to the timber harvest profile.

Uncertainty in timber yields can result from many different factors. Natural stand yields are based on the VDYP yield model, which predicts yields from stand attributes in forest inventory maps. Inaccuracies in the model, in decay estimates, or stand attributes can create uncertainties around actual stand yields.

Methodology

Run	How was it Analyzed?
a. Natural Stand Yields plus 10%	The yields associated with each natural stand analysis unit were increased by 10% (100 series AU's)
b. Natural Stand Yields minus 10%	The yields associated with each natural stand analysis unit were decreased by 10% (100 series AU's)

Results are shown in the graph and table below.

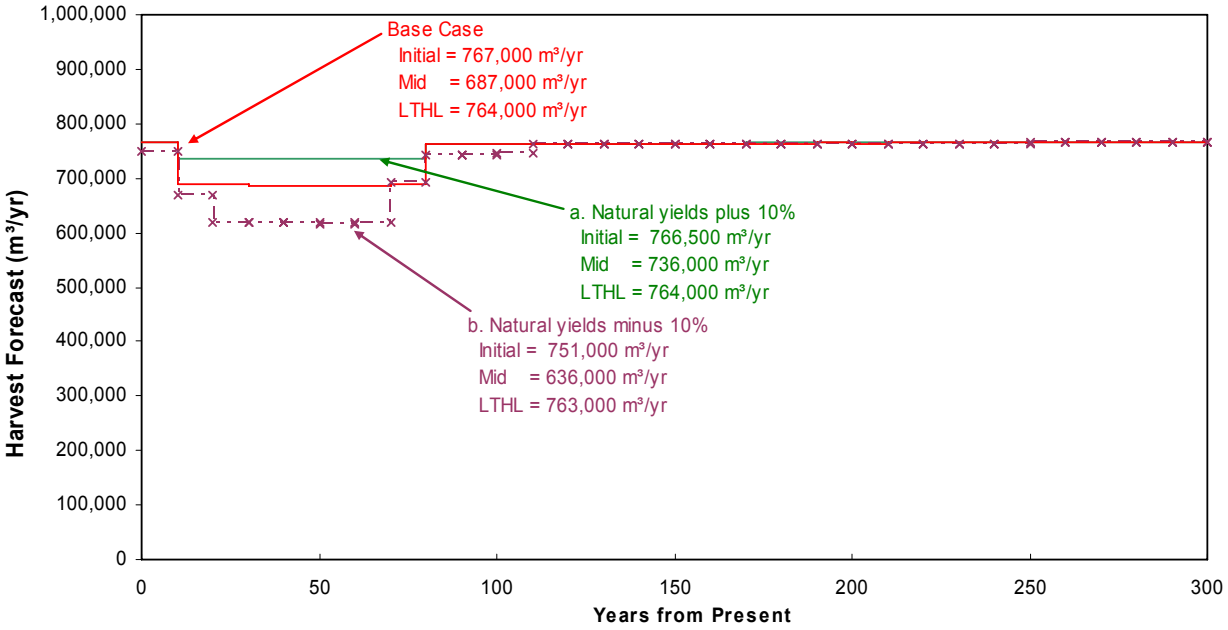


Figure 31. Alternative natural stand yield harvest forecasts

Results

Run	Initial	Mid Term	Long Term
a. Natural Stand Yields plus 10%	Minor decrease in the initial harvest level of 0.1% to 766,500 m³/yr	Average increase in the mid term harvest level of 7% to 736,000 m³/yr	No change by staying at 764,000 m³/yr
b. Natural Stand Yields minus 10%	Decrease in the initial harvest level of 2% to 751,000 m³/yr	Average decrease in the mid term harvest level of 7% to 636,000 m³/yr	Minor decrease in the long term harvest level of 0.1% to 763,000 m³/yr

Natural stands are the main source of volume during the first 6 decades and thus a decrease or increase in their yields has an immediate impact on short and mid term harvest flow. When more volume is present, it can

be metered out faster while waiting for managed stands to come online. When less volume is present, it must be metered out more slowing. These scenarios have no change in the long term.

A 10% increase in the natural stand yields has no impact on the initial harvest level but it has a 7% increase in the harvest level for the next 7 decades (years 11 to 80 from present). This occurs because additional volume is available only on the portion of the harvest profile coming from natural stands. A larger increase in harvest could have been implemented in the initial period with a subsequent lower gain in the mid term but the objective was to mimic the flow regime from the base case. Thus, the resulting harvest flow significantly decreases the drop of the mid term period by bringing it up almost to an even flow type.

A 10% decrease in natural yields results in a 2% drop in the initial period and a 7% drop in the mid term relative to the base case (Figure 31).

6.3 Use of VDYP7 to Estimate Natural Stand Yields

The Forest Inventory and Analysis Branch of the MFR recently adopted the VDYP7 yield prediction model as the standard tool for estimating volumes for stands in the provinces inventory files. The analysis described in this report was completed using the older (VDYP6 model) to predict natural stand yields because VDYP7 was not yet ready when yield curve development occurred. Because the VDYP7 model is now the official version, a sensitivity was designed to explore the differences that would have resulted from using VDYP7.

How was it Analyzed?

This sensitivity did not involve timber supply modeling but is rather a comparison of the initial growing stock in the TSA's THLB, when projected using VDYP6 vs VDYP7. The following describes how this comparison was made:

- A lookup table was created so that feature id's from the VDYP7 inventory file could be linked with the VDYP6 inventory file using GIS (97%+ of the polygons were identical – only the VRIMS updated polygons were different).
- The forest cover with the VDYP6 volume projections was projected forward by 1 year using VDYP6 batch v.6.6d so that the projection year for each Forest Cover was the same (2008).
- Comparisons were only made where there was a one to one relationship between the inventory files and polygons had identical ages and areas.
- The projected age from the resultant (VDYP6 forest Cover) that had depletions reflected was used to limit the volumes being compared to stands >60 years old. This ensured the areas being compared were the same and that depletions applied against the resultant (VDYP6) were reflected in the VDYP7 volumes.
- A total of 102,848 ha over 60 years old was able to be compared. This is approximately 75% of the THLB area but represents >97% of the area >60 yrs old.

Results

Using VDYP 7 as the growth and yield model for natural stands in this TSR analysis would have resulted in approximately 5.5% more natural stand volume on the THLB (Table 4). The VDYP 7 model suggests that there is an additional 3.2 million m^3 of standing inventory currently on the THLB. This volume can be distributed over the short and mid term decades and would have allowed a higher short term harvest level and/or a higher mid term trough. Based on the harvest flow selected for the 'Natural stand yields +10%' sensitivity presented above (section 6.2) we would expect the midterm trough to be reduced by ~24,500 m^3/yr (or a higher initial harvest flow could be achieved).

Table 4. Comparison of VDYP6 and VDYP7 inventory volumes for THLB stands >60 yrs old

Forest Inventory Projection Tool	Area (ha)	Volume (m^3)	% Change
VDYP6	102,848	58,842,921	-5.2% of VDYP7
VDYP7	102,848	62,072,569	+5.5% of VDYP6

This occurred because VDYP7's regression equations produce different (more accurate) estimates of volume. This is due partly to updated site index curves from new research projects, the use of basal area instead of crown closure, and the use of BEC based (ecological) factors to predict taper and loss factors instead of forest inventory zones (FIZ).

Table 5 shows the approximate percent difference of VDYP 7 volumes relative to VDYP 6 volumes by species. In general balsam, cedar, and hemlock volumes are larger using VDYP7, while other species volumes are smaller.

Table 5. Comparison of VDYP6 and VDYP7 inventory (THLB >60 yrs old) by leading species

Leading Species Group	Percent difference relative to VDYP6
Balsam	1.1%
Cedar	8.6%
Douglas-fir	-5.3%
Hemlock	6.2%
Other	-4.6%
Spruce	-11.7%

6.4 Future Dispersed Retention

When dispersed retention or scattered trees are retained in harvest units, they can have a significant impact on initial harvest yields and growth rates of regenerating stems underneath the retention. Base case modeling of this practice assumes a total retention of 30% in areas where dispersed retention is expected to be used (highly constrained visual areas). This is assumed to consist of 10% dispersed retention while the remainder is in patches/groups or along the block edge. This sensitivity is designed to test the impact of increasing the amount of dispersed retention to 20% while the other 10% remains in patches and along block edges.

Methodology

Run	How was it Analyzed?
Increased dispersed retention in highly constrained visual areas.	The 7,185 ha of THLB that had DR applied in the base case had dispersed retention increased from 10% to 20% (spatially retained in model). This is incremental to the 4.4% retention applied to all THLB stands for stand level retention. Thus, first harvest entries into these DR stands had 24.4% of their area retained from harvest. The regenerating yields on these stands were modeled in TIPSY in the same manner as the base case but assuming 20% dispersed retention instead of 10%. This provided a percentage impact factor to be applied to the standard yield curves. This resulted in yield curves that were 22% to 41% lower, and this was in addition to the growing site losses discussed in the paragraph above. The net result of the 10% additional DR was an additional volume loss of ~15-20% on the 7,185 ha of THLB with DR modeled.

Results are shown in the graph and table below.

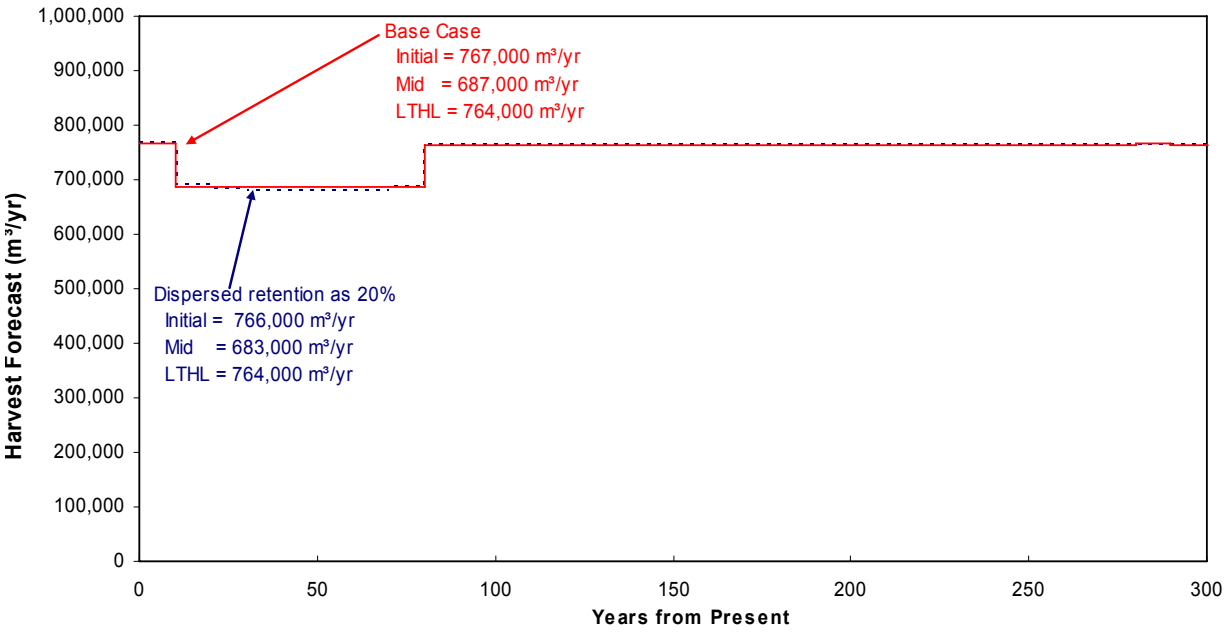


Figure 32. Harvest forecast using increased dispersed retention in highly constrained visual areas

Results

Run	Initial	Mid Term	Long Term
Increased dispersed retention in highly constrained visual areas.	Minor decrease in the initial harvest level of 0.2% to 766,000 m³/yr	Average decrease in the mid term harvest level of 1% to 683,000 m³/yr	No change shown because the 1% impact is within modeling tolerance (764,500 m³/yr)

The shifting of 10% retention from patches to dispersed retention does not have a significant impact to the harvest projection because the additional impact of 15-20% at the stand level is only applied to 7,185 ha (highly constrained visual areas – 5.8% of total THLB) so the scale of the impact is quite small when viewed from the entire TSA perspective (15-20% of 5.8% = 1% impact).

6.5 Minimum Harvest Ages

Uncertainty around the age that stands become merchantable for harvest is linked to both our ability to predict the future growth of stands and our ability to understand future conditions that will define merchantability (markets / products). The minimum harvest age was selected based on achieving a minimum volume/ha and a minimum diameter, while ensuring for future stands a harvest level within 90% of the culmination MAI age.

The large majority of minimum harvest ages used in the base case scenario was driven by the diameter criteria (56%) followed by the MAI criteria (33%).

The use of minimum harvest ages derived considering maximum MAI's tends to optimize long term harvest levels, but allowing stands to be harvested when they are first merchantable provides flexibility in the transition from short to long term harvest levels. The transition from short to mid term harvest levels in the TSR is heavily influenced by when managed stand volumes become available in significant quantities. It is unknown if there are more appropriate minimum harvest ages than those used in the base case, so sensitivity runs have been completed to explore the impact of both higher and lower harvest ages.

Methodology

Run	How was it Analyzed?
Min Harvest Ages decreased by 10 yrs	Minimum harvest ages for each AU were decreased by 10 years.
Min Harvest Ages increased by 10 yrs	Minimum harvest ages for each AU were increased by 10 years.

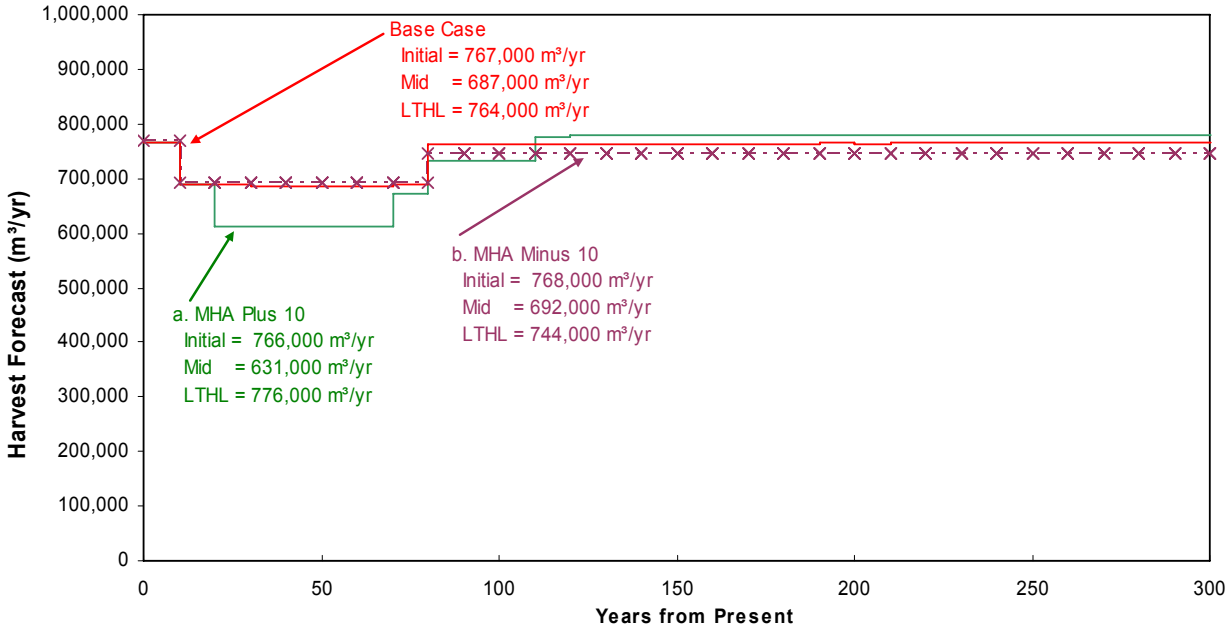


Figure 33. Minimum harvest ages increased (a) and decreased (b) by 10 years

Results

Run	Initial	Mid Term	Long Term
a. Min Harvest Ages increased by 10 yrs	1,000 m^3/yr lower	Average decrease in the mid term harvest level of 8% to 631,000 m³/yr	Average increase in the long term harvest level of 2% to 776,000 m³/yr
b. Min Harvest Ages decreased by 10 yrs	1,000 m^3/yr higher	Average increase in the mid term harvest level of 1% to 692,000 m³/yr	Average decrease in the long term harvest level of 3% to 744,000 m³/yr

Figure 33 shows that decreasing harvest ages by 10 years has a minor impact on the harvest flow. There are small gains in the short and midterm because of increased harvest flexibility, while long term flows are slightly worse off as typical harvest ages are getting further away from culmination ages. The increased access to younger stands in the mid term does not lead to an improvement in harvest flow because these stands would have to be harvested with lower volume/ha – offsetting any gains from having these stands available.

A significant decrease (-8%) in mid term harvest flow occurs as a result of increasing minimum harvest ages by 10 years. Figure 33 shows that a 10 year delay in when managed stands become available has a direct impact on the mid term. However, these longer rotations result in harvesting occurring closer to culmination age in the long term and an increase in the long term flow (+2%).

The timing of the transition from natural to managed stands is a critical point in this harvest forecast. Any delay in managed stands coming online has the potential to significantly impact the harvest flow.

6.6 Manage Cedar Harvest Profile

A harvest profile that is too dependant on one species or another in a specific period of the planning horizon can indicate an unachievable or undesirable solution. This sensitivity has been designed to explore the timber supply implications of maintaining a minimum harvest volume of cedar logs in each period. This scenario was setup to require at least 30% of the harvest to come from cedar leading stands in each period. Cedar leading stands was used as a surrogate for cedar volume because it was not practical to model/manage cedar volume from all stand types.

Methodology

Run	How was it Analyzed?
Manage cedar profile	Ensure harvest from cedar leading AU's makes up at least 30% of the total harvest in each period. This is a surrogate for managing actual cedar harvest.

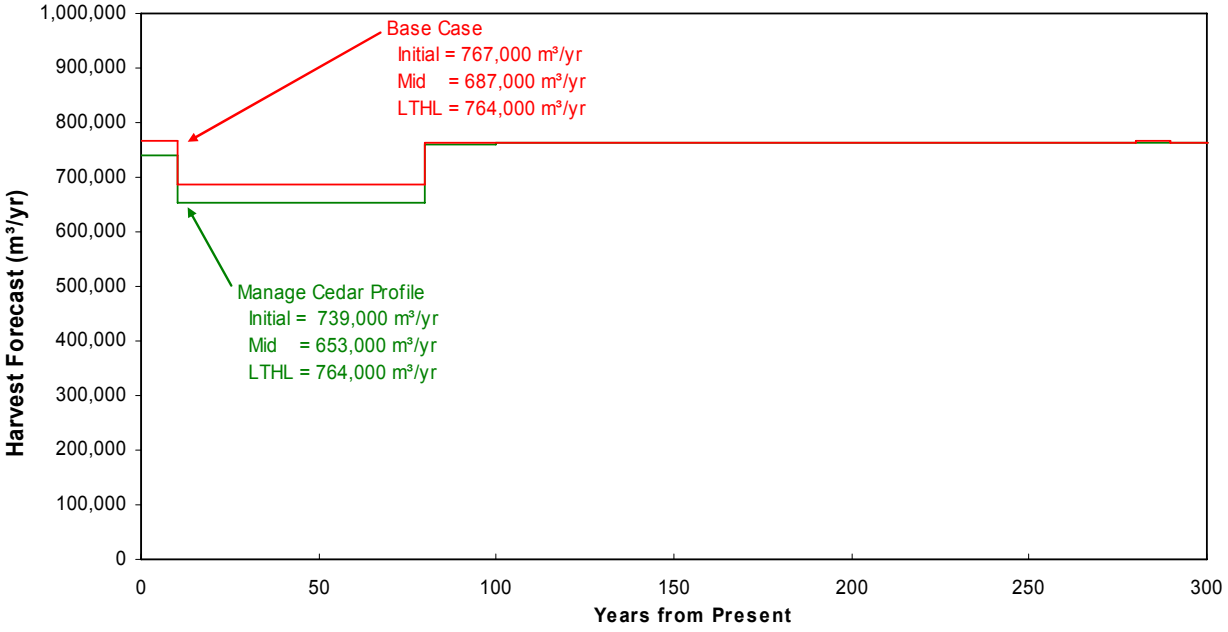


Figure 34. Manage cedar profile to a minimum of 30% of the periodic harvest level

Results

Run	Initial	Mid Term	Long Term
Manage cedar profile	A decrease in the initial period of 4% to 739,000 m³/yr	Average decrease in the mid term harvest level of 5% to 653,000 m³/yr	No change.

The 30% minimum requirement for cedar leading stands can be met but at the expense of harvest flow in the short and mid term. This occurs because the managed stands that come online first are dominantly hembal leading stands and there is little else to harvest during this transition time. Thus, the model has to move cedar volume from earlier periods to cover the gap in this period.

Harvest availability in the MidCoast TSA is defined in part by past harvest activity. Figure 9 illustrates that there is a significant amount of Hemlock-Balsam that does not currently meet minimum harvest age criteria, nearly double that of the cedar-cypress group. Meanwhile there is an abundance of cedar-cypress that does meet minimum harvest age criteria now, while hemlock-balsam group is significantly less. This situation is an

artefact of past harvest history. This cycle can only be expected to cycle throughout the planning horizon as the model is not preferential to a particular species or revenue objective in the base case.

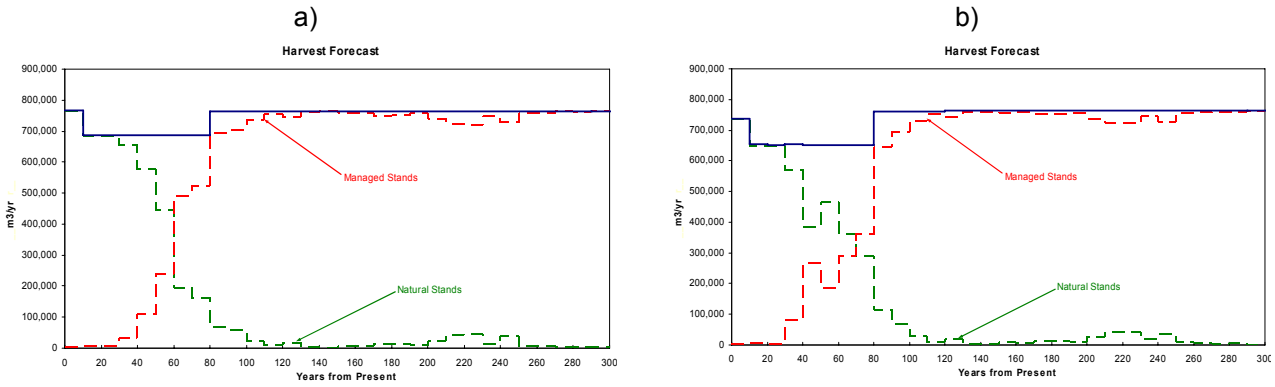


Figure 35. Transition of natural stands to managed stands: base case vs manage cedar profile

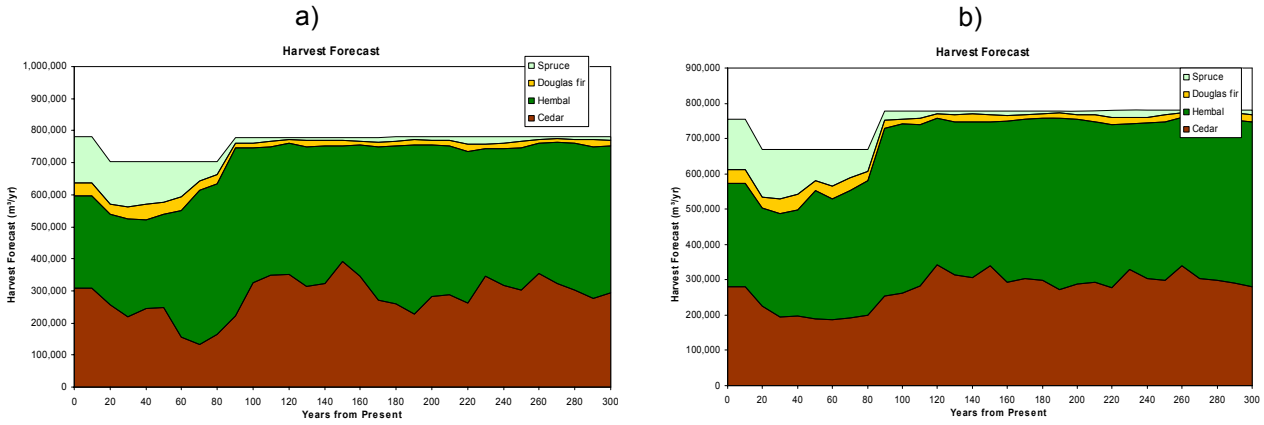


Figure 36. Harvest flow estimation by species: base case vs manage cedar profile

Figure 35 shows an important shift in the transition of natural to managed stands in this sensitivity run (b) compared to the base case transition (a). More volume is coming from the first cohort of managed stands earlier in the harvest schedule so that they can be mixed with cedar volume in existing natural stands. This reduces the sudden shift to managed stands in years 60-80, with its high proportion of hemlock, and provides a more even harvest of cedar volumes.

The consequence of doing this is that managed stands are now being harvested at a lower age with lower volumes, which reduces the harvest flow. Figure 36 shows the smoothening of the cedar leading stand harvest profile between years 60 and 90 relative to the base case. There is evidence that most of the volume is redistributed from neighbouring periods in order to fill up the gap.

6.7 Drop Grizzly EBM Requirements

Grizzly bears are a highly important regional species on the South Central Coast and Central and North Coast. The EBM orders spatially identify grizzly bear habitat and require that it be maintained as functional habitat (Objective 17). This sensitivity analysis aims to quantify the impact of these grizzly reserves on the forested landbase.

Methodology

Run	How was it Analyzed?
Drop Grizzly EBM requirements	Drop EBM grizzly habitat netdown. Since it was the last netdown applied, it was possible to simply add these areas (2,662 ha) back into the THLB (~2% increase in THLB).

Results

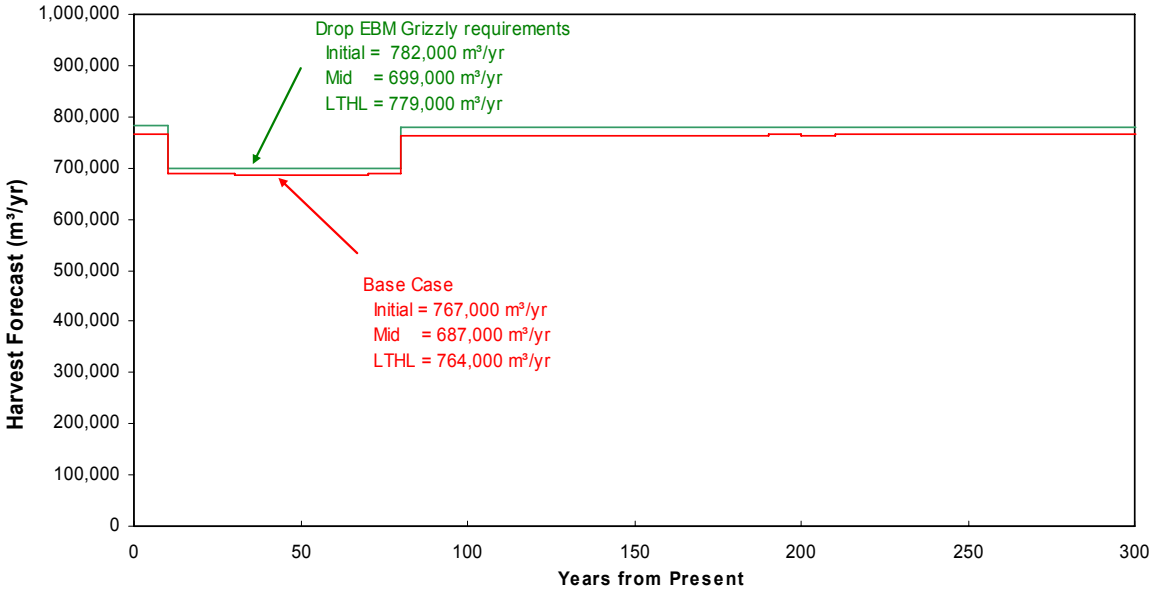


Figure 37. Impact of allowing harvesting in a portion of the mapped EBM Grizzly habitat

Run	Initial	Mid Term	Long Term
Drop Grizzly EBM requirements	Increase of the initial harvest level of 2% to 782,000 m³/yr	Average increase of the mid term harvest level of 2% to 699,000 m³/yr	Average increase in the long term harvest level of 2% to 779,000 m³/yr

Figure 37 shows a proportional increase in the harvest flow (+2%) relative to the increase in the THLB area (+2%). It should be noted that the vast majority of the mapped EBM grizzly bear habitat remained out of the THLB because of overlaps with other netdowns.

6.8 'Risk Managed' Old Seral Requirements

The CNC and SCC orders define old forest as a stand of trees 250 years or older, and then requires that a specific amount of old forest is retained within each landscape unit and Site Series Surrogate (SSS)[8]. The details of this can be found in Schedules 4, 4b, 4c, 4d (SCC) and 4, 4b, 4c (CNC) of the EBM orders. For simplicity, the default targets for old seral retention were used in the base case for all units. This sensitivity analysis explores the harvest flow impacts of the other extreme where Risk-Managed targets are adopted for all old seral retention units. These targets reduce the percentage of old growth that must be maintained in specific landscape units in the TSA once a specified list of activities has been completed ensuring that, for example, the habitat requirements for focal species have been addressed.

[8] Site Series Surrogate (SSS) are groupings of stand types within BEC variants. There are 13 potential stand groupings that can occur within each BEC variant that are a function of leading species and site index. For example, Stand type#1 = Fd leading with SI > 27.

Methodology

Run	How was it Analyzed?
EBM 'Risk- Managed' Old Seral Targets	Old seral requirements were modeled using forest cover constraints or objectives (e.g. min 20% > 250 yrs) in each LU/SSS combination. This sensitivity changed the target requirements (%'s) for old seral to a new set of targets that have lower requirements based on Schedule 4 in the EBM orders (Risk Managed targets).

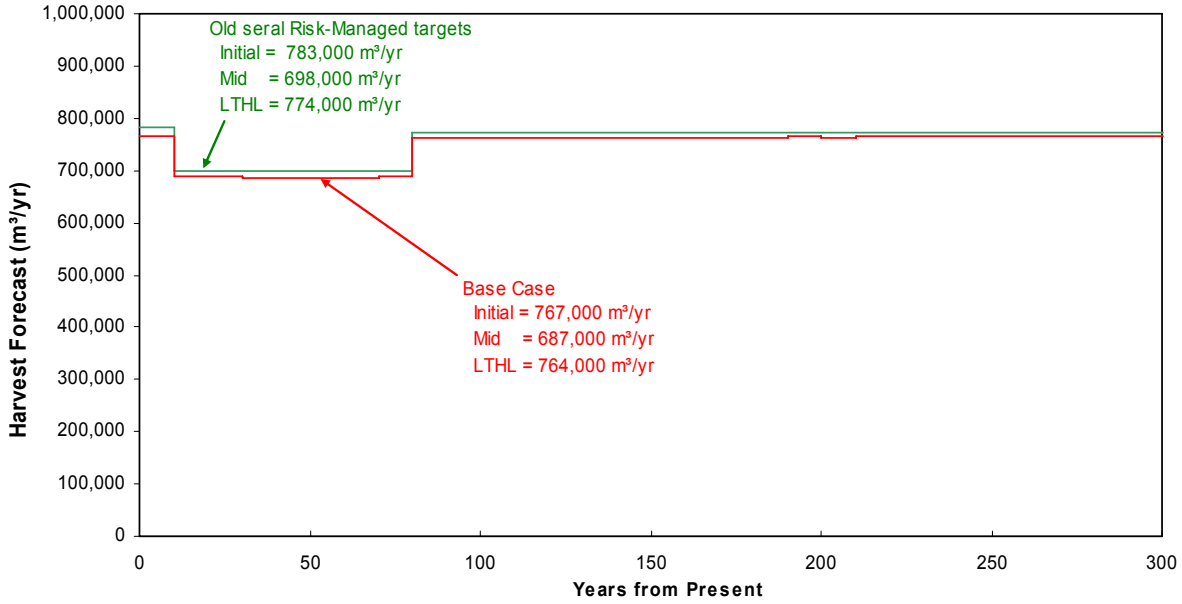


Figure 38. Harvest flow using EBM Risk-Managed targets for old seral requirements

Results

Run	Initial	Mid Term	Long Term
EBM 'Risk- Managed' Old Seral Targets	Increase of the initial harvest level of 2% to 783,000 m³/yr	Average increase of the mid term harvest level of 2% to 698,000 m³/yr	Average increase in the long term harvest level of 1% to 774,000 m³/yr

Figure 38 shows that adopting the 'risk-managed' old seral targets has a slight positive impact (+2%) on the harvest flow in the short and midterm. This occurs because the reduction in old seral requirements translates into more stands being available for harvest over time.

To understand the implications of adopting the risk managed targets, the initial condition of the land base was assessed relative to both sets of targets. The results showed that the old seral requirements in the TSA drop by 28% (from 250,979 ha down to 179,913 ha) when the Risk-Managed targets are applied. This change does not translate into significant gains in timber supply because much of this area was in the non THLB and thus releasing it does not translate into increased timber harvesting opportunities. The areas that are constraining in the base case, may not have had any reduction in old seral requirement under the Risk Managed target.

6.9 Outer Coast and Owikeno Harvest Profiles

In order to understand the harvest flow dynamics associated with the volume contributions from the Outer Coast and specific basins in the Owikeno watershed, sensitivity analysis were completed where constraints were placed on these areas. The outer coast harvest was an issue of concern in the last TSR analysis while concerns with the economic viability of some basins in the Owikeno watershed have been raised by MFR District staff in this TSR. The THLB stands in these basins were shown to be viable in the economic operability project (Forsite 2009[9]). All parties agree that this is a difficult place to operate in the TSA but the licensee currently working in this area (Kvamua Enterprises - Wuikinuxv First Nation) has harvested timber there in the last two years and has more planned in the future. This sensitivity was designed to assess the impact of dropping or deferring the Owikeno areas shown in Figure 39 (THLB reductions and deferrals).

Methodology

Run	How was it Analyzed?
a. Limit harvest volume contribution from outer coast to 10%.	Limit the volume contribution from the outer coast to 10% of the periodic harvest level (instead of 20%). Outer coast zone is consistent with the area identified and mapped in TSR2.
b. Limit harvest volume contribution from specific Owikeno watershed areas	Prevent harvest for 4 decades from the areas suggested as having short term concerns (12,781 ha), plus completely exclude harvest from areas with suggested perpetual concerns (1,390 ha).

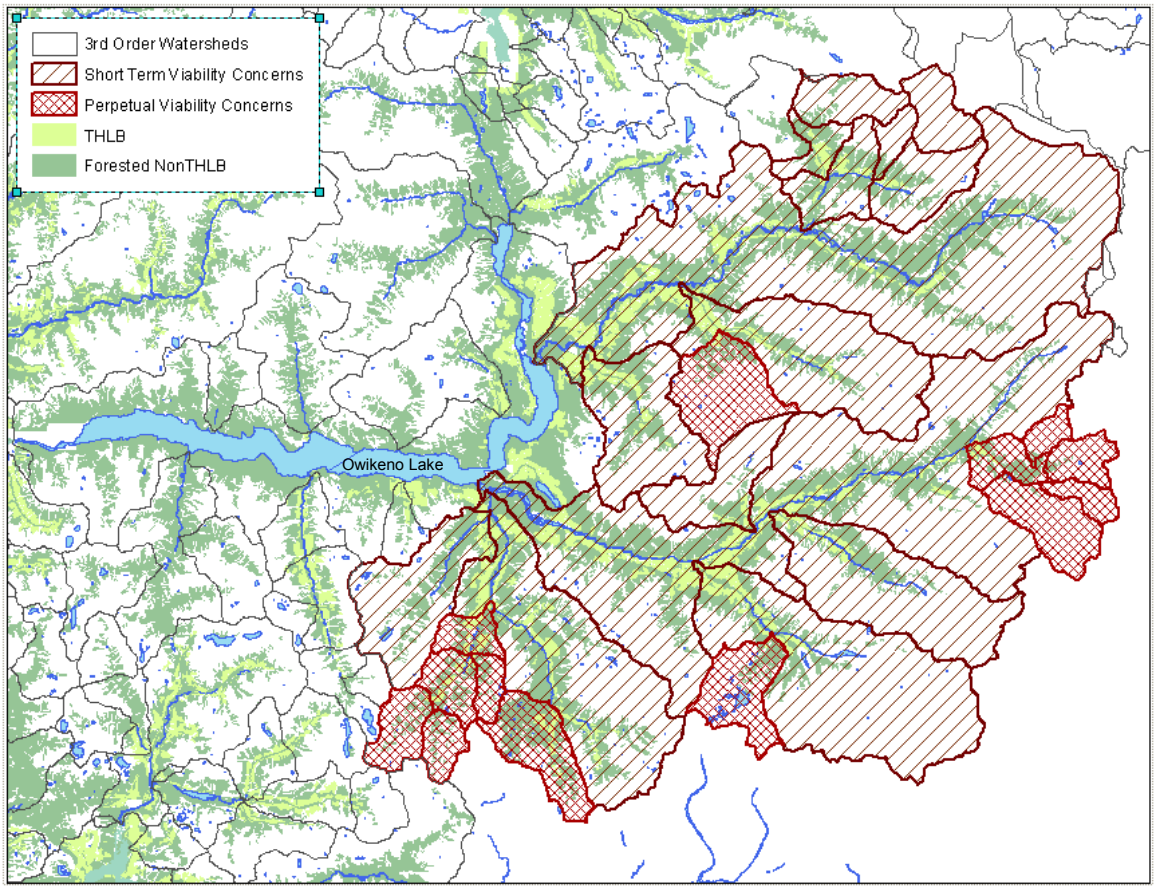


Figure 39. Owikeno watersheds with operability concerns as identified by MFR

[9] http://www.forsite.ca/MidcoastTSR3/files/MC_EconOperability_Report_March31-09.pdf

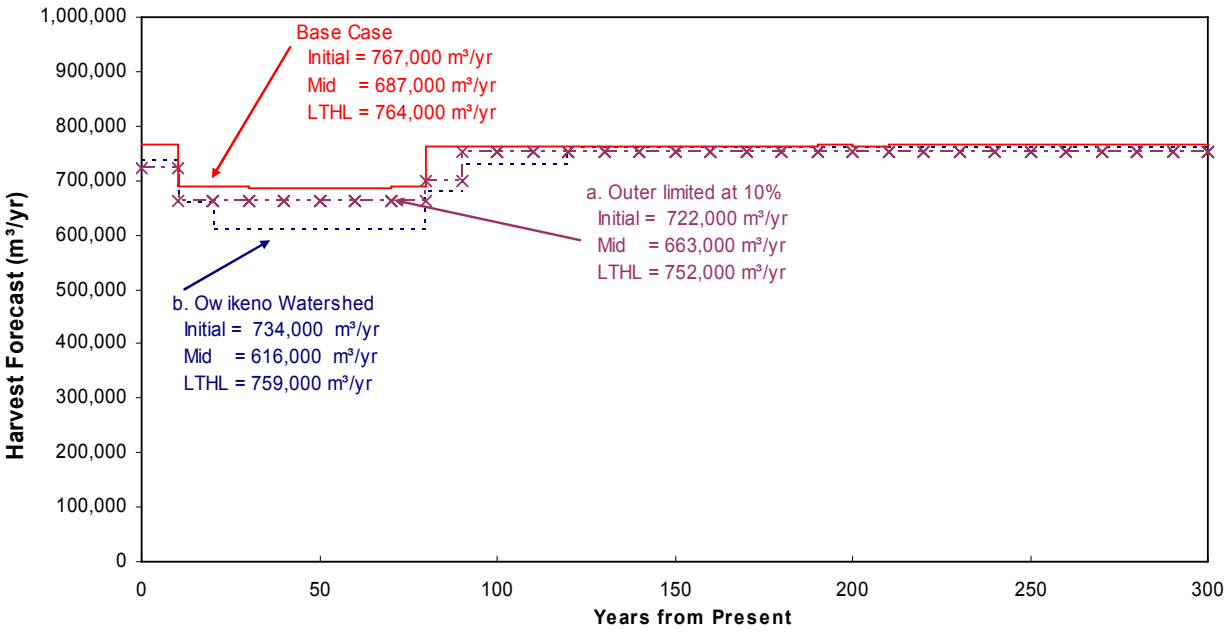


Figure 40. Harvest forecast with alternative limits on outer coast and Owikeno harvest contributions

Results

Run	Initial	Mid Term	Long Term
a. Limit harvest volume contribution from outer coast to 10%.	Decrease of the initial harvest level of 6% to 722,000 m³/yr	Average decrease of the mid term harvest level of 3% to 663,000 m³/yr	Average decrease in the long term harvest level of 2% to 752,000 m³/yr
b. Limit harvest volume contribution from specific Owikeno watershed areas	Decrease of the initial harvest level of 4% to 734,000 m³/yr	Average decrease of the mid term harvest level of 10% to 616,000 m³/yr	Average decrease in the long term harvest level of 1% to 759,000 m³/yr

Reducing the allowable contribution of the outer coast to 10% results in a 6% reduction in short term harvest and 2-3% reduction in the mid and long term harvest. Figure 41 shows that limiting the outer coast to 20% in the base case does not impact the harvest forecast because the highest value achieved is only 18%. However, when the limit is reduced to 10%, it becomes limiting in the majority of periods. When a 15% limit is used, there is essentially no impact to the harvest schedule because the model is able to shift the timing of stands to satisfy the objective.

The area identified as THLB in the outer coast area has the following characteristics:

- It represents 18.9% of the total THLB,
- 75.6% of the area is cedar
- 12.9% of the area is low or poor hemlock
- All of the area was evaluated to be economic in the economic operability analysis.

Annual licensee reporting information supplied by MRF staff indicates the amount of outer coast harvest ranged between zero and 20 percent of annual harvest volume in the TSA (2000-2008), with some of the best performance occurring in the most recent years (20% in 2007 and 17.7% in 2008). Given that not all of the outer coast area is administratively available for harvest activity because it has not been made available to any license holder in the TSA, the recent performance in the Outer Coast confirms that the amount of harvesting assumed in the base case (14-18% in short term, long term avg. of 12.6%) is reasonable. The

Outer Coast is an important and economically viable component of the TSA and should be allowed to contribute proportionally to harvest over time (see historical harvest profile in Appendix 3 – section 6.3)

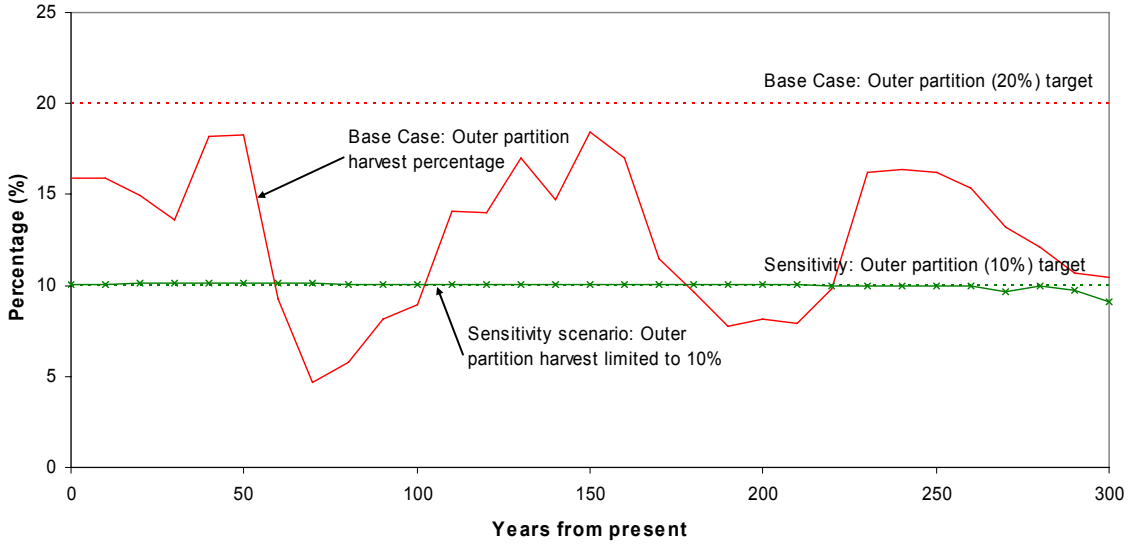


Figure 41. Harvest volume contribution over time from the outer coast when limited to 20% and 10%

When Owikeno areas are excluded or deferred from harvest, the short term harvest level falls by 4%, while the midterm is reduced by 10%, and the long term has very little change. This indicates that the amount of area lost in the long term is small but that the mature volume in the Owikeno units that are excluded/deferred is critical to short and midterm harvest flows.

Figure 42 shows that the base case harvested an average of 161 ha/period (16.1 ha/yr) from the Owikeno areas excluded in this sensitivity, while the base case harvested an average of 1,246 ha/period (124.6 ha /yr) from the deferred areas in this sensitivity analysis. Significantly more area is captured under the deferral than the exclusion. The figure shows that the deferral of volume is not completely made after yr 40 when harvest spikes upward until yr 70. The area above the line is less then the amount below the line in yrs 1-40 so constraints must be limiting the 'catchup' and resulting in midterm harvest impacts.

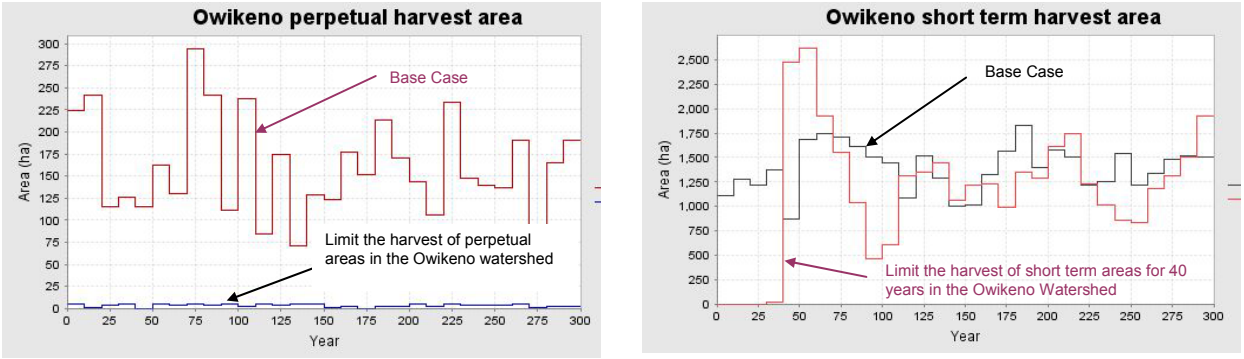


Figure 42. Harvest profile on the Owikeno deferral and exclusion areas relative to the base case

6.10 *Pre EBM Scenarios*

Two scenarios were modeled to explore the implication of EBM implementation. These two scenarios can be considered individual models more than sensitivity runs because they include numerous major changes from the base case. These scenarios aim to assess the impact of the implementation of the Ecosystem Based Management (EBM) objectives and the recently designated parks, conservancies, and protected areas.

Methodology

Run	How was it Analyzed?
a. Pre EBM + 2004 version of parks	Same changes as below plus ignore all parks except for Tweedsmuir, Hakai, and Fiordland. New landbase shown in Table 6 (48% increase in the Effective THLB).
b. Pre EBM with no changes to currently established parks and protected areas	Drop all EBM related netdowns and management objectives. New landbase shown in Table 6 (10% increase in the Effective THLB). Most EBM elements simply dropped, but some were replaced with FRPA requirements (explained in detail below netdown table).

Table 6. Landbase netdowns for the Pre EBM scenarios

		Effective* Area (ha)		
Land Base Element	**Total Area (ha)**	**Base Case**	**Pre EBM**	**Pre EBM + 2004 Parks**
Total area (Mid Coast TSA Bdy - less ocean)	**2,994,120**	**2,994,120**	**2,994,120**	**2,994,120**
Less:				
Private Land, Indian Reserves	14,365	14,365	14,365	14,365
TFL's, CFA's, PCFA, Misc Leases, Etc	263,393	263,393	263,393	263,393
Timber License's (unreverted)	5,279	5,279	5,779	5,845
Total TSA Area	**2,711,083**	**2,711,083**	**2,710,582**	**2,710,517**
Non forest / Non-productive forest	1,681,250	1,681,250	1,681,250	1,681,250
Non-Commercial Brush	480	480	480	480
Existing Roads, Trails and Landings	4,937	3,521	3,521	3,521
Total Productive Forest Land Base (PFLB)**		**1,025,831**	**1,025,331**	**1,025,265**
Less:				
Parks and Ecological Reserves	495,133	495,133	495,133	286,853
Inoperable / Inaccessible	819,219	327,229	327,229	420,499
Environmentally Sensitive Areas (ESA's)	261,177	28,977	28,977	61,252
Non-Merchantable or Problem Forest Types	196,805	33	33	2,215
Low Productivity Sites	177,662	17,819	17,819	44,039
Grizzly Wildlife Habitat Areas (WHA's)	13,661	3,755	3,755	5,187
Mountain Goat Winter Range	29,985	65	65	684
FRPA Riparian (all but S6's)	17,433	6,240	6,240	6,373
Recreation Values	10,470	3,466	3,466	5,931
EBM - High Value Fish Habitat (Obj 9)	5,782	1,603	0	0
EBM – Non High Value Aquatic Habitat (Obj 10)	6,630	2,094	0	0
EBM – Active Fluvial Units (Obj13)	5,693	1,150	0	0
EBM - HVFH Kimsquit River (Obj 9)	1,133	264	0	0
EBM – Sensitive Grizzly Bear Habitat (Obj 17)	42,420	2,662	0	0
Spatial Timber Harvesting Land Base (ha)		**135,343**	**142,615**	**192,233**
Non Spatial Netdowns Applied to Each THLB Polygon:				
FRPA Riparian – S6's (0.3% of THLB))		406	428	577
EBM – Arch/FN (Obj 4-7: 1.3%)		1,759	2,567	3,460
EBM – Red and Blue (Obj 15: 3.0%)		4,060	0	0
EBM – Stand Level Retention (Obj 16: 4.4%)		5,955	4,278	5,767
Effective THLB (ha)		**123,162**	**135,342**	**182,429**
Future Reductions:				
Future roads, trails and landings		2,713	2,713	2,713
Future Gains:				
TL Reversions		5,279	5,779	5,845
Long Term Timber Harvesting Land Base (ha)		**125,728**	**138,408**	**185,561**

EBM Objectives replaced with FRPA requirements:

- The EBM objectives for Archaeological/First Nations values were replaced with FRPA requirements (1.8% used in TSR2). This is higher than the EBM netdown used in the base case (1.3%) because less overlap occurs with other netdowns once EBM removed. The EBM scenario would be providing higher levels of protection for First Nations values.
- The management of red and blue listed species under FRPA was assumed to be addressed by WHA's.
- Stand level retention requirements under FRPA addressed using a 3% netdown (was 4.4% under EBM). The 3% impact for FRPA was determined using judgement and the fact that TSR2 used LU specific targets that ranged from 1% to 4%. It is not reasonable to look at the two estimates (3% and 4.4%) and say that EBM has only a 1.4% difference because the net impact of stand level retention is heavily dependant on the spatial netdowns already occurring on the landbase. EBM has a higher stand level retention requirement but it also implements numerous additional spatial netdowns (enhanced riparian reserves, grizzly bear habitat, etc) that can act to partially fulfill the stand level retention requirement.
- Old seral requirements (replacing EBM Obj 14) were based on the Provincial Non-Spatial Old Growth Order[10] and the landscape unit BEO assignments found in LU spatial file. This resulted in lower % old growth requirements being maintained on the landbase and the targets were met within broader geographic areas (LU/BEC variant combinations). Low BEO targets were not reduced to 1/3 of target because only 5 very small units were constraining at full target levels, and they had no impact on the timber supply.

Inclusion of Parks

- Netdowns were ignored for all parks and protected areas except for Tweedsmuir, Hakai, Fiordland. This required an operability designation to be included in the park area. The stand level economic assessment completed in the Economic Operability project (Forsite 2009) was used to define operability. Any stand within the parks that had a net value of greater than minus $10 was considered operable. Once these stands were flagged as operable, the standard netdowns were implemented and produced the landbase shown in Table 6.

The results of the analysis are shown in the graph and table below.

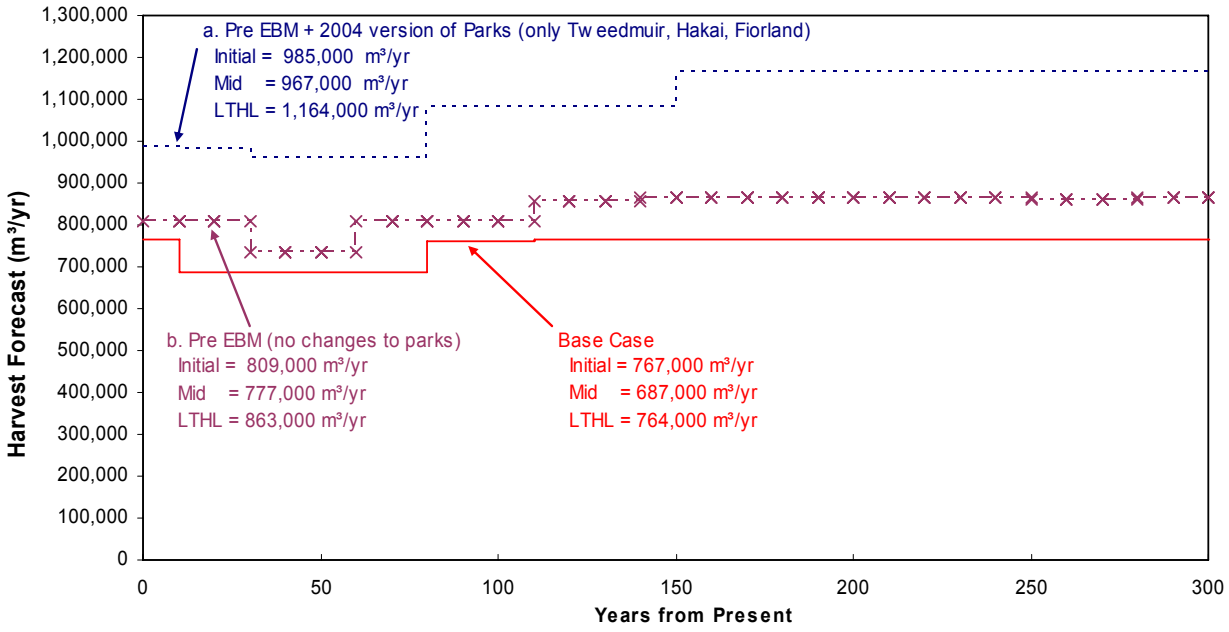


Figure 43. Pre EBM harvest forecasts

[10] http://ilmbwww.gov.bc.ca/slrp/lrmp/policiesguidelinesandassessements/oldgrowth/pdf/Old_Growth_Order_May18th_FINAL.pdf [accessed online: December 10, 2009]

Results

Run	Initial	Mid Term	Long Term
a. Pre EBM + 2004 version of Parks (only Tweedsmuir, Hakai, Fiordland parks)	Increase of the initial harvest level of 28% to 985,000 m³/yr.*	Average increase of the mid term harvest level of 41% to 967,000 m³/yr	Average increase in the long term harvest level of 52% to 1,164,000 m³/yr
b. Pre EBM with no changes to Parks	Increase of the initial harvest level of 5% to 809,000 m³/yr	Average increase of the mid term harvest level of 13% to 777,000 m³/yr	Average increase in the long term harvest level of 13% to 863,000 m³/yr

* Note: An alternative flow regime could have been presented where the current AAC could be maintained for 2 decade and then a slightly larger drop into the midterm trough occurred.

Both scenarios include major changes to the land base definition plus reductions in forest cover constraints, which is reflected as significant increases in harvest levels. Figure 43 shows that the Pre EBM scenario has a higher initial harvest level and a shorter mid term trough - only between years 40 and 60 from the present. Although both scenarios present an increase in harvest levels for the duration of the whole planning horizon, it is during the long term where the model has the highest response with a 13% and a 52% increase for the Pre EBM and Pre EBM+Parks, respectively. These main drivers are the increase in the THLB area, and to a lesser degree the reduced old growth seral targets, and the elimination of EBM objectives such as mid seral, sensitive fisheries watersheds, and upland streams.

Numerous harvest flows were possible with these two scenarios (tradeoffs between short/mid/long term harvest levels). The objective in scenario “a” was to start at or close to the TSR2 harvest level of 998,000 m^3/yr and maintain or improve on that harvest level if possible. Meanwhile the objective in scenario “b” was to mimic the harvest flow pattern achieved in “a” for as long as possible provided that a midterm step down no greater than that in the base case was necessary.

The ‘Pre EBM + 2004 version of parks’ assumptions are similar to what was modeled in TSR2 and the short term harvest flow reflects this. The long term looks dramatically different than TSR2 because of the site index adjustments and select seed gains applied to managed stands in TSR3.

7.0 Summary and Recommendations

Given the base case inputs and assumptions, a harvest level slightly below that of the current AAC can be maintained for 10 years (767,000 m^3/yr) before declining to an average of 687,000m^3/yr for the next 70 years. The long term harvest level is projected to be 1% lower than the current AAC. The short term harvest level is able to remain very close to the current AAC even with the implementation of EBM because of the more accurate operable landbase which greatly improves upon identifying the harvestable area within the TSA, increased flexibility with outer coast and helicopter harvest partitions, adjusted site indices, and recognition of volume gains from select seed.

The short and mid term harvest levels in the TSR3 base case are heavily influenced by a pinch point that exists 55-65 years into the future. This is the point where natural stands are no longer dominating the harvest and managed stands are just beginning to come online in a substantial way. It should also be noted that short to mid term harvest forecast includes 19% poor-low hembal volume, 30-35% helicopter harvest volume, and 14-18% outer coast volume. Note that a single stand can fit into all three of these profiles so the percentages can overlap.

The base case flow is substantially different from TSR2 results because of changes in assumptions and data used. For example, large areas of new parks and conservancy have been established and Ecosystem Based Management objectives have been implemented. These combine to significantly reduce the short term harvest from that published in TSR2 (998,000 m^3/yr). The TSR3 long term harvest flow is just above the TSR2 projection, even with a substantially reduced landbase, because of the much higher yields projected from managed stands (site index adjustments, use of select seed).

In order to assess the impacts of potential changes to modeling assumptions, and gain further understanding of the dynamics at work in the base case forecast, a series of sensitivity analyses were completed and are summarized below by the type of impact (Table 7).

Table 7. Summary of Sensitivity Analysis Results

Run	% Change to Harvest Forecast		
	Initial	Mid term	Long term
Negative Impacts			
Decreasing the THLB (higher stumpage target)	-15%	-15%	-13%
Partition: Limit the harvest in the Owikeno watershed	-4%	-10%	-1%
Natural stand yields minus 10%	-2%	-7%	none
Minimum harvest ages increased by 10 years	none	-8%	+2%
Partition: Limit Outer Coast contribution to 10%	-6%	-3%	-2%
Manage cedar profile to a minimum of 30% of harvest level	-4%	-5%	none
Positive Impacts			
Increasing the THLB (lower stumpage target)	+12%	+11%	+14%
Increasing the THLB (add in previously logged areas)	+4%	+5%	+6%
Natural stand yields plus 10%	none	+7%	none
Use of VDYP to estimate natural stand yields	?	+4%	none
Drop Grizzly EBM requirements	+2%	+2%	+2%
Old seral requirements using EBM Risk- Managed targets	+2%	+2%	+1%
Pre EBM with no changes in Parks	+5%	+13%	+13%
Pre EBM + 2004 version of Parks	+28%	+41%	+52%
Neutral Impacts			
Future dispersed retention at 20%	none	marginal	none
Minimum Harvest Ages decreased by 10 years	none	+1%	-3%

Sensitivity analyses revealed that the short term harvest level is highly dependant on the amount of existing natural stand volume and on achieving merchantable managed stand volumes in a timely manner. Any factors that could delay managed stands from becoming eligible for harvest or any reduction in the amount of natural stand volume on the land base will impact short term harvest levels.

The Pre EBM scenarios revealed that the implementation of the EBM Land Use Orders alone results in a 5-13% timber supply impact in the short term (13% in the long term). When EBM is combined with the parks and conservancies that have been created since 2004, the total impact is a 28-41% timber supply impact in the short to midterm and a 52% impact in the long term.

Recommendations:

The following are areas where improvements could be made in the next TSR:

1. Complete ecosystem mapping at the site series level in order to better manage for red/blue listed species, and old seral retention (replace the site series surrogates). This mapping may also be useful to delineate active fluvial units and forested swamps. The mapping could also be used to adjust site indices for stands that are not cedar or hemlock leading.
2. Complete a new forest inventory that also provides an update on previously logged blocks. There are numerous logged blocks in the forest cover dataset with no data. The mature forest cover polygons are large and have attributes that often not consistent with the field.
3. The impacts of Cultural Heritage and First Nations EBM objectives were estimated for this analysis but would benefit from a more rigorous examination and or operational experience.
4. There was significant discussion around the recreation netdown implemented here (and in TSR2) with licensees stating that no netdown should occur. These issues should be studied to provide objective data on the issue.
5. A tracking system should be setup and maintained to understand the operational impacts of EBM issues such as red/blue, forested swamps, FN values, grizzly habitat areas, stand level retention, etc.

6. Clarify the productive landbase losses associated with roads, trails, and landings. The unproductive widths used here were estimates and should ideally be supported with better data.
7. A review of ESA netdowns is suggested because the netdown approach used here was developed in 1999 and discussions during TSR3 indicated that it would be desirable to have better information. Some of the ESA's have logged blocks overlapping them. These were not netted down but they do indicate that an appropriate netdown % may be something less than 100%.
8. A better understanding of where risk managed targets for old seral will be applied would be useful. Similarly, understanding the degree to which licensees will work under the alternative riparian guidelines offered under the EBM land use order need to be better understood.
9. More information on why, how, and where dispersed retention is being implemented on the landbase would be desirable.
10. Non recoverable losses on the THLB should be updated to reflect changes such as yellow cedar decline.

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Appendix 1 — Acronyms

AAC	Allowable Annual Cut
Analysis	Timber Supply Analysis
AU	Analysis Unit
BCTS	BC Timber Sales (Formerly Small Business Forest Enterprise Program)
BEC	Biogeoclimatic Ecosystem Classification
BEO	Biodiversity Emphasis Options
BGB	Biodiversity Guidebook
BL	Balsam Fir
CF	Chief Forester
CFLB	Crown Forested Land base
CW	Western Red Cedar
DBH	Diameter at breast height (1.3m)
DFO	Department of Fisheries and Oceans
DM	District Manager
EBM	Ecosystem Based Management
ESA	Environmentally Sensitive Area
FD	Douglas Fir
FIP/FC1	Old Forest Cover Digital Files
FIZ	Forest Inventory Zone
FPC	Forest Practices Code
FRPA	Forest and Range Practices Act
GAR	Government Action Regulation
GIS	Geographic Information System
HLPO	Higher Level Plan Order
HW	Western Hemlock
ILMB	Integrated Land Management Bureau
LA	Alpine Larch
LRMP	Local Resource Management Plan
LU	Landscape Unit
LW	Western Larch
MAI	Mean Annual Increment
MHA	Minimum Harvest Age
MoAL	Ministry of Agriculture and Lands
MoE	Ministry of Environment
MoF	Ministry of Forests
MSY	Maximum Sustained Yield
MSYT	Managed Stand Yield Tables
MP	Management Plan
NCC	Non-Commercial Cover
NDT	Natural Disturbance Type
NP	Non Productive
NRL	Non-Recoverable Losses
NSR	Not Satisfactorily Restocked
NSYT	Natural Stand Yield Tables
OAF	Operational Adjustment Factor
OGMA	Old-Growth Management Areas
PA	Whitebark Pine
PEM	Predictive Ecosystem Mapping
PL	Lodgepole Pine
PSP	Permanent Sample Plot
PSYU	Public Sustained Yield Unit
PW	White Pine
PY	Ponderosa Pine
RIC	Resources Inventory Commission
RM	Regional Manager
RMZ	Riparian Management Zone
RONV	Range of Natural Variation
ROS	Recreation Opportunity Spectrum
RTEB	Resource Tenures and Engineering Branch
TFL	Tree Farm License
THLB	Timber Harvesting Land base
TIPSY	Table Interpolation Program for Stand Yields (growth and yield model)
TL	Timber License
TSA	Timber Supply Area
TSR	Timber Supply Review
UWR	Ungulate Winter Range
UREP	Use, Recreation, and Enjoyment of Public
VDYP	Variable Density Yield Predictor (growth and yield model)
VEG Ht	Visually Effective Greenup Height
VAC	Visual Absorption Capability
VQO	Visual Quality Objective
VRI	Vegetation Resource Inventory
WHA	Wildlife Habitat Area

Appendix 2 – Red and Blue listed species that occur or have the potential to occur in Mid Coast TSA

	Red-Listed (Endangered or Threatened)		
#	Category	Scientific Name	English Name
1	Vertebrate Animal	Accipiter gentilis laingi	Northern Goshawk, laingi subspecies
2		Brachyramphus marmoratus	Marbled Murrelet
3		Dermochelys coriacea	Leatherback
4		Fratercula corniculata	Horned Puffin
5		Fulmarus glacialis	Northern Fulmar
6		Gasterosteus sp. 18	Misty Lake "Lake" Stickleback
7		Gasterosteus sp. 19	Misty Lake "Stream" Stickleback
8		Gulo gulo vancouverensis	Wolverine, vancouverensis subspecies
9		Lampetra macrostoma	Cowichan Lake Lamprey
10		Microtus townsendii cowani	Townsend's Vole, cowani subspecies
11		Myotis keenii	Keen's Myotis
12		Phalacrocorax pelagicus pelagicus	Pelagic Cormorant, pelagicus subspecies
13		Phalacrocorax penicillatus	Brandt's Cormorant
14		Sorex palustris brooksi	American Water Shrew, brooksi subspecies
15		Uria aalge	Common Murre
16		Uria lomvia	Thick-billed Murre
17	Vascular Plant	Geum schofieldii	Queen Charlotte avens
18		Lathyrus littoralis	grey beach peavine
19		Symphyotrichum ascendens	long-leaved aster

	Blue-Listed (Endangered or Threatened)		
#	Category	Scientific Name	English Name
1	Vertebrate Animal	Acrocheilus alutaceus	Chiselmouth
2		Ardea herodias fannini	Great Blue Heron, fannini subspecies
3		Ascaphus truei	Coastal Tailed Frog
4		Asio flammeus	Short-eared Owl
5		Botaurus lentiginosus	American Bittern
6		Cervus canadensis roosevelti	Roosevelt Elk
7		Contopus cooperi	Olive-sided Flycatcher
8		Corynorhinus townsendii	Townsend's Big-eared Bat
9		Dendragapus fuliginosus	Sooty Grouse
10		Eumetopias jubatus	Steller Sea Lion
11		Euphagus carolinus	Rusty Blackbird
12		Falco peregrinus pealei	Peregrine Falcon, pealei subspecies
13		Fratercula cirrhata	Tufted Puffin
14		Glaucidium gnoma swarthi	Northern Pygmy-Owl, swarthi subspecies
15		Gulo gulo luscus	Wolverine, luscus subspecies
16		Hirundo rustica	Barn Swallow

	Blue-Listed (Endangered or Threatened)		
#	Category	Scientific Name	English Name
17		Lagopus leucura saxatilis	White-tailed Ptarmigan, saxatilis subspecies
18		Martes pennanti	Fisher
19		Megascops kennicottii kennicottii	Western Screech-Owl, kennicottii subspecies
20		Mustela erminea anguinae	Ermine, anguinae subspecies
21		Oncorhynchus clarkii clarkii	Cutthroat Trout, clarkii subspecies
22		Patagioenas fasciata	Band-tailed Pigeon
23		Ptychoramphus aleuticus	Cassin's Auklet
24		Rana aurora	Red-legged Frog
25		Rangifer tarandus pop. 15	Caribou (northern mountain population)
26		Salvelinus confluentus	Bull Trout
27		Salvelinus malma	Dolly Varden
28		Stenodus leucichthys	Inconnu
29		Synthliboramphus antiquus	Ancient Murrelet
30		Thaleichthys pacificus	Eulachon
31		Ursus arctos	Grizzly Bear
32	Vascular Plant	Abronia latifolia	yellow sand-verbena
33		Arnica chamissonis ssp. incana	meadow arnica
34		Artemisia furcata var. heterophylla	three-forked mugwort
35		Bidens amplissima	Vancouver Island beggarticks
36		Calystegia soldanella	beach bindweed
37		Carex glareosa var. amphigena	lesser saltmarsh sedge
38		Carex gmelinii	Gmelin's sedge
39		Carex heleonastes	Hudson Bay sedge
40		Carex lenticularis var. dolia	Enander's sedge
41		Carex pansa	sand-dune sedge
42		Carex paysonis	Payson's sedge
43		Douglasia laevigata var. ciliolata	smooth douglasia
44		Draba lonchocarpa var. vestita	lance-fruited draba
45		Draba ruaxes	coast mountain draba
46		Epilobium ciliatum ssp. watsonii	purple-leaved willowherb
47		Epilobium glaberrimum ssp. fastigiatum	smooth willowherb
48		Epilobium x treleasianum	Trelease's hybrid willowherb
49		Erythronium montanum	white glacier lily
50		Glehnia littoralis ssp. leiocarpa	American glehnia
51		Hedysarum occidentale	western hedysarum
52		Hippuris tetraphylla	four-leaved mare's-tail
53		Juncus stygius	bog rush
54		Lasthenia maritima	hairy goldfields
55		Lloydia serotina var. flava	alp lily
56		Malaxis paludosa	bog adder's-mouth orchid

	Blue-Listed (Endangered or Threatened)		
#	Category	Scientific Name	English Name
57		Montia chamissoi	Chamisso's montia
58		Myriophyllum quitense	waterwort water-milfoil
59		Nymphaea tetragona	pygmy waterlily
60		Ophioglossum pusillum	northern adder's-tongue
61		Pinus albicaulis	whitebark pine
62		Pleuropogon refractus	nodding semaphoregrass
63		Polemonium elegans	elegant Jacob's-ladder
64		Polystichum setigerum	Alaska holly fern
65		Potentilla nivea var. pentaphylla	five-leaved cinquefoil
66		Pyrola elliptica	white wintergreen
67		Sanguisorba menziesii	Menzies' burnet
68		Saxifraga nelsoniana ssp. carlottae	dotted saxifrage
69		Senecio moresbiensis	Queen Charlotte butterweed
70		Viola biflora ssp. carlottae	Queen Charlotte twinflower violet

Source: BC Species and Ecosystems Explorer Database on-line. Ministry of Environment, Canada. [http://a100.gov.bc.ca/pub/eswp/search.do?method=reset, Accessed November 10, 2009]

Appendix 3 – Data Inputs and Modeling Assumptions

Mid Coast Timber Supply Area
Timber Supply Review #3

Analysis Assumptions Document
(Data Package)

Version 2.3

May 10, 2010

Prepared for:

Mid Coast TSA Licensee/Agency Group

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FORSITE
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Record of Changes since V1.0 (March 10, 2009)

Change	Who	Date
Typos and minor text changes suggested by licensees and MoF, plus NRL values reduced to reflect smaller THLB than in TSR2.	Cam Brown	May 15, 2009
Detail added for recreation and riparian netdowns.	Cam Brown	May 20, 2009
Fixed typo that showed total area of existing road was 3,721 ha instead of 4,937 ha. Corrected ocean classification so it was excluded from Total Area in netdown table. Also fixed misclassified Indian Reserves and TFL TL's.	Cam Brown	June 17, 2009
Numerous sections changed to reflect the EBM Order Amendments made legal in March 2009. This included changes to Cw/Yc stand retention (Cedar Stewardship Areas), Important Fisheries Watersheds / Upland Streams areas, High Value Fish Habitat (Kimsquit), Old Seral Retention requirements, and Grizzly Bear Habitat areas.	Cam Brown	June 25, 2009
Genetic gains for Fd and Cw were adjusted to reflect the portion of the THLB where the species are planted (using AU's and SPU's).	Cam Brown	June 25, 2009
Text clarifications/edits based on review comments from MFR district staff (June 18-09 email from Jennifer Barolet). Included regen assumptions adjustments (species %'s, natural vs planted %'s, and initial planting density to 900 sph.	Cam Brown	June 25, 2009
Parks/Conservancy names updated, grizzly bear Section 7 Notice text added, Cedar Stewardship Areas text added.	Jim Brown	July 6, 2009
Operability dataset was updated so that ESA soils polygons were not excluded by this dataset (fixed error in dataset) – this made the ESA netdown larger.	Cam Brown	July 10, 2009
Stand level retention % was increased to 4.4% (incremental above all other netdowns).	Cam Brown	July 22, 2009
Fixed netdown where it was removing previously logged sites with low sites and ESAs.	Cam Brown	Sept 17, 2009
Dispersed Retention and Visuals modeling methodology included in section 5.1, 5.2, and 8.2. A new AU (315) was added in section 4.1 for existing dispersed retention stands. Future dispersed retention treatments had yields factored off of clearcut AU's.	Cam Brown	Oct 14, 2009
Minimum harvest ages updated to include dispersed retention, reflect adjusted regen assumptions, fix typos, and shift to 5 year increments (instead of 10 yr).	Cam Brown	Oct 14, 2009
Appendix A updated to include Dispersed Retention Yield (AU 315).	Cam Brown	Oct 14, 2009
Appendix B updated to reflect the old seral units being modeled and their associated targets as taken from Sched 4 in the EBM orders.	Cam Brown	Oct 19, 2009
Natural disturbance regime altered to be consistent with RONV old seral targets (section 7.2).	Cam Brown	Dec 15, 2009
Rationale added for modeling of harvest profile limits (partitions).	Mike Landers	March 1, 2010
Typos and comments suggested by the MoF (AAC's added to harvest profile tables (section 6.3)	Cam Brown	April 14, 2010
Clarification added re group selection vs clearcut with reserves and productivity impacts associated with forest edge. Sec 5.1	Cam Brown	May 10, 2010

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This project was funded by the Forest Investment Account and was coordinated by Ian Robertson / Wendy Ravai on behalf of International Forest Products Ltd.

This work was prepared directly by or under the direct supervision of Cam Brown, RPF.

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1.0 Introduction

This document outlines the basic information and assumptions that are proposed for use in the provincial Timber Supply Review (TSR) process currently underway in the Mid Coast Timber Supply Area (TSA). The purpose of the review is to examine effects of current forest management practices on the short- and long-term availability of timber for harvesting in the TSA. A review of this type is intended to be completed at least once every five years in order to capture changes in data, practices, policy, or legislation influencing forest management in the TSA. The previous review (TSR2) was completed in June 1999 with a final Annual Allowable Cut (AAC) determination on June 1, 2000 establishing and AAC of 998,000 m^3/yr. In July of 2002 and September 2006, the Chief Forester set out orders that decreased the AAC because of new designated areas (conservancy and biodiversity areas). The AAC has been set at 768,000 m^3/yr since September 2006. The current TSR process will work towards having all work completed by Dec 31, 2009 such that a new AAC determination can be in place by June 2010.

This timber supply review will focus on a single forest management scenario that reflects current management practices in the TSA. Thus, the analysis goal is to model "what-is", and not "what-if". Current practice here will reflect the land base removals for new parks, conservancies and biodiversity areas associated with the Central Coast Land Use Decision (CCLUD) and Ecosystem Based Management (EBM) practices as described in the Ministerial Land Use Orders. In addition to this current management or "Base Case" scenario, an assessment of how results might be affected by uncertainties is completed using a number of sensitivity analyses. Together, the sensitivity analyses and the Base Case form a solid foundation for discussions among government and stakeholders about appropriate timber harvesting levels.

It is recognized that ongoing treaty negotiations with First Nations have the potential to impact timber supply in the TSA. However, "current management" is the underlying assumption for the analysis and no settlement has yet been reached. The final results from treaty negotiations will be modeled in subsequent timber supply reviews that have the benefit of legal direction in this area.

This report is the first of three documents that will be released during the TSR3 process for Mid Coast TSA. This document provides detailed technical information on the upcoming analysis. A separate document called the Analysis Report will summarize the results of the timber supply analysis and will provide a focus for public discussion. The final document will outline the Chief Forester's AAC decision and the reasoning behind it.

1.1 Purpose of the data package

The purpose of this data package is to:

- provide a detailed accounting of the land base, growth and yield, and management assumptions related to timber supply that the Chief Forester must consider under the *Forest Act* when determining an allowable annual cut (AAC) for the Mid Coast TSA and how these will be applied and modeled in the timber supply analysis;
- provide the evidentiary basis for the information used in the analysis.

1.2 Roles and Responsibilities

The Mid Coast Licensee-Agency group chose to take on the responsibility of leading the Mid Coast TSR3 process in 2008. The group consists of major licensees and First Nations with harvesting tenure in the Mid Coast TSA. To deliver on this commitment, the planning and analysis work associated with the TSR was tendered and subsequently awarded to Forsite Consultants Ltd.

Government agencies play a key role in this TSR process – they set and enforce standards and are responsible for approval of the final Data Package and Analysis Reports. The Ministry of Forests and Range (MFR) provides technical support, facilitate resolution of issues, and validate technical information. Various resource

specialists in the Ministries of Agriculture and Land (MoAL), Environment (MoE) and Tourism, Culture and Arts (MoTCA) contribute their knowledge and experience. The following table shows the general roles and responsibilities associated with the timber supply analysis leading to an AAC determination.

Table 1. Roles and responsibilities

LICENSEE-AGENCY GROUP Obligations	Government Obligations	
	Forest Analysis Branch	**District And Regional Staff**
Compile data needed for the timber supply analysis, including forest cover and other data related to forest and land characteristics, administration and management regimes. Provide a summary of the data, management assumptions, and modeling methods to be applied in the timber supply analysis in a Data Package document.	Set standards for the data package	Provide data, information, and knowledge of current practices in the TSA.
Provide information to the public and First Nations and summarize comments received for government.		
Make any necessary changes to the data package and submit for government approval.	Review and accept the data package (focus on how data is to be applied in Timber supply analysis).	Review and accept the data package (focus on confirming current practice).
Perform and document a timber supply analysis according to standards provided by the Ministry of Forests.	Provide technical advice and set standards for the analysis and reporting.	
Submit an Analysis Report and digital file containing the complete dataset used in the timber supply analysis.	Review and accept (together with the chief forester) the analysis report.	Review the analysis report to ensure local issues and current practices are adequately reflected.
Provide information to the public and First Nations and summarize comments received for government.		Formal consultation obligations.
Provide additional information as required by the chief forester.	Compile and prepare information for presentation to the chief forester at the determination meetings.	Assist in compiling and preparing information for presentation to the chief forester at the determination meetings.

1.3 Description of the Land base

The Mid Coast TSA is located on the central coast of British Columbia and covers approximately 2.2 million ha. The Mid Coast TSA extends from Cape Caution in the south to Sheep Passage in the north and is bordered by the Pacific Ocean to the west and Tweedsmuir Park to the East (Figure 1). The northern boundary is made up of Tree Farm License (TFL) 25, the Fiordland Recreation Area, and the Kitlope Heritage Conservancy Protected Area.

The terrain is rugged and variable including low lying islands, outlying coastal mainland areas, inland mountainous regions, high elevation non-forested areas, and productive valley bottom steep sided inlets. The forests of the Mid Coast are dominated by four main biogeoclimatic zones as illustrated in Figure 2 below and include Coastal Western Hemlock (CWH), Mountain Hemlock (MH), Engelmann Spruce Subalpine Fir (ESSF), and alpine (CMA). Other zones such as IDF, MS, SBPS, and SBS exist in the transition zone to the interior ecosystems that is contained entirely within Tweedsmuir Park.

The Mid Coast TSA exhibits high levels of diversity in landscape, wildlife, and culture. Diverse populations of both marine and terrestrial wildlife exist in the TSA. The TSA's forests are culturally rich and diversified as well. Archaeological work has yielded evidence of some of the oldest First Nation's habitations on the BC coast.

The Mid Coast TSA is remote and sparsely populated, with the majority of the population living in the Bella Coola valley. Other populated areas include small isolated communities along the outer coast.

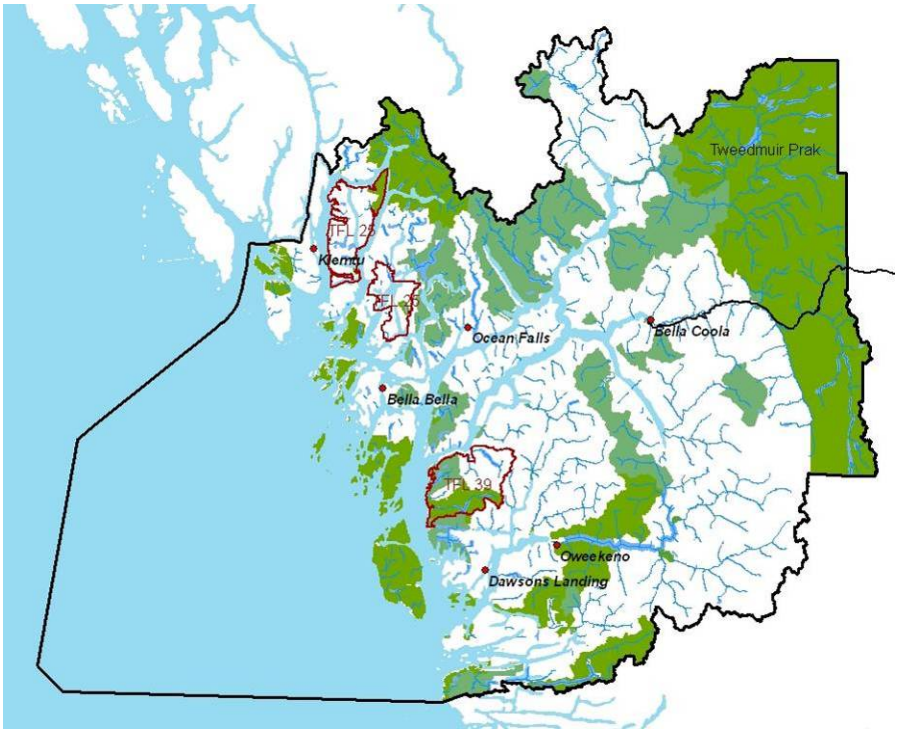


Figure 1. Mid Coast TSA land base

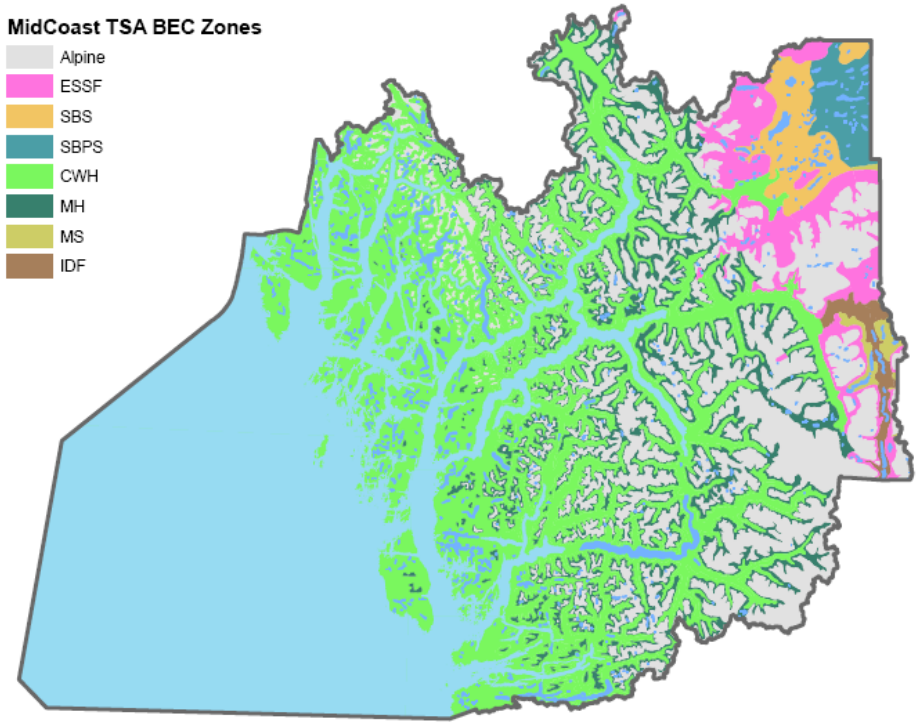


Figure 2. BEC Zones present in Mid Coast TSA

1.4 History of the Annual Allowable Cut

The history of the Annual Allowable Cut (AAC) for the Mid Coast TSA is summarized below.

- During the mid 1970's to the early 1990's the AAC on the Mid Coast was periodically increased to meet elevating demand for access to timber and improved harvesting practices that allowed utilization of poor forest types. In 1992 the AAC was 1,516,600 m^3/yr.
- Effective January 1992 the AAC was reduced by 39 % as poorer quality stands were not being harvested to the extent previously expected, which left the AAC at 1,000,000 m^3/yr. Also a partition was introduced that required 130,000 m^3/yr of the AAC come from stands of a height class three (trees over 120 years of age and less than 28.5 m in height).
- From 1992-1995 the AAC remained unchanged however the partition requirement was modified to include height class three stands on the outer coast, decadent hemlock-balsam stands outside the operability line, and stands that are accessible by helicopter outside operability lines.
- In June 2000 the AAC for the Mid Coast was determined to be 998 000 m^3/yr. The reduction was to account for a newly issued probationary community forest agreements (PCFA). Within the 2000 AAC existed a partition of 200,000 m^3/yr requiring harvesting to occur in poor or low site hemlock / balsam leading stands (site index ≤17m). The Chief Forester also stated that at least 59,000 m^3/yr should come from the outer coast and 178,000 m^3/yr should come from outside the conventional operability lines. These are not formal partitions but expectations that will be evaluated in the next TSR when defining the new timber harvesting land base.
- In July of 2002 the chief forester issued an order decreasing the AAC by 203,000 m^3/yr to account for establishment of the Central Coast Designated Area. This volume was removed from both the partition and the overall total volume and remained unchanged until the Designated Area section in the Forest Act expired in January 2006.
- In September of 2006 a new Designated Area section was established in the Forest Act and the Chief Forester reinstated the order that decreased the AAC to the current level of 768,000 m^3/yr.

1.5 Current Practice and EBM

Within the general TSR process, current management practices are primarily defined by:

- Legislation (e.g. Forest and Range Practices Act and its Regulations)
- Ministerial Orders (e.g. South Central Coast Order, Central Coast Designated Areas),
- Government Actions Regulation Orders (e.g. Karst, WHA's, Visuals),
- Current management practices described in Forest Stewardship Plans,
- Other approved BC Forest Service and joint agency forest management practices and policy,
- Current practices of forest tenure holders.

As a result of the Central Coast Land Use decision and the establishment of the South Central Coast Order (Aug 2, 2007) and the Central and North Coast Order (Jan 3, 2008), land use objectives implementing Ecosystem Base Management (EBM) were put in place for the whole of the Mid Coast TSA (Figure 3). Draft amendments to these orders were made public in December 2008 and available for review and comment until Feb 16, 2009. They were then made legal in March 2009. These legal objectives now direct forest practices implemented under the Forest and Range Practices Act. Thus, current practice for Mid Coast TSR3 includes both FRPA and the amended EBM management guidelines. The elements of EBM are discussed in detail throughout this document.

The EBM orders and background data/interpretation information can be found here:
http://ilmbwww.gov.bc.ca/slrp/lrmp/nanaimo/cencoast/plan/objectives/index.html

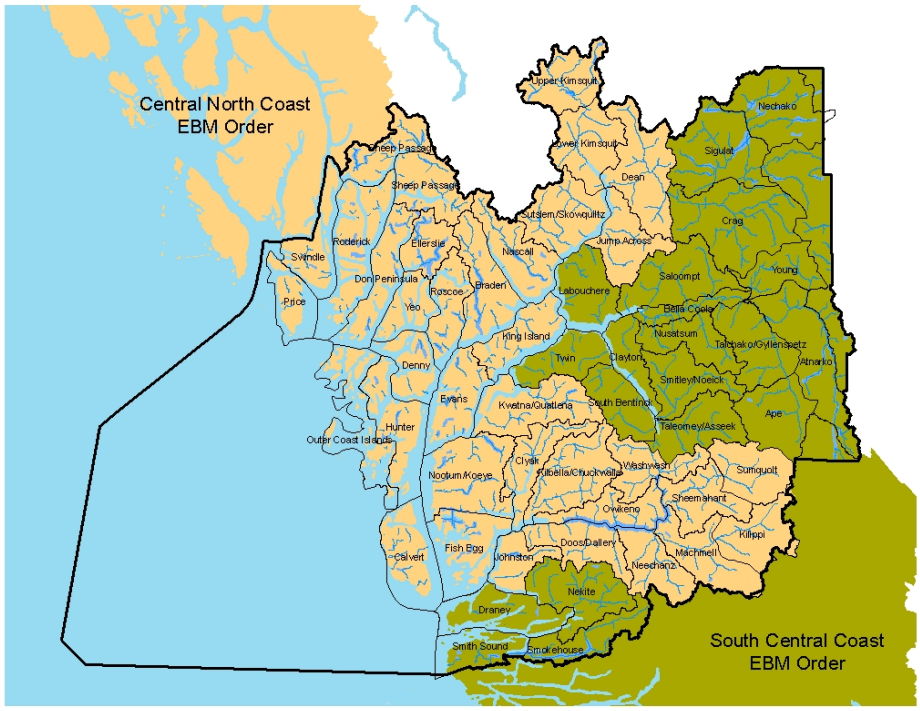


Figure 3. Location of Ministerial Order Boundaries (2009) within the Mid Coast TSA

A list of the EBM elements included in the orders is provided below. These elements are discussed in detail later in the document (see referenced section numbers).

First Nations Elements

- Objective 3: First Nations' traditional forest resources (Section 3.4.1);
- Objective 4: First Nations' traditional heritage features (Section 3.4.1);
- Objective 5: Culturally modified trees (Section 3.4.1);
- Objective 6: Monumental cedar (Section 3.4.1);
- Objective 7: Stand-level retention of Western red and Yellow Cedar (Section 3.4.1);

Aquatic Habitats

- Objective 8: Important fisheries watersheds (Section 8.5.6);
- Objective 9: High value fish habitat (Section 3.3.12.1);
- Objective 10: Aquatic habitat that is not high value fish habitat (Section 3.3.12.2);
- Objective 11: Forested swamps (Section 8.5.9);
- Objective 12: Upland streams (Section 8.5.10);
- Objective 13: Active fluvial units (Section 3.3.12.4);

Biodiversity

- Objective 14: Landscape-level biodiversity (Section 8.5.12);
- Objective 15: Red-listed and blue-listed plant communities (Section 3.4.2);
- Objective 16: Stand-level retention (Section 3.4.3); and
- Objective 17: Grizzly bear habitat (Section 8.5.15).

2.0 Thematic Data

2.1 Data Sources

Many different data layers were compiled to provide input into the timber supply analyses described in this report and they are documented in Table 2. The use of these data layers is described in subsequent sections of this appendix.

Table 2. Data layers

Data Description	Forsite Coverage Name	Data Source	Description	Vintage
Administrative Line Work				
TSA Boundary	TSABDY	LRDW	Outer boundary of the TSA.	2003
Landscape Units/BEO	LU	ILMB	Legal LU boundaries from LRDW. (identical to LU's in EBM orders)	2000
Ownership	Owner2008	Forsite	Forsite created using data from LRDW (parks, CFA's, TFL's). TSR2 ownership file (IR's, TL's, Private, UREP, Misc Resv), and ILMB Nanaimo conservancy data. Edits made to TL's.	2008
Ministerial Order Boundaries	Order_bdy	ILMB	ftp://ftpnan.env.gov.bc.ca/dist/gisdata/cclrmp/ebm_data. Landscape units were dissolved to make up the order boundaries.	2009
Inventories				
BEC	Abec_bc_v7	LRDW	Biogeoclimatic units with NDT added based on BEC Web definitions	2008
DEM for slope classes	Slope_mc	TRIM	Elevation data points used to generate slope classes.	
Depletions	Blks_Mar08	Forsite	Forsite compiled using block data from licensees, results, FTA	2008
Vegetation	Veg	LRDW	Projected to Jan 1, 2008. Site series surrogate values added.	2008
ESA	ESA	TSR2	ILMB Nanaimo. TSR2 ESA were added to the current Veg file.	Pre 1996
Inner/Outer Coast	Partition	TSR2	ILMB Naniamo.	1999
Operability	Oper09	Forsite	Developed by Forsite using economic operability modeling. Updated to include ESA areas in July 2009	2009
Registered Heritage/ARCH	MC_ArchSites	Arch Branch	Polygon data indicating legally protected archeological sites - provided by John McMurdo.	2008
Roads	Roads08	Forsite	Forsite developed using licensee data, FTEN, TRIM, Timberline Woodshed project roads. Includes both existing and proposed rds.	2008
Karst	Karst	LRDW	Gives Karst likelihood and Karst development	2003
EBM				
Active Fluvial Units	Flood08	Forsite	Created using CC_flood cover from LRMP + added TRIM floodplains around Bella Coola - then removed coniferous stands >200 yrs.	2008
Grizzly Bear Habitat	griz_09dis	ILBM	ftp://ftpnan.env.gov.bc.ca/dist/gisdata/cclrmp/ebm_data/ grizzly_bear_nc and grizzly_scc	2009
High Value Fish Habitat (HVFH)	HVFH	Forsite	20,000 scale streams with a gradient of <=5% fall on terrain with <=5% slope.	2008
Kimsquit River HVFH	Kimsquit	ILBM	ftp://ftpnan.env.gov.bc.ca/dist/gisdata/cclrmp/ebm_data/ Kimsquit_River_cnc	2009
Aquatic Non High Value Fish Habitat	AQ_NHVFH	Forsite	20,000 scale streams classified into S1-S6 – then any S1-S3 streams not called HVFH. Lake and wetlands from TRIM.	2008
Important Fisheries Watersheds	fsw_3rd_2009	ILMB	ftp://ftpnan.env.gov.bc.ca/dist/gisdata/cclrmp/ebm_data/ Forsite compiled 4 separate IFW datasets provided by ILMB Nanimo – two original EBM order datasets plus additional watersheds coming from the amended order (NCMO_IFW_7FN and ISW_FN_Final).	2009
Site Series Surrogates	n/a	ILMB	Assigned to veg file using leading species and site index groups.	2008
Other Watersheds (Upland Streams)	fsw_3rd_2009	ILMB	3rd order watersheds. ftp://ftpnan.env.gov.bc.ca/pub/outgoing/dist/Coast%20Implementation/EBM%20WG/Data/watersheds/ These watersheds were used to fill in around the IFW's.	2007
Management Guidance				
Recreation Inventory	Rec_Inv	LRDW	Inventory describing the significance and sensitivity of the land base from a recreation perspective.	2006
VQO's	VQOs	MFR	http://www.for.gov.bc.ca/dni/gar/GAR.htm. VAC attribute added from dataset off of the LRDW.	2005

Data Description	Forsite Coverage Name	Data Source	Description	Vintage
Streams (Classified)	Streams	Forsite	20,000 scale streams (corporate watershed base) classified into S1-S6 using stream gradient and stream order/magnitude.	2008
Lakes Classified	Lakes	Forsite	20,000 scale lakes and wetlands (corporate watershed base) classified in to L1-L5 / W1-W5 based on size and proximity to each other.	2008
Community Watersheds	CWSs	LRDW	Legal Community Watersheds	2008
Ungulate Winter Range	UWR	LRDW	Deer and Mtn Goat winter range habitat areas. http://www.env.gov.bc.ca/wld/frpa/uwr/approved_uwr.html	2007
Wildlife Habitat Areas	WHAs	LRDW	Legally established WHA's (Grizzly only)	2007

2.2 Forest Cover Inventory

The forest cover inventory is a key component to the timber supply review of the TSA. The history of the current forest cover inventory in the Mid Coast TSA can be summarized briefly as follows:

- The inventory data was originally prepared in 1988-1990 from 1977-79 photography and is currently in a Vegetation Resources Inventory (VRI) Forest inventory Planning (FIP) Rollover format. There are several mapsheets of full VRI format data in the NE corner of the TSA (portion of Tweedmuir park).
- A single flat file was obtained from Forest Analysis and Inventory Branch (James Wang) that included only Rank 1 stand information. Attributes were projected to January 1, 2008 using VDYP 6.
- Disturbances from harvesting and fire will be updated in the GIS resultant to March 2008 using data compiled from licensees and RESULTS. Fires from 2001-2007 were provided by the MFR FAIB.
- An inventory audit was carried out in 1994 (published 1995) and indicated that the inventory was statistically reliable for some strategic planning purposes at a broad management unit level.
- No ground sampling (Phase 2 work) has been completed to support adjustments to inventory attributes so no adjustments have been applied.
- Site index adjustments have been developed for regenerating managed stands (Timberline's 2008 SIA project[1]) and were used to develop managed stand yield curves. Existing inventory site indices were used for natural (unmanaged) stand yield curves.

It should be noted that planners and practitioners using the forest inventory at a sub-unit or polygon level have found the attributes quite unreliable.[2] The extra demands of EBM (e.g. Site Series Surrogate status reporting) emphasizes the need for more dependable information. To that end a multi year, multi million dollar project to create a new VRI inventory to replace the current forest cover information was initiated in 2008 but will not be completed in time for inclusion in this analysis. In lieu of access to any better forest information the FIP-based data is employed in this TSR.

3.0 Timber Harvesting Land Base

3.1 Land Base Definitions

The Productive Forest Land Base (PFLB) is the area of productive forest under crown ownership. This is the land base that contributes to landscape level objectives for biodiversity and non timber resource management. The PFLB excludes non-crown land, probationary community forest agreements (PCFA), non-forest and non-productive areas.

[1] Site Index Adjustment Of The Mid Coast Timber Supply Area (Project # BC0108405), January 2009, Timberline Natural Resource Consultants, Victoria, BC

[2] Central Coast LRMP Area Vegetation Resources Inventory Strategic Inventory Plan, February 2008. pg 7

The Timber Harvesting Land Base (THLB) is the portion of the management unit where forest licensees under license to the province of BC are expected to harvest timber. The THLB excludes areas that are inoperable or uneconomic for timber harvesting, or are otherwise off-limits to timber harvesting. Operationally, harvesting activity does occur in areas outside the modeled THLB. The THLB is a subset of the PFLB. For modeling purposes, the THLB must be approximated in a GIS format and is described in detail below. Table 3 and Figure 4 / Figure 5 summarize the land base planned for use in the base case harvest forecast.

Table 3. Land base Area Netdown Summary

	Base Case			
Land Base Element	**Total Area (ha)**	**Effective* Area (ha)**	**% Total**	**% PFLB**
Total area (Mid Coast TSA Bdy – less ocean)	**2,994,120**	**2,994,120**		
Less:				
Private Land, Indian Reserves	14,365	14,365		
TFL's, CFA's, PCFA's, Misc Leases, Etc	263,393	263,393		
Timber License's (unreverted)	5,279	5,279		
Total TSA Area	**2,711,083**	**2,711,083**	100.0%	
Non forest / Non-productive forest	1,681,250	1,681,250	61.6%	
Non-Commercial Brush	480	480	0.4%	
Existing Roads, Trails and Landings	4,937	3,521	0.1%	
Total Productive Forest Land Base (PFLB)**	**1,024,416**	**1,025,831**	37.8%	100%
Less:				
Parks and Ecological Reserves	495,133	495,133	18.3%	48.3%
Inoperable/Inaccessible	819,219	327,229	12.1%	31.9%
Environmentally Sensitive Areas (ESA's)	261,632	28,977	1.1%	2.8%
Non-Merchantable or Problem Forest Types	196,865	33	0.0%	0.0%
Low Productivity Sites	177,662	17,819	0.7%	1.7%
Grizzly Wildlife Habitat Areas (WHA's)	13,661	3,755	0.1%	0.4%
Mountain Goat Winter Range	29,985	65	0.0%	0.0%
FRPA Riparian (not including S6's)	17,433	6,240	0.2%	0.6%
Recreation Values	10,470	3,466	0.1%	0.3%
EBM – High Valve Fish Habitat (Obj. 9)	5,782	1,603	0.1%	0.2%
EBM – Non High Value Aquatic Habitat (Obj. 10)	6,630	2,094	0.1%	0.2%
EBM – HVFH Kimsquit River (Obj. 9)	5,693	1,150	0.0%	0.1%
EBM – Active Fluvial Units (Obj. 13)	1,133	264	0.0%	0.0%
EBM – Grizzly Bear Habitat (Obj. 17)	42,420	2,662	0.1%	0.3%
Spatial Timber Harvesting Land Base (ha)		**135,343**	5.0%	**13.2%**
Non Spatial Netdowns Applied to Each THLB Polygon:			0	
FRPA Riparian – S6's = 0.3%		406	0.0%	0.0%
EBM – Arch/FN (Obj. 4-7) = 1.3%		1,759	0.1%	0.2%
EBM – Red and Blue (Obj. 15) = 3.0%		4,060	0.1%	0.4%
EBM – Stand Level Retention (Obj. 16) = 4.4%		5,955	0.2%	0.6%
Effective Timber Harvesting Land Base (ha)		**123,162**	4.5%	**12.0%**
Future Reductions:				
Future roads, trails and landings		-2,713	0.1%	0.3%
Future Gains:				
TL Reversions		+5,279	0.2%	0.5%
Long Term Timber Harvesting Land Base (ha)		**125,728**	4.6%	**12.3%**

* Effective netdown area represents the area that was actually removed as a result of a given factor. Removals are applied in the order shown above, thus areas removed lower on the list do not contain areas that overlap with factors that occur higher on the list. For example, the parks netdown does not include any non forested area.

** Productive forest in this context denotes the forest area that contributes to forest management objectives, such as landscape-level biodiversity, wildlife habitat and visual quality. It does not include alpine forest or Non productive areas with tree species.

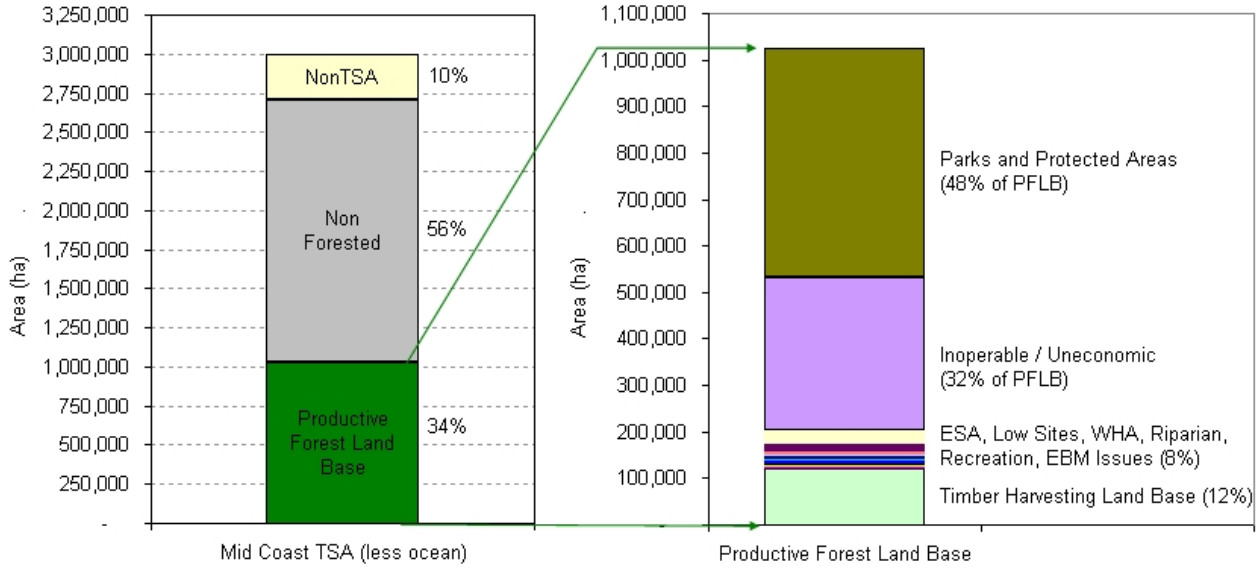


Figure 4. Mid Coast Land Base Area Summary

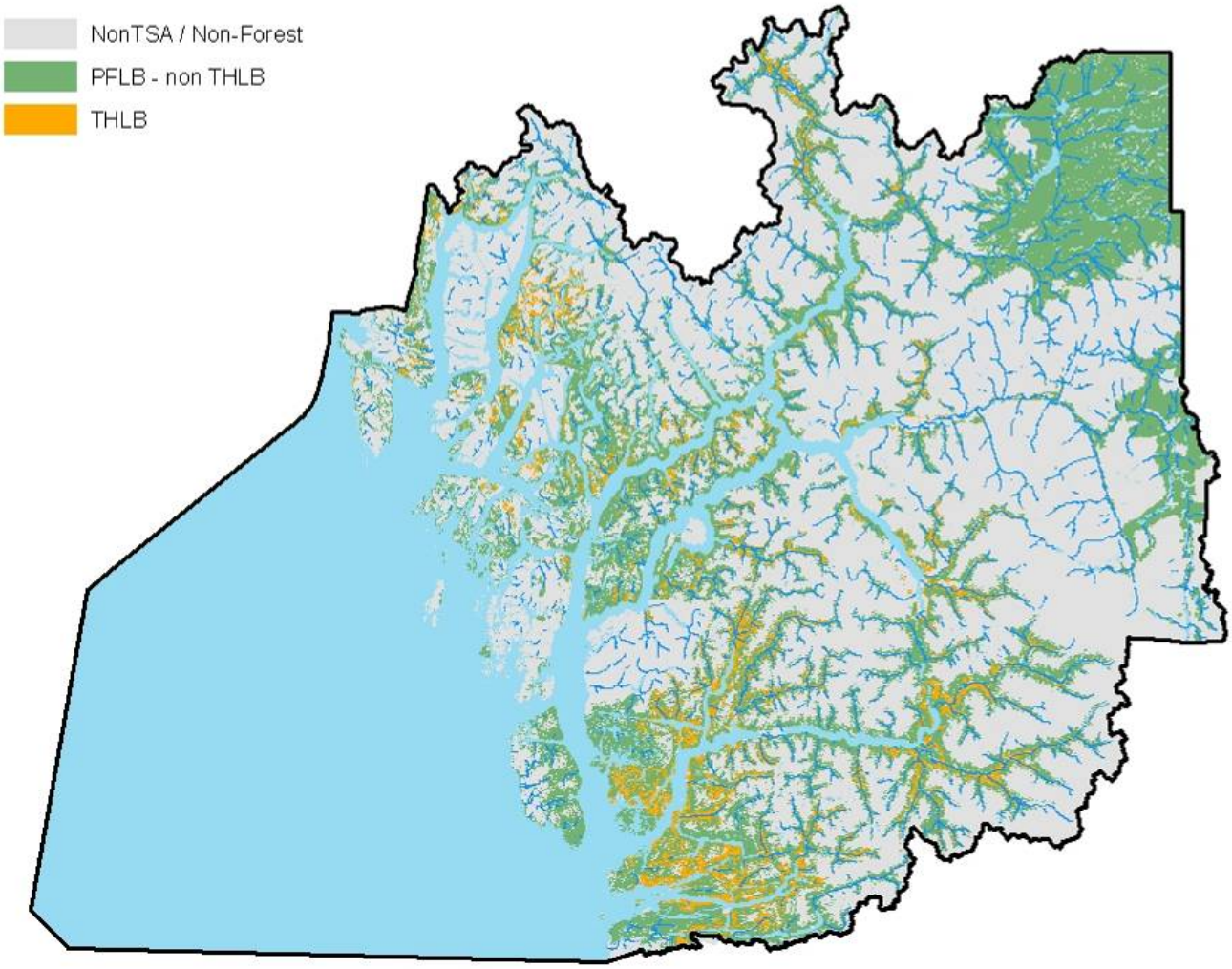


Figure 5. Mid Coast TSA Land Base Definition Map

3.2 Exclusions from the Productive Forest Land Base (Spatial)

3.2.1 Ownership classes not part of the TSA

The area of the Mid Coast Timber Supply Area is divided into ownership classes that describe the nature of ownership of a particular parcel of land. For forest management in the Mid Coast TSA, only those lands that are under provincial crown ownership will contribute to forest management objectives, like landscape level biodiversity.

Table 4 describes the various ownership codes in the Mid Coast TSA, and their contribution to the Productive Forest Land Base, the Timber Harvesting Land base, or both. Parks and protected areas are described in more detail in section 3.3.1.

Table 4. Ownership codes and application in TSR3

Ownership Code Description	Percent Contribution to PFLB	Percent Contribution to THLB	Total area (ha)	Effective Netdown Area (ha)
Community Forest Agreement (CFA)	0%	0%	169,160	169,160
Indian Reserve	0%	0%	5,059	5,059
Miscellaneous Reserve	0%	0%	1,434	1,434
Private	0%	0%	9,305	9,305
Tree Farm License (TFL)	0%	0%	86,280	86,280
Timber License's reverting to CFA (TL/CFA)	0%	0%	6,451	6,451
Use, recreation enjoyment of the public (UREP)	0%	0%	68	68
Total			**277,758**	**277,757**

Note: More detail is provided on park areas in Table 8.

3.2.2 Non-forest, non-productive and non-typed

All land classified as non-forest, non-productive (lakes, swamps, rock, alpine, *etc.*), or non-typed in the forest cover files were excluded from the timber harvesting land base. The non-forest and non-productive areas used in the netdown process are listed in Table 5.

Table 5. Non-forest and non-productive area

Description	Percent Reduction	Total area (ha)	Effective Netdown Area (ha)
Alpine	100%	1,074,702	1,074,702
Alpine forest	100%	294,099	294,099
Clearing	100%	88	88
Clay bank	100%	341	341
Gravel bar	100%	403	403
Gravel pit	100%	4	4
Lake	100%	72,964	72,964
Meadow	100%	52	52
Mud flat	100%	185	185
Non-productive	100%	167,372	167,372
Non-productive brush	100%	11,298	11,298
Non-productive burn	100%	1,663	1,663
No typing available	100%	35,464	35,464
Open range	100%	1	1
Rock	100%	6,085	6,085
River	100%	8,482	8,482
Swamp (muskeg)	100%	7,503	7,503
Tidal flat	100%	138	138
Urban	100%	405	405
Total		**1,681,250**	**1,681,250**

3.2.3 Non-commercial cover

Non-commercial cover is productive forest land that is otherwise occupied by non-commercial tree or shrub species. This area of land does not currently grow commercial tree species, and is not expected to do so without intervention. This area was therefore excluded from the Productive Forest Land Base.

Table 6. Non-commercial cover

Description	Percent Reduction	Total area (ha)	Effective Netdown Area (ha)
Non-Commercial (NF Desc=NCBr or NC)	100%	480	480

3.2.4 Roads, trails, and landings

Quantifying the area that is, and will be, disturbed by roads, trails, landings (RTLs) and other access features in the TSA is an important part of determining the THLB. Areas that were expected to remain non-productive were removed from the working land base as outlined below.

3.2.4.1 Existing classified roads

Classified roads are those roads identified in the forest cover inventory. These roads are frequently large roads or highways with a wide right-of-way and are netted out in Table 5.

3.2.4.2 Existing unclassified roads, trails, and landings

Roads not represented in the forest cover data are considered unclassified. Roads and trails are tracked as line features in separate road files. A consolidated dataset was compiled by Forsite in August 2008 using data from licensees, TRIM, MFR tenures, and a woodshed analysis project completed by Timberline in 2000. Roads were flagged as either existing or proposed with a road type of either mainline or spur. The widths associated with these road features were estimated by members of the Mid Coast TSR technical committee and applied as buffers to the existing roads (Table 7). These areas were assumed to include landings, pullouts, and unmapped trails – and were removed spatially from the timber harvesting land base.

Table 7. Access feature classification

Road Type	Unproductive Road Width (m)	Total Area (ha)	Effective Netdown Area (ha)
Main	15 m	4,937	3,521
Spur	11 m		

Note: Overlap between these features and non-forested areas exist but no double counting occurred during netdowns.

3.2.4.3 Future roads, trails and landings

Deductions for future roads are necessary to account for the unproductive area created as new roads, trails and landings are built. The first time conventional logging occurs in an unroaded area of the TSA, all of the timber volume in that stand is captured. Any subsequent entries will harvest less volume, recognizing that there is now an unproductive area that would exist as roads, trails and landings.

FRPA limits the impact of permanent access structures to 7.0% and this value is consistent with commitments made in licensee Forest Stewardship Plans. For the purpose of this analysis, the 7% impact associated with future permanent access structures will be applied to the following area:

- Unlogged THLB (natural stand AU's), that are
- >250 meters from existing roads, and
- planned for conventional logging systems (not helicopter logging).

It is assumed that the area within 250 m can currently be accessed from the existing roads and all previously logged areas will not need the netdown applied.

Deductions for future roads, trails and landings were applied as a volume reduction to the yield tables of all future managed stand analysis units. The THLB area meeting the criteria described above (38,755 ha) was multiplied by 7.0% to get an effective area reduction (**2,713 ha**). This area was then calculated as percentage of the total area on the future managed stand yield curves (106,283 ha) and implemented as a volume reduction (2.5%) on these curves.

3.3 Exclusions from the Timber Harvesting Land Base

3.3.1 Parks and Protected Areas

Provincial parks and other protected areas in the Mid Coast TSA are excluded from the THLB but can contribute to non-timber objectives, meaning that they remain in the productive forest land base (PFLB) Table 8 summarizes the existing parks, protected areas, and conservancies in the TSA.

Table 8. Parks and Ecological Reserves in Mid Coast TSA

Date of Establishment	Conservancy or BMTA Name	Productive Forest Area (ha)	Effective Netdown Area (ha)
Before June 1, 2000	Codville Lagoon Marine Park	384	384
	Entiako Park	2	2
	Hakai Conservation Study Area	11,281	11,281
	Huchsduwachsdu Nuyem Jees / Kitlope Heritage Conservancy	2	2
	Penrose Island Park	922	922
	Sir Alexander Mackenzie Park	5	5
	Tweedsmuir Park (North)	148	148
	Tweedsmuir Park (South)	264,232	264,232
Bill28 - 03/05/2006	Calvert Island Conservancy	11,695	11,695
	Fiordland Conservancy	11,192	11,192
	Kitasoo Spirit Bear Conservancy	2,569	2,569
	Koeye Conservancy	15	15
	Tsa-latl/Smokehouse Conservancy	13,114	13,114
Bill24 - 03/05/2007	Cape Caution-Blunden Bay Conservancy	9	9
	Carter Bay Conservancy	292	292
	Clyak Estuary Conservancy	166	166
	Cranstown Point Conservancy	77	77
	Goose Bay Conservancy	937	937
	Kilbella Estuary Conservancy	81	81
	Lady Douglas - Don Peninsula Conservancy	1,910	1,910
	Lockhart - Gordon Conservancy	14,970	14,970
	Machmell Conservancy	1,364	1,364
	Nekite Estuary Conservancy	256	256
	Outer Central Coast Islands Conservancy	5,796	5,796
	Owikeno Conservancy	22,301	22,301
	Penrose-Ripon Conservancy	2,153	2,153
	Sheemahant Conservancy	610	610
	Ugwiwey/Cape Caution Conservancy	3,480	3,480
Bill38/r437 26/06/2008	Bella Coola Conservancy	4	4
	Burnt Bridge Creek Conservancy	598	598
	Cascade-Sutslem Conservancy	19,387	19,387
	Clayton Falls Conservancy	650	650
	Codville Extension Conservancy	764	764
	Dean River Conservancy	17,514	17,514
	Dean River Corridor Conservancy	2,700	2,700
	Ellerslie-Roscoe Conservancy	10,867	10,867
	Ellerslie-Roscoe Conservancy (Roscoa)	12,957	12,957

Date of Establishment	Conservancy or BMTA Name	Productive Forest Area (ha)	Effective Netdown Area (ha)
(…cont.)	Hot Springs - No Name Creek Conservancy	3,438	3,438
	Jump Across Conservancy	7,255	7,255
Bill38/r437	Kimsquit Estuary Conservancy	531	531
26/06/2008	Kwatna Estuary Conservancy	81	81
	Nooseseck Conservancy	25	25
	Namu Conservancy	27	27
	Restoration Bay Conservancy	776	776
	Thorsen Creek Conservancy	2,512	2,512
	Troup Passage Conservancy	1,512	1,512
	Upper Kimsquit River Conservancy	1,989	1,989
	Ape Lake	757	757
BMTAs	Barer Creek	1,110	1,110
OIC 002-2009	Bentinck Estuaries	35	35
01/09/09	Fish Egg	11,460	11,460
	Inland Cape Caution	9,302	9,302
	King	11,710	11,710
	Kunsoot River	979	979
	Nekite Estuary West	196	196
	South Bentinck	6,033	6,033
	Total	**495,133**	**495,133**

3.3.2 Inoperable or Inaccessible Areas

Inoperable areas are areas that are not available for timber harvesting because they are not economically viable to access and harvest. In response to concerns expressed by the Chief Foresters in his TSR2 rationale, a new operability study was conducted as part of this TSR (*Economic Operability Assessment for the Mid Coast TSA,* Forsite, March 2009). The study used the following general approach:

- A road network was developed to show the extent of potential access throughout the TSA, and included both existing and planned/potential roads. This road dataset is a coarse approximation of what is likely to occur in the future and was used to assign harvest systems. Areas within 250 m of roads were considered conventional harvest, while areas beyond that but limited to 2km away were considered helicopter harvest. Helicopter harvest was also designated up to 2km from potential water drop locations. Areas without a harvest system were immediately considered inoperable (20,080 ha). Those with a harvest system were assessed for economic viability.
- Stands with no potential for harvest in the future were removed from eligibility (Non TSA ownership, parks/designated areas, very low productivity sites, highly environmentally sensitive areas, major riparian areas / floodplains, mountain goat habitat areas, important grizzly habitat areas, etc). An economic subset of these areas was ultimately put back into the operable land base so that TSR netdowns and sensitivities could explore the impacts of these factors.
- Costs were assigned to each stand for planning, logging, barging, scaling, and silviculture using costs provided by licensees and the coastal appraisal manual. See the full project report for more detail.
- Values were assigned to each stand using 10 year average market prices for each species and grade. Grade distributions were determined using historical TSA scaling data for each species and then these species specific grade distributions were applied to each stand in the forest inventory.
- A net value (before road costs) was determined for each stand, and then these values and a full road network (existing and proposed) was fed into a model (Patchworks) to allocate harvesting and road use across the land base for 200 years. Road use triggered any required building costs, maintenance costs, and hauling costs associated with harvesting a specific set of stands. The sum of the stand net values less road related costs in each period provided average net revenue in each period.

- The modeling objective was to find the largest possible land base that could generate a reasonable economic return to the crown over time. Cut block blending or the ability to harvest positive and negative value blocks within each period was allowed as long as the net return after all costs were considered was $6.33/m^3$ in every 5 year period. The $6.33/m^3$ target is based on the average stumpage paid in the TSA over the last 10 years ($9.08/m^3$ not including BCTS) less the current EBM allowance of $2.75/m^3$. This financial objective limited the amount of negative value stands harvested in each period to a reasonable level.
- Any stands harvested by the model during the 200 years planning horizon were considered to be operable. Previously logged blocks in the TSA were considered operable only when they were logged by the model. This left over 10,499 ha of previously logged stands outside of the operability land base.

The size of the area considered inoperable is shown in Table 9. For more detail on how the operable area was developed, refer to the full report cited above.

Table 9. Inoperable areas

Description	Percent Reduction	Prod Area (ha)	Effective Netdown Area (ha)
Inoperable	100%	819,219	327,229

The Ministry of Forestry District has indicated some concerns about the operability in the back of the Owikeno Watershed but licensees still see opportunities in the area. This area will be modeled with no restrictions but its contribution to the base case flow will be reported out and a sensitivity analysis will be preformed.

3.3.3 ESAs and Unstable Terrain

Environmentally sensitive sites and areas of significant value for other resource uses have been delineated within the forest cover inventory as Environmentally Sensitive Areas (ESA's). ESA's are broad classifications that indicate sensitivity for unstable soils (E1s), forest regeneration problems (E1p), snow avalanche risk (E1a), and high water values (E1h). Where terrain stability mapping is available, it is often used in place of ESA soils designations, but there was none available for use in this analysis. Table 10 summarizes the netdown areas attributed to ESA's. Environmentally sensitive area reductions were established by MFR for the 1999 timber supply analysis. The percentages reflect sites sensitivity to forest management, value for other resources, and current management practices.

Table 10. ESA netdown areas

ESA Type	Description	Percent Reduction	Prod Area (ha)	Effective Netdown Area (ha)
ESA1 a	High Avalanche Sensitivity	100%	4,397	592
ESA1 p	High Regeneration Sensitivity	100%	101,771	6,562
ESA1 s	High Soil Sensitivity / Unstable Terrain	90%	139,556	18,450
ESA2 s	Mod Soil Sensitivity / Unstable Terrain	40%	15,454	3,372
Total			**261,177**	**28,977**

Note: The total productive area of ESA1 soils (TSA forested land) was 155,062 ha and the total for ESA2 soils was 38,634 ha.

These netdowns were implemented spatially by randomly selecting ESA polygons from the TSA's forested land base until the correct percentage was achieved. The selected polygons were then 100% removed from the THLB. Areas with previous logging history were not removed as part of this netdown.

3.3.4 Non-Merchantable or Problem Forest Types

Non-merchantable forest types are stands that contain tree species not currently utilized in the TSA, or timber of low quality, small size and/or low volume. Non-merchantable types are entirely excluded from the timber harvesting land base as shown in Table 11.

Table 11. Non-merchantable forest types

PFT Type	Description *	Percent Reduction	Prod Area (ha)	Effective Netdown Area (ha)
Pine	All pine leading stands (Pl / Pw / Py)	100%	177,954	25
Larch	All larch leading stands	100%	8	0
Decid.	All deciduous leading stands	100%	18,843	8
Total			**196,805**	**33**

* Sites with a previous logging history were retained in the land base.

The net impact of this netdown is low because these stands were typically deemed uneconomic during the operability assessment because they provided little to no economic value (revenue) when harvested. Alder leading stands may be put back into the THLB during a sensitivity analysis to determine alder volume availability.

3.3.5 Low Productivity Sites

Sites with low growing potential are areas that are not expected to contribute to the THLB because they take too long to produce a commercial crop of trees. The list of exclusion criteria can be found in Table 12. These definitions were derived based on a review of past licensee performance in various site index categories. Limited logging occurred in stands with site indices below the thresholds shown here but it was not significant enough to warrant inclusion of all stands with that site index in the THLB.

Table 12. Low site netdowns

Leading Species	Description *	Percent Reduction	Prod Area (ha)	Effective Netdown Area (ha)
Fd	150 yr old Fd stands <350 m3/ha or SI<17 m	100%	3,982	380
Cw/Yc	150 yr old Cw stands <300 m3/ha or SI<12 m	100%	105,696	16,304
Hw/Ba	150 yr old Hw/Ba stands <350 m3/ha or SI<11 m	100%	47,192	1,128
Sx	150 yr old Sx stands <350 m3/ha or SI <10 m	100%	20,792	7
Total			**177,662**	**17,819**

* Sites with a previous logging history were not removed by this netdown.

A portion of these stands were already removed during the economic operability assessment as they were not economically viable to harvest. Low productivity stands incurred higher costs because they were assumed to have smaller piece sizes and they had less volume per ha over which to amortize fixed costs such as logging system setup, road building, and silviculture costs.

Only a small proportion of the total 'low site' area is netted down here because the remainder of the area was already removed by other netdowns such as parks, operability, and ESA's.

3.3.6 Cultural Heritage Resource Deductions

The *Heritage Conservation Act* provides for the protection of British Columbia's archaeological sites predating 1846. In accordance with the *Act* (Section 13(2)), archaeological sites may not be damaged, excavated or altered without a permit issued by the Minister or designate. The BC Provincial Heritage Register database is the basis for records on archaeological sites. The sites contained in this database were obtained and reviewed by Mid Coast technical committee members from the Heiltsuk and Gwa'sala'Nakwaxda First Nations. The mapped areas were deemed inadequate to represent the issue as several know sites were missing and there will be further impacts from currently unknown sites. Considering the effort required to improve the dataset and the sensitivity of this information to FN's, it was decided to include this issue with the non spatial netdown approach taken to address the First Nation EBM issues discussed later in this document. Refer to section 8.5 for more detail. Uncertainty around this issue will be addressed in the THLB size sensitivity analysis.

3.3.7 Karst

In March 2007, a GAR order established specific elements of karst systems as "resource features" in the North Island - Central Coast Forest District and this designation results in protection under FRPA's Forest Planning and Practices Regulations. The elements named in the GAR order are:

- Karst caves
- Important features and elements within high and very high vulnerability karst
- Significant surface karst features

Mapped inventory data reflecting karst likelihood (presence) and development intensity (quality) was reviewed for the Mid Coast TSA. This mapping does not directly identify karst vulnerability it was assumed that areas with a high likelihood of occurrence combined with a high quality rating would meet this definition. There was almost no area ranked as high (primary) likelihood in the TSA. Discussions within the MFR staff and licensees confirmed that karst features are rare in the TSA and any occurrences can be effectively dealt with using stand level retention strategies. Thus, no netdown was specifically implemented for karst.

3.3.8 Wildlife Habitat Areas (WHA's)

The provincial *Identified Wildlife Management Strategy* provides for the creation of Wildlife Habitat Areas (WHA) within the TSA, to protect key habitat features of listed wildlife species. Legal WHA's exist in the TSA for Grizzly Bear while Draft WHA's have been developed for Sandhill Crane, Tail Frog, Northern Goshawk, and Marbled Murrelets. Only the legal Grizzly Bear WHA's will be netted out of the land base in the Base Case as the others are not yet finalized. Proposed WHA's may be evaluated using sensitivity analysis and can also be addressed at the time of determination by considering their contribution to the target 1% impact on the THLB as defined in the Identified Wildlife Management Strategy.

The FRPA Section 7 Notice indicates that 16,000 hectares of grizzly bear habitat are to be maintained in the Mid Coast TSA of which no more than 6,046 ha[3] can be within the TSR2 THLB. The established grizzly WHA's were designed to be consistent with this requirement. Since grizzly bear habitat was factored into the TSR1/TSR2 analysis (and considered as pre-FPC practice) the impact of this requirement is deemed to be extra to the IWMS 1% limit.

Table 13. Reductions for established WHA's

Description	Percent Reduction	Prod Area (ha)	Effective Netdown Area (ha)
Grizzly Bear WHA's	100%	13,661	3,755

3.3.9 Mountain Goat Winter Range

In 2007, a Government Action Regulation (GAR - #U-5-004)) order was established that identifies habitat areas and prevents harvest from occurring in 90% of the habitat area in each landscape unit. This will be modeled by ensuring 90% of the habitat in each LU is spatially reserved from harvest.

[3] The total area indicated in the Notice equals the area mapped by MELP in 1988 as critical forest habitat for grizzly bears. The maximum impact on THLB indicated in the Notice is equal to the area of THLB reported in the TSR2 AAC Rationale. However, grizzly bear areas were factored into the analysis as cover constraints, not reserves, so the equivalent impact on the TSR2 THLB is less than 10,000 hectares. Calculations based on TSR2 LTHL, estimate an equivalent THLB impact of 6,046 hectares (3.2% of base case). WHAs 5-120 through 5-541 were established under this account.

Table 14. Reductions for Mountain Goat

Description	Percent Reduction	Prod Area (ha)	Effective Netdown Area (ha)
Mountain Goat Winter Range	90%	29,985	65

Note: The total productive area (TSA forested land) was 33,318 ha.

The area to be reserved (90% or 29,985 ha) was selected using any constrained land base first and then any unconstrained land base starting with the lowest site indexes. Each LU was evaluated independently. The vast majority of the Mountain Goat area overlapped with inoperable areas, parks, or ESA's. There were only 4 LU's where the unconstrained land base did not satisfy the minimum of 90% of the required area: Johnston (35 ha), Bella Coola (21 ha), Ellerslie (8 ha), and Sheep Passage (3 ha). The overall Mountain Goat Winter Range protection reaches 32,555 ha (98%) at the TSA level.

3.3.10 FRPA Riparian Reserve and Management Zones

Riparian reserve areas around lakes, wetlands, and streams in the Mid Coast TSA are excluded from the timber harvesting land base. Management practices within riparian management zones also resulted in areas excluded from the timber harvesting land base. Based on typical licensee FSP commitments, a portion of the volume/area of these zones was retained as shown in the tables below. In the analysis, this was represented by an additional buffer width that was 100% excluded. When the reserve zone and representative portion of the management zone were added together, an "effective" buffer width was defined and then ultimately used in the model as a 100% spatial netdown. See Table 16 for a description of the netdown assumptions for lakes and wetlands, and Table 15 for a description of stream netdown assumptions.

3.3.10.1 Streams and Rivers

Stream classifications were assigned to all TRIM stream reaches using a classification algorithm designed to be consistent with the FRPA definitions. Stream widths were inferred from stream order and magnitude (number of reaches above). Buffers were applied to both sides of mapped streams using 'effective' widths as per Table 15 and then removed from the timber harvesting land base. Basal area retention in management zones is reflective of typical management practices in the TSA.

Table 15. Land base reductions for streams

Stream Class	Reserve Zone (RRZ) (m)	Mgmt Zone (RMZ)(m)	RMZ Basal [(1)] Area Retention (%)	Effective [(2)] Riparian Rsv Width (m)	Prod [(3)] Area (ha)	Effective Netdown Area (ha)
S1-A (>100 m)	0	100	50	50	4,417	1,729
S1-B (20-100 m)	50	20	50	60		
S2	30	20	50	40	3,997	1,687
S3	20	20	50	30	3,668	1,207
S4	0	30	25	7.5	2,894	905
S5	0	30	15	4.5	826	224
S6	0	20	5	1	-	-
Total					**15,803**	**5,752**

(1) Based on licensee operational practices as per approved FSPs.
(2) Effective riparian rsv width = RRZ + (RMZ * (basal area retention / 100)). This width is applied to both sides of the stream.
(3) This area excludes protected and conservancy areas (parks/conservancy and designated areas).

Only buffered S1-S5 streams were removed spatially. The small buffers on S6 streams were used to calculate a non-spatial retention percentage for each polygon and then this was tracked in Patchworks. These areas are able to contribute toward non timber objectives but did not contribute toward harvest volumes/areas.

3.3.10.2 Lakes and Wetlands

Lake and wetland classifications were assigned to all TRIM water polygons consistent with the logic in the Riparian Management Guidebook (MFR 1997). Buffers were created adjacent to mapped lakes and wetlands using 'effective' widths as per Table 16 and then removed from the timber harvesting land base.

Table 16. Land base reductions for lakes and wetlands

Lake/Wetland Class	Reserve Zone (RRZ) (m)	Mgmt Zone (RMZ) (m)	RMZ Basal [4] Area Retention (%)	Effective [5] Riparian Rsv Width (m)	Prod [6] Area (ha)	Effective Netdown Area (ha)
L1-A (>1000 ha)	0	0	0	0	973	288
L1-B (5-1000 ha)	10	40	0	10		
L2	10	20	25	15	-	-
L3	0	30	25	7.5	167	61
L4	0	30	25	7.5	-	-
Total					**1,140**	**349**
W1 (> 5ha)	10	40	25	20	115	21
W2	10	20	25	15	-	
W3	0	30	25	7.5	175	66
W4	0	30	25	7.5	-	
W5	10	40	25	20	200	52
Total					**490**	**139**

[4] Based on licensee operational practices as per approved FSPs.
[5] Effective riparian reserve width = reserve zone + (management zone * (basal area retention / 100)).
[6] This area excludes protected and conservancy areas (parks/conservancy and designated areas).

3.3.11 Recreation Features

Recreation features are features on the land base that are important to public and commercial recreation activities. These can include wildlife viewing areas, camp sites, sheltered moorage areas, etc and can sometime result in the exclusion of harvest activities.

Using the Recreation Features Inventory (RFI) dataset for the Mid Coast TSA, high value areas were identified. Polygons coded with Significance/Sensitivity ratings of VH-H, H-H, VH-M, H-M, M-H were selected for netdown considerations. After a review of these areas, it was determined that only a subset (50%) of the areas falling outside constraining VQO polygons (Preservation, Retention, Partial Retention) should be removed as netdowns. These areas represented things like grizzly bear viewing areas in river valleys and a 100% netdown was considered excessive. Licensee's operational experience in the TSA is that recreational values can be accommodated through management and rarely result in land base netdowns.

Table 17. Recreation netdowns

Recreation inventory polygons outside of P, R, and PR VQO's with the following Significance - Sensitivity ratings:	Prod Area (ha)	50% Random Selected Area (ha)	Effective Netdown Area (ha)
VH - H	472	209	90
H - H	8,914	4,423	1,364
VH - M	248	121	8
H - M	11,284	5,717	2,003
M - H	1	-	-
Total	**20,920**	**10,470 (50%)**	**3,466**

The 50% netdown was turned into a spatial 100% netdown (10,470 ha) by randomly selecting resultant polygons until half of the designated productive area was selected. Then only the area falling outside of previous netdowns was counted toward the effective netdown area. A significant portion of the effective netdown area had past logging in it but it was still removed from the landbase.

3.3.12 EBM Riparian Management

EBM requirements for High Value Fish Habitat, Aquatic Non High Value Fish Habitat, Active Fluvial Units (Floodplains), and Forested Swamps have the potential to result in additional land base netdowns and are discussed below. EBM requirements for Upland Streams and Important Fisheries Watersheds are addressed using forest cover constraints and are discussed in sections 8.5.6 and 8.5.10.

For the purpose of defining reserve zones, the following tree heights were used:

- Outer Coast: 30 m
- Inner Coast: 40 m

Both EBM Orders[4] also offer the potential to use alternative riparian reserve strategies with the implementation of adaptive management, information sharing with FN's, and environmental monitoring – but the default EBM assumptions have been assumed for the base case.

3.3.12.1 High Value Fish Habitat (EBM Obj 9)

High Value Fish Habitat is defined as "critical spawning and rearing areas for anadromous and nonanadromous fish". This occurs in a subset of streams and portions of the ocean shoreline.

For streams:
HVFH was spatially identified using 1:20000 scale streams with a gradient of <= 5% on terrain with <=5% slope and under 900 m in elevation. These criteria are meant to capture the vast majority of alluvial streams in the TSA based on the direction that all alluvial streams should be treated as HVFH unless proven otherwise in the field[5]. The link between 5% gradient streams and alluvial streams is drawn from work completed by Glynnis Horel, P. Eng.[6]. The inclusion of the terrain constraint was intended to eliminate sharply incised draws that are unlikely to be alluvial in nature. A buffer of 45m (30 m x 1.5) on the outer coast and 60 m (40 m x 1.5) on the inner coast was then applied to both side of the streams and the resulting area was fully reserved from harvest.

The Central North Coast Order (2009) also defines as high value fish habitat a reserve zone of 150 m on each side of the natural boundary for the lower portion of the Kimsquit River (Schedule 7). The buffer polygon was obtained from the Integrated Land Management Bureau webpage under the Coast Land Use Decision Implementation section[7]. This polygon has a total area of 1,133 ha and resulted in an effective netdown of 264 ha. The South Central Coast Order (2009) also defines as HVFH the lower portion of the Klinaklini River and Viner Creek but these are outside the boundaries of the Mid Coast TSA.

For oceans:
Key spawning habitat was identified on nautical charts using symbology indicating a high correlation with the occurrence of high value fish habitat (shallow water depth, soft seabed). These portions of the shoreline were then captured and buffered in the same manner as HVFH streams.

Table 18. Reductions for HVFH

Description	Percent Reduction	Prod Area (ha) (Incremental to Other Riparian)	Effective Netdown Area (ha)
HVFH	100%	5,782	1,603
HVFH lower portion Kimsquit River	100%	1,133	264

[4] South Central Coast Order (March 27, 2009) and the Central and North Coast Order (March 27, 2009). Source: http://www.ilmb.gov.bc.ca/slrp/lrmp/nanaimo/cencoast/plan/objectives/index.html [accessed online: May 28, 2009].

[5] Background and Intent Document for the SCC and CNC Land Use Objectives Orders, April 18, 2008, pg 23. Source: http://www.ilmb.gov.bc.ca/slrp/lrmp/nanaimo/cencoast/plan/objectives/LUO.pdf. [accessed online: May 20, 2009]

[6] Defining Active Fluvial Units, Glynnis Horel - Ostapowich Engineering Services Ltd, April 1, 2006, pg 2

[7] Primary source: http://www.ilmb.gov.bc.ca/slrp/lrmp/nanaimo/cencoast/plan/objectives/index.html. Schedule 7 – Kimsquit 150 m Buffer source: http://www.ilmb.gov.bc.ca/slrp/lrmp/nanaimo/cencoast/docs/kimsquit_sched_20090316.pdf. Buffer polygon source: ftp://ftpnan.env.gov.bc.ca/dist/gisdata/cclrmp/ebm_data/CNC_Amendments/Kimsquit_River_cnc.zip [accessed online: May 20, 2009]
It should be noted that this polygon did not line up well with the 20k stream netdown – was obviously created from more coarse data.

The total productive area shown here represents only the incremental reserves beyond FRPA requirements. If HVFH were to be implemented without FRPA, this area would be significantly higher.

3.3.12.2 Aquatic Non High Value Fish Habitat (EBM Obj 10)

Aquatic non-high value fish habitat was also derived from the TRIM 20,000 scale stream data and using FRPA stream classifications. Both orders require that S1-S3 streams, lakes >0.25 ha, and wetlands >0.25 ha that are not HVFH be classified as aquatic non-high value fish habitat. The orders differ slightly in their requirements for reserves (Table 19) and the areas impacted can be found in Table 20.

Table 19. Riparian Retention requirements for Aquatic Non HVFH

Riparian Feature	SCC Order	CNC Order
S1- S3 Streams that are not HVFH	Retain 90% of the PFLB within 1.5x dominant tree height * (implemented as 100% reserve within 1.35x tree height)	
Lakes and wetlands >1ha	Retain 90% of the PFLB within 1.5x dominant tree height * (implemented as 100% reserve within 1.35x tree height)	
Lakes and wetlands 0.25 to 1ha	SCC order : 90% Retention within 1.5 tree height. (1.35 x tree height)	CNC order: 90% Retention within 1.0 tree height. (0.9 x tree height)

* Tree heights were 30 m on outer coast and 40 m on inner coast.

Table 20. Reductions for Aquatic NonHVFH

Description	Percent Reduction	Prod Area (ha) (Incremental to Other Riparian)	Effective Netdown Area (ha)
Aquatic Non HVFH	100%	6,630	2,094

The total productive area shown here represents only the incremental reserves beyond FRPA requirements. Without FRPA, this area would be significantly higher.

3.3.12.3 Forested Swamps (EBM Obj 11)

Both EBM orders require that forested swamps >0.25 ha are to have 70% retention within 1.5x the dominant tree height. Because they are relatively rare in coastal BC[8], and typically have marginal timber values on them, they were assumed to be addressed in the netdown for stand level retention (EBM Obj 16).

3.3.12.4 Active Fluvial Units (EBM Obj 13)

Floodplain (active fluvial units) areas were identified using the CCLRMP floodplain dataset (which was derived using the coastal small scale PEM SELES model) and the mapped TRIM floodplains. These areas were then reduced by excluding any areas occupied by coniferous stands at least 200 years old (>80% coniferous) and any isolated polygons <=0.25 ha in size. The very small polygons were considered to be noise in the dataset and eliminated. The CCLRMP floodplains included high bench floodplains that were not meant to be considered active fluvial units in the final orders. Thus areas with old conifer stands were assumed to be stable within the timeframe of forest management and not “active fluvial units” as defined in the orders (Defining Active Fluvial Units, Glynnis Horel, P. Eng., Ostapowich Engineering Services Ltd, April 1, 2006).

[8] Pers. Con. Ken Zielke of Symmetree Consulting Ltd. Based on experience doing EBM training work and compliance assessments.

Reserved areas for floodplains are detailed in both the North and South Central Coast EBM orders, although the application of reserves differs. The SCC order requires the reserve of 90% of mapped floodplain areas and the CNC order requires the reserve of 100% of mapped floodplain areas plus 90% retention within 1.5 times dominant tree hts (1.35X avg. dominant tree ht.). Tree heights were 30 m on outer coast and 40 m on inner coast.

Within the SCC area, the area to be reserved (90%) was selected using any constrained land base first and then any unconstrained land base starting with the lowest site indexes.

Table 21. Reductions for Active Fluvial Units

Description	Percent Reduction	Prod Area (ha) (Incremental to Other Riparian)	Effective Netdown Area (ha)
Active Fluvial Units (Floodplains) – SCC	100%	941	203
Active Fluvial Units (Floodplains) – CNC	100%	4,752	947
Total		**5,693**	**1,150**

The total productive area shown here represents only the incremental reserves beyond FRPA requirements. Without FRPA, this area would be significantly higher.

3.3.13 Grizzly Bear Habitat (EBM Obj. 17)

Grizzly bears are a highly important regional species on the South Central Coast and Central and North Coast. The EBM orders spatially identify grizzly bear habitat and require that it be maintained as functional habitat. The WHA's discussed under section 3.3.8 have a high degree of overlap with these EBM grizzly habitat areas.

SCC Order Area:

The order requires that grizzly bear habitat mapped in Schedule 2 (released March 2009)[9] be maintained. These mapped areas represent class 1 grizzly bear habitat. The order provides for limited harvesting to occur in these areas if a qualified professional confirms that it will not cause a 'material adverse impact' to the suitability of the grizzly bear habitat, suitable monitoring is completed, and information sharing/consultation takes place with First Nations. Limited harvesting can also occur if needed to accommodate minor block boundary adjustments, or if no practicable alternative for road access exists.

CNC Order Area:

This order requires that all class 1 grizzly bear habitat and 50% of class 2 grizzly habitat as mapped in Schedule 2 be maintained (released March 2009)[10]. It also allows for harvesting under the same circumstances described for SCC Order above.

Implementation:

The licensees felt that this would preclude harvest from 90% of the mapped habitat based on their opinion that not all of the mapped area will have the desired attributes on the ground, a small amount of harvesting would not negatively impact habitat values, and small incursions for operational/safety reasons is allowed. Thus, a spatial netdown representing 90% of the mapped grizzly habitat area was implemented. The 90% target was met in each grizzly polygon unit by selecting non-contributing or constrained areas first – this left the areas most likely to be in the THLB as contributing. For example, if up to 10% of the mapped habitat area in a grizzly polygon is THLB then there would be no impact on the THLB. Table 22 shows the effective netdown area from the THLB (2,745 ha).

The grizzly polygon GIS data obtained for both EBM orders was dissolved on Class 1 and 2 (adjacent polygons in the same class become one polygon). The constraint is applied using these grizzly polygons. The data also identified previously harvested areas as habitat, which should not have been

[9] Source: http://www.ilmb.gov.bc.ca/slrp/lrmp/nanaimo/cencoast/docs/grizzly_bear_sched_sc_20090323.pdf. Database source: ftp://ftpnan.env.gov.bc.ca/dist/gisdata/cclrmp/ebm_data/SCC_Amendments/Grizzly_scc.zip [accessed online: May 20, 2009]

[10] Source: http://www.ilmb.gov.bc.ca/slrp/lrmp/nanaimo/cencoast/docs/grizzly_bear_sched_nc_20090323.pdf. Database source: ftp://ftpnan.env.gov.bc.ca/dist/gisdata/cclrmp/ebm_data/CNC_Amendments/grizzly_bear_nc.zip [accessed online: May 20, 2009]

included and thus were excluded them from the analysis[11]. Previously logged areas provide temporary habitat because of high abundance of berries but are not a permanent grizzly bear habitat area.

Table 22. Reductions for Grizzly Bear Habitat

Description	Prod Area (ha)	Percent Reduction	Area Reduction (ha)	Effective Netdown Area (ha)
CNC Class 1 Grizzly Bear Habitat	36,356	90%	32,721	2,245
CNC Class 2 Grizzly Bear Habitat	4,747	50%	2,374	59
SCC Class 1 Grizzly Bear Habitat	8,139	90%	7,325	441
Total	**49,243**		**42,420**	**2,745**

3.4 Exclusions from the Productive Forest Land Base (Non-Spatial)

3.4.1 EBM Objective 4, 5, 6, 7 – First Nations Considerations

Both the Central and North Coast Order (CNC) and the South Central Coast Order (SCC) contain objectives to manage for issues important to First Nations that will result in land base netdowns:

- Objective 4 (Traditional Heritage Features) is aimed at protecting specific traditional heritage features that are of continuing importance to First Nations.
- Objective 5 (Culturally Modified Trees) is designed to identify and protect culturally modified trees of continuing importance to First Nations.
- Objective 6 (Monumental Cedar) is designed to provide for a sufficient volume of monumental cedar to support the present and future cultural cedar needs of First Nations.
- Objective 7 (Stand Level Retention of Cw/Yc) is designed to ensure that sufficient western red and yellow cedar is maintained within Cedar Stewardship Areas to support the applicable First Nations use of these species for cultural and social uses.

Note: Objective 3 (Traditional Forest Resources) is not addressed through netdowns so is not included here. See section 8.5.1 for details.

The consideration of First Nations values described in EBM Objective's 4, 5, 6, and 7 are estimated to have a 1.3% net/incremental impact on the THLB (Obj 3 is addressed in 8.5.1). This impact level is based on a similar netdown developed for the Kingcome TSR3 project where the known impact was mapped and then doubled. The Kingcome dataset representing known First Nations heritage sites was more complete, and updating the Mid Coast dataset was not considered practical within the timelines of this TSR. The technical committee felt that it was best to rely on the recent efforts invested in Kingcome TSA for application in the Mid Coast TSA. This 1.3% impact was implemented as a non spatial reduction to all THLB polygons and the resulting netdown was treated as part of the PFLB.

The full impact of managing for First Nations considerations is known to be larger than 1.3% but this value represents the incremental impact after other factors are also considered (e.g. parks, inoperable, ESA's, FRPA and EBM riparian areas, wildlife habitat reserves, stand level retention requirements, etc). These other factors leave only ~13% of the forested landbase where timber harvesting is expected to occur and it is this area that the additional 1.3% impact is applied. Uncertainty around this issue will be addressed in the THLB size sensitivity analysis.

3.4.2 EBM Objective 15 – Red and Blue Listed Plant Communities

The SCC and CNC orders require 100% retention (5% can be disturbed for access) of red listed plant communities and 70% retention of blue-listed plant communities. Identifying the spatial locations of these communities is currently difficult as there is little detailed ecosystem mapping available for the Mid Coast TSA. Thus, the net THLB impact for the Kingcome TSR3 process was considered as a starting point. The

[11] Pers. Con. Tony Hamilton. Large Carnivore Specialist, Wildlife Science Section. Ministry of Environment, Victoria, BC.

Kingcome TSR3 analysis applied a 3% incremental net impact over and above all other landbase constraints that came from EBM being applied to 80% of the landbase, mathematically this would extrapolate to 3.8% for Midcoast (100% EBM).

However, the Kingcome TSA estimate was based on a biophysical model simulation of ecosystems and correlations between these ecosystems and red/blue listed plant communities developed by the Timberline Natural Resources Group.[12] After consideration of the methods used to identify these sites in the biophysical modeling project, and the improved understanding of how sites are to be identified in the field the Mid Coast licensees felt that a 3% impact is likely excessive and thus it should not be increased any further. The basis for this conclusion is primarily because the areas attributed to the plant communities listed in Obj15 (Sched 6) are expected to occupy only a subset of the mature site series that was spatially identified in the biophysical model and the site series described on the CDC Blue List. In addition to this operational experience suggests that an incremental impact for Blue Listed plant communities is unnecessary. Thus 3% will be used in the base case. This impact is entirely attributed to blue listed plant communities because red listed plant communities are assumed to be captured by other netdowns. The 3% net impact was implemented as a non spatial area reduction to all THLB polygons. The resulting netdown area was treated as part of the PFLB. Uncertainty around this issue will be addressed in the THLB size sensitivity analysis.

3.4.3 Stand Level Retention (EBM Obj. 16)

The retention of mature standing timber in each block is required to provide structure and diversity at the stand level. Both the SCC and CNC orders state that a minimum 15% of each cutblock should be retained and 50% of this retention should be internal to the cutblock if it's over 15 ha. For the purpose of timber supply analysis, it was necessary to determine what the net impact of this stand level retention objective was because there is significant overlap with other factors already being modeled. For example, riparian areas are often used to meet stand level retention requirements and they have already been addressed in the THLB netdown process.

Based on an EBM monitoring report produced by Symmetree Consulting Group that examined the retention left in EBM blocks in 2006[13], the net impact of the 15% retention requirement was estimated by Forsite to have an incremental impact of 4.6% on the THLB after all other netdowns were considered. The key findings were that the group retention and clearcut blocks had an actual retention level of 21% (instead of 15%) and 21.8% of this retention appeared to be incremental to the netdowns already spatially addressed in this analysis. This suggested a 4.6% net impact from the EBM stand level retention requirement.

District MFR staff also examined this issue using RESULTS data (2005-2008) and found that blocks with aggregate retention had retained 23% on average. This estimate is slightly higher than that found by Symmetree (21%) but came from a much larger sample. As there was no breakdown in RESULTS of the reasons why the 23% was left, the Symmetree study's net impact percentage (21.8%) was used to reduce the 23% to a net impact of 5.0% (above all spatial netdowns). Licensees felt that a gross retention percentage of 23% (net 5%) was higher than what was currently occurring on the landbase but agreed to use it for the purpose of this analysis.

The 1.3% impact discussed earlier for First Nations EBM considerations was felt to partially overlap with the 5% because it had not yet been considered in the estimate, plus the licensees would likely choose to use areas retained for First Nations issues (CMT's, heritage sites) to meet stand level retention objectives. In absence of better information, it was assumed that 50% of the 1.3% would overlap (1.3* 50%=0.6) so this left a 4.4% net impact (5% -0.6%) to be attributed to stand level retention. This level of netdown appears conservative considering the fact that >88% of the TSA's productive forested land base has already been excluded from timber harvesting and incremental impacts for First Nations issues and Red/Blue listed plant communities are also being assumed.

[12] Methods Used to Model Ecosystem Based Management in the Kingcome TSA for Timber Supply Review 3, Timberline Natural Resource Group, 2007

[13] Implementation Monitoring of EBM in the Central Coast (Symmetree, Feb 28, 2007)

This 4.4% impact was modeled as a non spatial reduction to all THLB polygons (in addition to the 1.3% for FN issues and 3% for red/blue listed species). The resulting netdown was treated as part of the PFLB. Uncertainty around this issue will be addressed in the THLB size sensitivity analysis.

3.5 Timber License Reversions

Timber licensees (TL's) are old tenures where licensees have the rights to harvest standing mature timber within specified tenure boundaries and this harvest does not count toward the TSA's AAC. Once harvested and regenerated, these areas revert to the crown and become part of the TSA land base – thus contributing to the mid and long term timber supply in the TSA.

Area that were < 50 yrs old inside the mapped TL's were consider to have already reverted to the TSA for purposed of timber supply modeling. The remaining areas were considered to revert at 600 ha per year (consistent with TSR2 assumptions.)

Table 23 provides a summary of the TL's falling inside the Mid Coast TSA.

Table 23. Timber Licences occurring in the Mid Coast TSA

TL #	Licensee	Location	Expiry Date
T0377	A&A Trading Ltd	TSA	June 10, 2019
T0398	IFP	TSA	Sept. 3, 2024
T0407	IFP	TSA	Sept. 3, 2009 (extension submitted).
T0438	IFP	TSA	Sept. 3, 2010
T0474	IFP	TSA	Sept. 3, 2024
T0483	IFP	TSA	Sept. 3, 2017
T0572	IFP	TSA	Sept. 3, 2015
T0608	IFP	TSA	Sept. 3, 2024
T0614	Dean Channel FP Ltd	TSA	Sept. 3, 2021
T0633	Dean Channel FP Ltd	TSA	Sept. 3, 2015
T0690	IFP	TSA	Dec. 9, 2010
T0697	IFP	TSA	Dec. 30, 2009
T0742	IFP	TSA	Apr. 16, 2016
T0906	WFP	TSA	Expired (extension submitted).
T0912	WFP	TSA	Apr. 27, 2010
T0941	IFP	TSA	Oct. 23, 2007
T0945	IFP	TSA	Oct. 23, 2009
T0952	A&A Trading Ltd	TSA	Oct. 23, 2024
T0964	IFP	TSA	Oct. 23, 2024
T0973	IFP	TSA	Oct. 23, 2024
T0980	IFP	TSA	Oct. 23, 2024
T0996	IFP	TSA	Oct. 23, 2024
T1001	IFP	TSA	Oct. 23, 2014

The TL's that will revert to the Community Forest's upon harvest will not contribute toward the TSA in the future. Only the areas associated with the TL's that will ultimately revert to the TSA are shown below.

Table 24. Timber license area summary

Currently Reverted Area (ha)	Currently Unreverted Area (ha)	Total Area (ha)
22,409	5,279	27,688

3.6 Changes from TSR2

Since the last timber supply review for the Mid Coast TSA, numerous changes have occurred that impact the size of the THLB. A summary of these changes is provided below:

- New Conservancies, and Biodiversity, Mining and Tourism Areas have been established.
- Two new community forest tenures exist and are no longer part of the TSA.
- A new operable area was defined using stand level economic assessments and Patchworks modeling.
- Low productivity site netdowns now use lower thresholds (vol/ha and site index).
- Recreation netdowns are now based on a new inventory and then limited to areas outside of the most constraining VQO polygons (Preservation, Retention, Partial Retention)
- Legal WHA's exist for grizzly bear.
- New Mountain Goat Winter Range areas have been established and almost entirely exclude harvest.
- Riparian netdowns were implemented spatially using classified stream/lake/wetland datasets.
- Culturally Modified Trees (CMT's) were addressed as part of the First Nations EBM issue.
- EBM considerations from the North and South Central Coast Orders resulted in netdowns for:
    - High Value Fish Habitat (HFVH)
    - Aquatic Non High Value Fish Habitat
    - Active fluvial units (floodplains)
    - CMT's/Cultural Cw/ Monumental Cw
    - Grizzly Bear Habitat
    - Stand Level Retention / Forested Swamps
    - Red and Blue List Species

The TSR3 short term effective THLB of 123,162ha is smaller than the TSR2 'preferred reference' forecast[14] THLB by 35.3%. The majority of this difference comes from the introduction of new parks/protected areas, a new operable land base, and the introduction of EBM and wildlife requirements.

Other, non-THLB related changes since TSR2 include (described in section 8.0):

- Disturbance limits exist in Important Fisheries Watersheds (EBM Obj. 8)
- ECA requirements applied in portions of certain watersheds to manage Upland Streams (EBM Obj. 12)
- Higher old seral retention requirement are now applicable and they were modeled at a finer level on the land base (LU-site series surrogate combinations instead of LU-BEC variant combinations).
- The amount of mid seral forest was limited to 50% within LU-SSS combinations.
- A new UWR order for black tailed deer exists and requires from 20-25% of the habitat in each LU to be >141 yrs old at any time. TSR 2 required 25% > 250 yrs old.
- Dispersed Retention harvesting is modeled in Preservation and Retention VQO areas and no forest cover disturbance constraints are applied in these areas. Dispersed Retention harvesting is also applied in 10% of the Partial Retention VQO areas, along with forest cover disturbance constraints.
- Existing dispersed retention blocks were assigned to a separate AU (315) with reduced yields.

[14] 190425 ha - TSR2 Rationale pg 17. This THLB area was the same as in the 'revised operability' forecast but the rate of harvest from the outer coast and non-conventional areas was controlled to be sustainable over the long term – effectively lowering the amount of these areas that could be accessed in the short and midterm and making this comparison of land base imperfect.

4.0 Growth and Yield

4.1 Analysis Units

To reduce the complexity and volume of information in the timber supply analysis, individual stands were aggregated into 'analysis units' based on leading tree species (inventory type group), site productivity, and age. Each analysis unit had an associated yield table that provided the net merchantable volume available for harvest at various stand ages.

Table 25. Analysis Unit Descriptions

Analysis Unit Description	Existing Stand AU #	Regen Stand AU#	PFLB Area (ha)	THLB Area (ha)	SI Wtd Avg (Inv)	SI Wtd Avg (Adj)	Variables used to define analysis unit		
							Leading Species	Site index range	Age Range (yrs)
Existing Natural Stands:			**980,833**	**105,999**					
Douglas-fir-good	101	201	1,111	400	29.7	29.7	Fd	>27	26-140yrs
Douglas-fir-medium	102	202	3,397	789	24.7	24.7	Fd	20-27	26-140yrs
Douglas-fir-poor	103	203	3,630	119	17.9	17.9	Fd	<20	26-140yrs
Cedar-good	104	204	1,163	621	27.2	23.9	Cw or Yc	>23	20-140yrs
Cedar-medium	105	205	3,087	2,002	22.9	23.1	Cw or Yc	>19-23	20-140yrs
Cedar-poor	106	206	1,029	573	15.5	21.2	Cw or Yc	15-19	20-140yrs
Cedar-low	107	207	1,991	122	13.8	23.6	Cw or Yc	<15	20-140yrs
Hemlock/balsam-good	108	208	6,331	2,191	28.1	27.3	H or B	>22	26-140yrs
Hemlock/balsam-medium	109	209	17,570	6,230	21.6	26.9	H or B	>17-22	26-140yrs
Hemlock/balsam-poor	110	210	7,288	534	14.6	26.2	H or B	12.5-17	26-140yrs
Hemlock/balsam-low	111	211	12,151	39	11.7	24.8	H or B	<12.5	26-140yrs
Spruce-good	112	212	1,316	282	27.7	27.7	S	>22	26-140yrs
Spruce-medium	113	213	3,444	318	20.7	20.7	S	15-22	26-140yrs
Spruce-poor	114	214	4,097	55	11.7	11.7	S	<15	26-140yrs
Douglas-fir-good	121	221	391	42	27.7	27.7	Fd	>27	>140yrs
Douglas-fir-medium	122	222	5,283	1,007	23.2	23.2	Fd	20-27	>140yrs
Douglas-fir-poor	123	223	9,325	643	18.7	18.7	Fd	<20	>140yrs
Cedar-good	124	224	386	149	24.2	22.3	Cw or Yc	>23	>140yrs
Cedar-medium	125	225	2,717	816	20.4	23.6	Cw or Yc	>19-23	>140yrs
Cedar-poor	126	226	48,270	17,279	16.6	20.9	Cw or Yc	15-19	>140yrs
Cedar-low	127	227	262,713	36,515	13.1	19.2	Cw or Yc	<15	>140yrs
Hemlock/balsam-good	128	228	4,558	520	24.3	26.9	H or B	>22	>140yrs
Hemlock/balsam-medium	129	229	44,770	10,048	18.8	25.2	H or B	>17-22	>140yrs
Hemlock/balsam-poor	130	230	132,065	19,987	15.0	24.5	H or B	12.5-17	>140yrs
Hemlock/balsam-low	131	231	133,282	2,868	11.7	23.0	H or B	<12.5	>140yrs
Spruce-good	132	232	3,436	341	27.4	27.4	S	>22	>140yrs
Spruce-medium	133	233	23,452	730	18.8	18.8	S	15-22	>140yrs
Spruce-poor	134	234	43,764	778	13.3	13.3	S	<15	>140yrs
Non Merch - Cottonwood	151	256	3,294	-	-	-	Ac	All	All
Non Merch - Alder	152	255	9,016	-	-	-	Dr	All	All
Non Merch - All Others	153	257	186,504	-	-	-	At, Mb, Pl, L	All	All
Existing Managed Stands:			**44,810**	**29,343**					
Douglas-fir-good	301	401	1,158	707	28.6	28.6	Fd	>27	<=25
Douglas-fir-medium/poor	302	402	2,639	1,803	23.5	23.5	Fd	20-27	<=25
Douglas-fir-poor	303	403	1,086	342	16.0	16.0	Fd	<27	<=25
Cedar-good	304	404	1,010	919	26.7	23.2	Cw or Yc	>23	<=19
Cedar-medium	305	405	2,648	1,785	22.0	21.6	Cw or Yc	19-23	<=19
Cedar-poor	306	406	3,359	2,281	17.0	19.1	Cw or Yc	15-19	<=19
Cedar-low	307	407	2,056	1,112	13.0	21.0	Cw or Yc	<15	<=19
Hemlock/balsam-good	308	408	7,623	5,375	25.1	25.6	H or B	>22	<=25
Hemlock/balsam-medium	309	409	12,895	9,320	21.5	25.8	H or B	>17-22	<=25
Hemlock/balsam-poor	310	410	4,028	2,185	15.1	21.3	H or B	12.5-17	<=25
Hemlock/balsam-low	311	411	2,118	324	11.6	20.9	H or B	<12.5	<=25
Spruce-good	312	412	998	581	27.8	27.8	S	>22	<=25
Spruce-medium	313	413	1,425	860	21.0	21.0	S	15-22	<=25
Spruce-poor	314	414	89	72	12.0	12.0	S	<15	<=25
Existing Dispersed Retention	315	415	1,678	1,678	15.8	20.4	Ex blocks with multi-storied stk stds		
Total			**1,025,643**	**135,343**	**17.2**	**22.5**			

Note: The adjusted site index (SI Wtd Avg -Adj) shown for each AU in this table is only applicable to managed stands (AU's > 200).

4.2 Site Index

Estimates of site productivity were required in this analysis to predict the rate of growth that will occur on each site throughout the TSA. The height of a "site" tree at age 50 (measured at breast height) is one measure of site productivity and is commonly referred to as "site index".

4.2.1 Site Index Adjustment for Managed Stands

Timberline Natural Resource Group completed a Site Index Adjustment (SIA) project for the Mid Coast TSA during 2008[15]. The project developed improved estimates of site index for managed Cw and Hw leading stands. These adjusted site indexes will be used in place of inventory site indexes when building managed stands yield curves (TIPSY curves) for the TSR3 base case.

The statistical adjustment process compared field data to expert derived preliminary estimates of site index generated for individual polygons and then used a ratio-of-means (ROM) statistical procedure to adjust the site indexes. The 95% sampling error was 1.2m for Cw and 1.3m for Hw and was within the target sampling error of ±1.5m (95% probability).

Table 26. Cw and Hw Site Index Adjustment Statistics

Species	Target Population		Sample List			ROM	R^2	Adj. Pop.	
	Area (ha)	Prelim PSI (m)	n	Field SI (m)	Prelim PSI (m)			Avg. SI (m)	SE (m)
Cw	483,436	20.5	42	23.6	22.6	1.046	4.4	21.4	1.2
Hw	483,436	24.8	60	27.7	27.6	1.002	1.1	24.9	1.3

N = number of samples, SE = sampling error.

When the adjusted site indexes are compared against inventory site indexes (Cw and Hw stands) in the target population, the adjusted values can be seen to be significantly higher: +7.3m (or 56%) for Cw and +9.8m (or 63%) for Hw. The change is average site index for each Analysis Unit and the THLB as a whole can be viewed Table 25. When applied fully in the THLB, the average site index rises from 17.2m to 22.3 m (+5.1m or 29.7%).

4.2.2 Site Curves

For each tree species, site curves were available to illustrate the relationship between stand height and age for a range of site indices. In all cases, this analysis used the standard site curves recommended by the BC Ministry of Forests as identified in the *Site Tools* software. They were as follows:

Table 27. Site index source

Species	Source
Cw (coastal)	Kurucz (1985ac)
Hw (coastal)	Wiley (1978ac)
Ss	Nigh (1997)
Fd (coastal)	Bruce (1981ac)
Ba	Kurucz (1982ac)
Dr	Nigh and Courtin (1998)

4.3 Utilization Level

Utilization levels define the maximum height of stumps that may be left on harvested areas, the minimum top diameter (inside bark), and the minimum diameter at breast height (dbh) of stems that must be removed from

[15] Timberline Natural Resource Consultants Ltd. 2009. *Site Index Adjustment of the Mid Coast Timber Supply Area* (Project # BC0108405), January 2009, Timberline Natural Resource Consultants, Victoria, BC

harvested areas. These factors were needed to calculate merchantable stand volume for use in the analysis, and will be used for all analysis units.

Table 28. Utilization levels

Species	Minimum dbh[5] (cm)	Maximum stump height (cm)	Minimum top dib[6] (cm)
Existing Natural Stands	17.5	30	10
Existing Managed Stands	12.5	30	10
Future Managed Stands	12.5	30	10

[5] Diameter breast height
[6] Diameter inside bark

4.4 Decay, Waste and Breakage for Unmanaged Stands

Decay, waste and breakage (DWB) factors are applied to natural stand yield tables (VDYP) to obtain net harvest volumes per hectare. Initial net volume estimates were generated using the adjusted inventory attribute values (age, height, site index) in VDYP with the default decay, waste and breakage factors applied.

4.5 Operational Adjustment Factors for Managed Stands

Operational Adjustment Factors (OAFs) were applied in order to adjust potential yields generated by the TIPSY growth and yield model down to net operational volumes. This included reductions for such things as gaps in stands, decay/waste/breakage, and endemic forest health losses.

There were two types of OAFs used in the TIPSY model. OAF 1 is a constant percentage reduction to account for openings in stands, distribution of stems or clumpiness, endemic pests and diseases, and other risks to potential yield. OAF 2 is an increasing percentage reduction that can be applied to account for decay, waste and breakage. OAF 2 is applied after OAF 1 and increases linearly over time from 0 percent at age 0 to the specified percentage at 100 years of age.

Standard operational adjustment factors (OAF) were used to model managed stands. OAF1 was set to 0.85 (15% reduction) and OAF2 was set to 0.95 (5% reduction).

4.6 Natural Stand Volume Projections

Yield tables were derived for existing natural stands using VDYP 6 Batch v6.6d. A yield table was generated for each polygon and then aggregated into one table for each Analysis Unit (AU) using area weighted averages. The yield tables used during modeling and are provided in Appendix A.

4.7 Managed Stand Yield Tables

All future managed stand AU's had an associated existing stand AU from which it inherited stands when they were logged. These future managed stand AU's used the area weighted adjusted site indexes for each AU (Table 25) and the regeneration assumption outlined in this document (Section 5.0). These values were input into Batch TIPSY 4.1c to generate a yield curve for each AU.

Existing managed stand yields were also derived using the adjusted site index (Table 25) and the regeneration assumptions outlined in Section 5.0. Existing managed stands are those currently under 25 years of age (est. 1983) for Fd, Hw and Ba stands and under 19 years of age (est. 1989) for Cw/Yc stands.

The regeneration assumptions required to model managed stands in TIPSY consist of:

- Species composition (See section 5.1);
- Initial density (See section 5.1);
- Regeneration method (See section 5.1);
- Area-weighted average site index (See section 5.1);

- Area-weighted genetic gains (See section 5.4);
- Operational adjustment factors (See section 4.5); and
- Regeneration delay (See section 5.3).

Once merchantable stand yields were obtained from TIPSY, yield estimates were further reduced to reflect the area lost to future roads (see section 3.2.4.3). These 'effective' yield tables were used during modelling and are provided in Appendix A.

4.8 Existing Timber Volume Check

To verify that no errors were made in natural stand yield table aggregation and that no significant aggregation bias exists, the total volume of the current (starting) inventory using polygon-specific inventory volumes was compared to the volume derived using analysis unit yield tables. The results for existing natural (VDYP) AU's are shown in Table 29 by AU and in Table 30 by age class.

Table 29. Existing timber volume check by AU

AU	THLB Area (ha)	Volume derived from:		Difference From Inv		Comments
		Yield tables (AU)	Inventory	m^3	%	
101	400	187,943	190,160	2,217	-1.2%	AU's 101 to 114 (which are natural stands <140 yrs), tended to have poorer correlations between inventory and yield tables. Better correlations occurred in the older (≥ 140 yrs) AU's where the bulk of the THLB exists.
102	789	226,177	238,057	11,880	-5.3%	
103	119	17,139	16,269	-870	5.1%	
104	621	111,184	109,638	-1,546	1.4%	
105	2,002	84,727	67,464	-17,263	20.4%	
106	573	24,876	48,435	23,559	-94.7%	
107	122	16,284	24,075	7,791	-47.8%	
108	2,191	739,080	700,676	-38,404	5.2%	
109	6,230	654,081	583,484	-70,597	10.8%	
110	534	76,249	83,662	7,413	-9.7%	
111	39	7,409	9,526	2,117	-28.6%	
112	282	72,874	55,022	-17,852	24.5%	
113	318	38,272	30,741	-7,531	19.7%	
114	55	7,178	8,297	1,119	-15.6%	
121	42	37,709	38,670	961	-2.5%	
122	1,007	660,526	702,063	41,537	-6.3%	
123	643	265,690	316,599	50,909	-19.2%	
124	149	125,724	129,024	3,300	-2.6%	
125	816	592,201	627,640	35,439	-6.0%	
126	17,279	10,151,917	10,189,438	37,521	-0.4%	
127	36,515	15,668,931	16,043,562	374,631	-2.4%	
128	520	520,147	495,790	-24,357	4.7%	
129	10,048	8,413,272	8,178,844	-234,428	2.8%	
130	19,987	12,540,019	12,543,481	3,462	0.0%	
131	2,868	1,311,870	1,368,975	57,105	-4.4%	
132	341	395,122	365,441	-29,681	7.5%	
133	730	868,607	672,146	-196,461	22.6%	
134	778	587,310	572,074	-15,236	2.6%	
All VDYP	**105,999**	**54,402,518**	**54,409,254**	**6,736**	**-0.01%**	

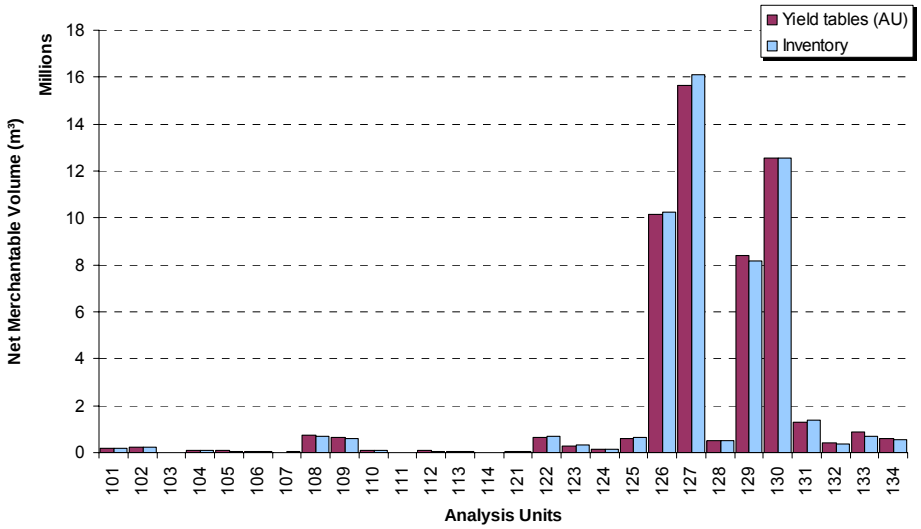


Figure 6. Net volumes by AU based on AU curves or forest inventory data

Table 30. Existing timber volume check by Age Class

Age Class	THLB Area (ha)	Volume derived from:		Difference From Inv		Comments
		Yield tables (AU)	Inventory	m^3	%	
0-20	348	318	21	-297	93.4%	Yield curves in younger age classes (<140 years) tended to have poor correlations between yield curves and inventory volumes. Better correlations occurred in the older (≥ 140 yrs) age classes where the bulk of the THLB exists.
21-40	9,041	482,169	392,918	-89,251	18.5%	
41-60	2,237	474,608	471,509	-3,099	0.7%	
61-80	400	151,515	142,150	-9,365	6.2%	
81-100	723	360,584	340,686	-19,898	5.5%	
101-120	442	230,147	244,180	14,033	-6.1%	
121-140	1,084	564,132	574,041	9,909	-1.8%	
141-250	13,013	7,508,271	7,510,991	2,720	0.0%	
250+	78,711	44,630,774	44,732,757	101,983	-0.2%	
All VDYP	**105,999**	**54,402,518**	**54,409,254**	**6,736**	**-0.01%**	

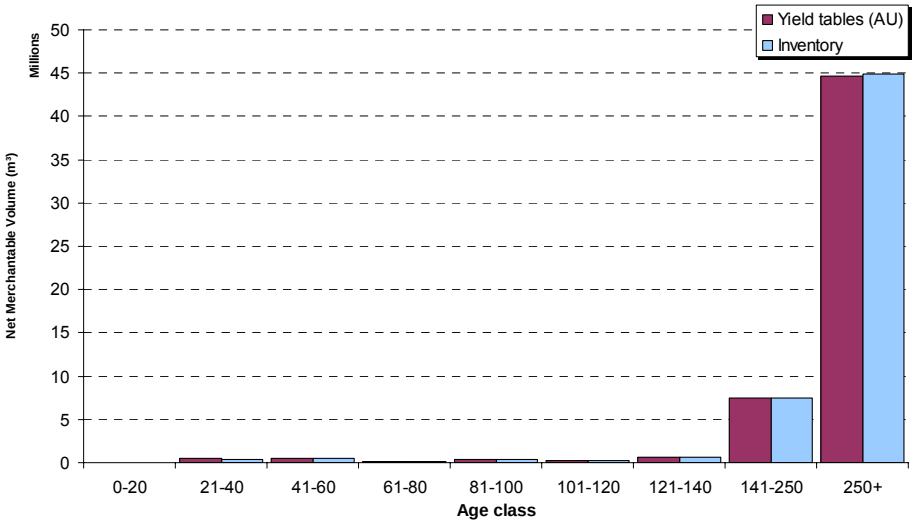


Figure 7. Net volumes by age class based on AU curves or forest inventory data

Overall, the volumes being generated from the AU yield tables correlated well with the inventory (<1% difference).

5.0 Silviculture

5.1 Silviculture management regimes

While several different silvicultural management regimes have historically been utilized in the Mid Coast TSA, the dominant regime has been to clearcut and retain patches of leave trees within or adjacent to harvest units. With the introduction of EBM, there has been an emphasis on leaving more retention, and leaving a porton of it internal to the block for larger harvest units. Specific to the Mid Coast TSA, this type of silviculture can be broken down into two broad categories:

- Clearcut with Reserves
  - Retention is left in patches that are either along the edge of a block or internal to a block – and these patches are retained for a full rotation. With EBM, blocks over 15 ha in size require half of the required retention to be left internal to the block. This has been interpreted to mean islands of trees, riparian strips, or fingers of retention jutting out into the block.[16]
  - The amount of retention left in clearcut with reserve blocks in the Mid Coast TSA has historically averaged 23% and this is addressed though spatial netdowns and the stand level retention netdown discussed in section 3.4.3.
  - EBM is likely to result in more internal retention than in traditional FRPA blocks and thus there is potential for some incremental productivity losses associated with forest edge/shading. This issue is currently not modeled in BC when clearcut with reserves is used because it is very small, but as retention levels and the amount of edge increases, the issue could begin to be a concern. No productivity reductions have been modeled here because TIPSY does not model edge impacts from cutblock perimeter edge and because EBM does not explicitly require internal retention to provide 'forest influence' over any particular amount of the block (there is no spacing requirements for retention).
  - This silviculture regime is expected to be the dominant approach used in the TSA going forward.
- Dispersed Retention
  - Retention is left scattered throughout the harvest unit so that most of the unit is under some influence of retained stems.
  - This type of retention was used in a subset of blocks in the Mid Coast between 2001 and 2006, but it has not been used in recent years because of challenges getting stocking standards approved in FSP's and sustainability concerns when high levels of retention were used.
  - Between 2001 and 2006, the amount of retention in dispersed retention blocks was higher than with clearcut with reserves blocks (retention levels avg. 34%). This is partially because the systems were often utilized in areas managed for visuals or other non timber values.

  - Modeling Historical Dispersed Retention;
    - Based on RESULTS data, blocks utilizing multi-storied stocking standards were queried out and assumed to be dispersed retention blocks. This provided an area of ~2,800 ha but only 1,678 ha were in the THLB. Numerous existing blocks were removed by netdowns such as operability and ESA soils netdowns. Recent blocks start the analysis at an age of zero.
    - The 1,678 ha were placed into a separate Analysis Unit (AU 315) and had a yield curve developed that reflected 34% of the stand as mature and 66% of the stand as regenerating.
    - A regenerating yield curve was developed in TIPSY using the inputs shown in Table 32 and assuming a retention level of 34% (80% dispersed, 20% aggregate). Top heights were 40 m, crown size was 30 m^2, and aggregate group sizes were a half hectare (5,000 m^2). This curve was used to define the minimum harvest age.

[16] Background and Intent Document for the South Central Coast and Central and North Coast Land Use Objectives Orders Apr 2008 http://archive.ilmb.gov.bc.ca/slrp/lrmp/nanaimo/cencoast/plan/objectives/LUO.pdf page 42

- The volume attributed to the mature portion of the stand was estimated using the VDYP curve for 109 (HB Med) and an assumed harvest age of 150 years (628 m^3/ha, conservative estimate of volume).
- The volume for the retained stand (34% of AU 109 at age 150) was added to the TIPSY regen curve at time zero and shifted the entire TIPSY curve upward. This was done so that the old VR retention prescription is not imbedded in the yield curve – only the reduced productivity on the regenerating portion of the stand is reflected in the curve (not loss of growing space). Without this step, we would be assuming that 34% of the area would never be harvested again. The intent is to recognize the full volume on the site (less std spatial netdowns) if it is clearcut in the future or else follow the future VR prescription if it is designated for that to occur (R, P, 10%PR VQO's).

o Modeling Future Dispersed Retention (DR)

- Any future use of dispersed retention is expected to be limited to highly constrained visually sensitive areas. All stands within Preservation or Retention VQO polygons will be modeled as DR, and 10% of the THLB in Partial Retention VQO's (selected randomly) will be modeled as DR. This results in 7,185 ha of THLB being assigned to DR future treatments (599 ha of which were also historical DR).
- Future DR has been defined as 30% retention (10% dispersed + 20% group). The group retention was assumed to be captured by the spatial netdowns and the 4.4% stand level retention already being applied. Thus, the 4.4% was applied in addition to 10% DR.
- 14.4% (10 DR + 4.4 Agg Retn) of the landbase was retained spatially for each DR polygon[17] throughout the analysis. Thus the first harvest entry with a DR treatment has no yield curve reduction but does have 10% less area harvested than if it was clearcut.
- Any second entry harvests in DR polygons use reduced yield curves that reflect the lower productivity of regeneration in DR stands (loss of growing sites already taken care of by the spatial netdown applied above).
- A TYPSY yield curve was generated for each AU from its published regen assumptions but with a shift to 80% planting/20% natural and applying a 10% retention factor (100% dispersed). Top heights were 40 m and crown size was 30 m^2.
- A percent yield impact was determined relative to the AU's clearcut yield curve, and then reduced to reflect the fact that the loss of growing site is already being modeled spatially (so impact reduced by 10%). This avoids double counting the loss of growing site.
- The DR yield reduction for each AU (using 100 years as base age) was then used to factor down the clearcut yields for each AU (creating a virtual set of DR AU's). For example, if TIPSY showed a 18% yield impact with DR relative to its clearcut equivalent, a DR harvest yield was derived by factored down the typical AU yield by 8% – while the other 10% was implemented throughout the analysis as a spatial retention. This is consistent with what is occurring on the ground – the retained portion of the stand is not logged and the regenerating portion experiences a yield reduction.
- In general, the 10% DR resulted in 19-25% (avg. ~23%) gross yield impacts in TIPSY. These were modeled as 9-15% yield impacts (other 10% were modeled spatially as well as 4.4% for aggregate groups).

The term 'High Retention' harvesting has received a large amount of attention in the last several years on the BC coast. It involves leaving a large amount of dispersed mature stems on site (>30-40 m^2 of basal area) such that the stand is still considered 'stocked' after harvesting and thus there is no regeneration obligation. In the Mid Coast TSA, a small amount of this type of harvesting has occurred in the last 5 years and mostly in what was considered to be Non THLB stands. Past harvest areas fitting this description have been depleted from the inventory. In the future, licensees have no plans to do High Retention harvesting so it has not been modeled in this analysis.

[17] Actually implemented in conjunction with other nonspatial netdowns such as red/blues listed species. Actual spatial retention values of 19% in DR polygons (10 DR + 4.4 Agg Retn + 0.3 S6 + 1.3 FN + 3.0 red/blue) and 9% in all other polygons (4.4 Agg Retn + 0.3 S6 + 1.3 FN + 3.0 red/blue) were applied throughout the analysis.

5.2 Regeneration Assumptions

After harvest, stands in the TSA follow various regeneration regimes depending on originating stand type. Some stand types rely on natural regeneration while others rely on planting or a combination of the two. This section of the data package summarizes the silvicultural management inputs used in the TIPSY growth and yield model for each managed stand AU. Table 31 provides a summary of the inputs used in TIPSY to produce managed stand yield curves. These assumptions were developed by licensee silviculture staff and reflect current regeneration practices for each of the stand types shown.

Table 31. Regeneration Assumptions (TIPSY inputs) Future Managed Stands

Existing AU#	Regen AU #	Description	Regen Method	Regen Species and Weighting (%)	SI Range	Initial Competing Density* (stems/ha)	OAFs	Regen Delay (yrs)	Genetic Worth (Prorated GW)
101/121	201/221	Douglas fir good	Plant 100	$Fd_6Cw_2Hw_2$	>27	900	15/5	1	Fd – 0.4% Hw – 0% Cw – 4.2% Ss – 0%
102/122	202/222	Douglas fir medium	Plant 95 Natural 5	$Fd_6Cw_2Hw_2$ Fd_5Hw_5	20-27	900 4000	15/5	1 2	
103/123	203/223	Douglas fir poor	Plant 80 Natural 20	$Fd_7Hw_2Cw_1$ $Fd_5Hw_3Cw_2$	<20	900 4000	15/5	1 2	
104/124	204/224	Cedar good	Plant 70 Natural 30	$Cw_7Hw_2Ba_1$ $Cw_5Hw_4Ba_1$	>23	900 4000	15/5	1 2	
105/125	205/225	Cedar medium	Plant 70 Natural 30	$Cw_7Hw_2Ba_1$ Hw_5Cw_5	>19-23	900 4000	15/5	1 2	
106/126	206/226	Cedar poor	Plant 70 Natural 30	$Cw_7Hw_2Yc_1$ $Cw_4Hw_4Yc_2$	15-19	900 4000	15/5	1 3	
107/127	207/227	Cedar low	Plant 70 Natural 30	$Cw_6Yc_2Hw_2$ $Cw_4Hw_4Yc_2$	<15	900 4000	15/5	1 3	
108/128	208/228	Hemlock/balsam good	Natural 100	$Hw_7Ba_2Cw_1$	>22	4000	15/5	2	
109/129	209/229	Hemlock/balsam med	Plant 20 Natural 80	$Hw_5Ba_3Cw_2$ Hw_5Ba_5	>17-22	900 4000	15/5	1 2	
110/130	210/230	Hemlock/balsam poor	Plant 20 Natural 80	$Hw_6Ba_2Cw_2$ $Hw_6Ba_3Cw_1$	12.5-17	900 4000	15/5	1 3	
111/131	211/231	Hemlock/balsam low	Plant 20 Natural 80	$Hw_6Ba_2Yc_1Cw_1$ $Hw_6Ba_3Yc_1$	<12.5	900 4000	15/5	1 3	
112/132	212/232	Spruce good	Plant 95 Natural 5	$Ss_5Ba_4Hw_1$ $Hw_5Ss_4Ba_1$	>22	900 4000	15/5	1 3	
113/133	213/233	Spruce medium	Plant 95 Natural 5	$Ss_4Ba_4Hw_2$ $Hw_4Ba_3Ss_3$	15-22	900 4000	15/5	1 3	
114/134	214/234	Spruce poor	Plant 95 Natural 5	$Ss_4Ba_3Hw_3$ $Hw_6Ba_2Ss_2$	>15	900 4000	15/5	1 3	
151	251	Cottonwood	Natural 100	Ac	All	5000	15/5	1	
152	252	Alder	Natural 100	Dr	All	5000	15/5	1	

* This density refers to the number of stems/ha that are competing to be the next crop trees. This number is typically higher than a well spaced number and lower than a total stems number because all competing stems are counted but those in a different layer (or cohort) are not counted.

Table 32. Regeneration Assumptions (TIPSY inputs) Existing Managed Stands

Existing AU#	Regen AU #	Description	Regen Method	Regen Species and Weighting (%)	SI Range	Initial Competing Density* (stems/ha)	OAFs	Regen Delay (yrs)	Genetic Worth (Prorated GW)
301	401	Douglas-fir-good	Plant 100	$Fd_6Cw_2Hw_2$	>27	900	15/5	1	300-series Fd – 0% Hw – 0% Cw – 0% Ss – 0%
302	402	Douglas-fir-medium/poor	Plant 95 Natural 5	$Fd_6Cw_2Hw_2$ Fd_5Hw_5	20-27	900 4000	15/5	1 2	
303	403	Douglas-fir-poor	Plant 80 Natural 20	$Fd_7Hw_2Cw_1$ $Fd_5Hw_3Cw_2$	<20	900 4000	15/5	1 2	
304	404	Cedar-good	Plant 80 Natural 20	$Cw_6Hw_3Ba_1$ $Cw_6Hw_3Ba_1$	>23	900 4000	15/5	1 2	
305	405	Cedar-medium	Plant 80 Natural 20	$Cw_7Hw_2Ba_1$ Hw_5Cw_5	>19-23	900 4000	15/5	1 2	
306	406	Cedar-poor	Plant 80 Natural 20	$Cw_7Hw_2Yc_1$ $Cw_4Hw_4Yc_2$	15-19	900 4000	15/5	1 3	400-series Fd – 0.4% Hw – 0% Cw – 4.2%
307	407	Cedar-low	Plant 80 Natural 20	$Cw_6Yc_2Hw_2$ $Cw_4Hw_4Yc_2$	<15	900 4000	15/5	1 3	

Existing AU#	Regen AU #	Description	Regen Method	Regen Species and Weighting (%)	SI Range	Initial Competing Density* (stems/ha)	OAFs	Regen Delay (yrs)	Genetic Worth (Prorated GW)
308	408	Hemlock/balsam-good	Natural $_{100}$	$Hw_7Ba_2Cw_1$	>22	4000	15/5	2	Ss – 0%
309	409	Hemlock/balsam-medium	Plant $_{20}$ Natural $_{80}$	$Hw_5Ba_3Cw_2$ Hw_5Ba_5	>17-22	900 4000	15/5	1 2	
310	410	Hemlock/balsam-poor	Plant $_{20}$ Natural $_{80}$	$Hw_6Ba_2Cw_2$ $Hw_6Ba_3Cw_1$	12.5-17	900 4000	15/5	1 3	
311	411	Hemlock/balsam-low	Plant $_{20}$ Natural $_{80}$	$Hw_6Ba_2Yc_1Cw_1$ $Hw_6Ba_3Yc_1$	<12.5	900 4000	15/5	1 3	
312	412	Spruce-good	Plant $_{95}$ Natural $_{5}$	$Ss_5Ba_4Hw_1$ $Hw_5Ss_4Ba_1$	>22	900 4000	15/5	1 3	
313	413	Spruce-medium	Plant $_{95}$ Natural $_{5}$	$Ss_4Ba_4Hw_2$ $Hw_4Ba_3Ss_3$	15-22	900 4000	15/5	1 3	
314	414	Spruce-poor	Plant $_{95}$ Natural $_{5}$	$Ss_4Ba_3Hw_3$ $Hw_6Ba_2Ss_2$	>15	900 4000	15/5	1 3	
315	415	Hemlock/balsam-medium	Plant $_{20}$ Natural $_{80}$	$Hw_4Cw_4Ba_2$ $Hw_5Cw_3Ba_2$	>17-22	900 4000	15/5	1 2	

5.3 Regeneration delay

Regeneration delay is the time between harvesting and the time when stand regrowth begins. The delay incorporates both the time taken to establish a stand, and the age of seedling stock planted, if applicable. Based on past practices and the anticipated approach going forward, a one year delay for planted stands and a 2-3 year delay for naturally regenerating stands were used. See Table 31 for details.

5.4 Gene resources — use of select seed

Where it is available, the TSA uses select seed (class A seed from orchards) for regeneration because of its superior volume production. This section describes the yield adjustments used in this analysis to account for the use of select seed (i.e. orchard & superior provenance seed with a known genetic gain as measured by Genetic Worth (GW)).

Seed Planning Units (SPU's) are polygon features that geographically delineate the appropriate area of seedling use for stock originating from specific seed orchards throughout the province. Each SPU identifies the area and elevation range in which seedlings of a given orchard may be used in regeneration. The SPUs relevant in the Mid Coast TSA are shown in Table 33. Hemlock is not shown because it is rarely planted. Douglas fir and Cedar are only planted in specific analysis units. The respective area and proportion of the analysis units, the estimates of future genetic worth, and seedling availability from MFR Tree Improvement Branch are provided for each SPU in Table 34. Only a reduced portion of the Seed Planning Units will be effectively regenerated with the respective species. This specific portion for each SPU is defined by the Analysis Units and their regeneration strategy.

Table 33. Seed Planning Units within the Mid Coast TSA (Class A seed)

Species	Genetic Class "A" Seed Planning Zone	Elevation Band (m)
Douglas Fir	Maritime high	700-1200
Douglas Fir	Maritime low	1-700
Douglas Fir	Submaritime low	400-1200
Western Red Cedar	Maritime low	1-600
Western Red Cedar	Maritime high	600-1500
Western Red Cedar	Submaritime low	200-100

Table 34. Seed Planning Units (Class A Seed) genetic worth and seed availability

SPU	THLB Area (ha)	Percent of Regeneration Area by Species (7)	Genetic Worth Achieved (2006-08	Percent Class A Seedlings (2006-08	Planned GW for 2009	Planned Class A Seed Availability for 2009	Projected Future Genetic Worth %	Projected Class A Seed Availability (2015)

			Spar)	Spar)			(2015)	
Fdc M High	47	1%	0%	0%	0%	0%	0%	0%
Fdc M low	352	6%	8%	50%	14%	35.8%	17%	60.2%
Fdc SM low	4,187	71%	0%	0%	2%	42.8%	8%	85.7%
Cw M High	9,601	7%	0%	0%	0%	0%	0%	0%
Cw M low	91,595	66%	2%	80%	8%	97.2%	12%	100%
Cw SM Low	22,798	16%	0%	0%	0%	0%	0%	0%

(7) This percentage is the area of the analysis units in the THLB that will be planted with some proportion of Douglas fir or cedar, respectively. The rest of the area to complete the 100% considers Class B Seed.

A net GW applicable to each SPU was calculated using the values shown above for 2009 (GW x Avail% x % THLB). For example, Cw M Low has a gain of 8% projected for 2009 and class A seed is expected to be used 80% of the time on 66% of area that will effectible planted with cedar (8 x 0.8 x 0.66 = 4.2%). Current use (2008) of select seed is less than predicted by timelines for 2009 but this was felt to be offset by the increased gains projected into the future (between 2008 and 2015).

These values were then simplified to the species level by prorating the SPU values using THLB area.

Existing managed stands did not receive any adjustment reflecting improved seed use as the majority of stands would not have been established with improved seed. There will be a slight underestimation of timber supply in the future as a small portion of these stands will actually benefit from GW gains.

Future managed stands received the 2009 net GW's for Fdc (0.4%), Cw (4.2%).

Genetic gains were incorporated into the growth and yield curves through TIPSY model functionality. When Cw or Fdc were included in a planted managed stand AU, its associated Net GW was input into TIPSY. This net GW reflects the average genetic gain associated with ALL seedlings of a given species planted in a typical year and is shown in Table 35.

No increase in genetic worth was implemented during the planning horizon. This likely results in an underestimation of long term timber supply but was done because long term projected gains have yet to be proven.

Table 35. Net genetic worth by species to be applied in timber supply model

Species	Genetic Gains applied in TIPSY For Base Case Future Managed Stands (GW%xAval%)
Cw	4.2%
Hw	0%
Fdc	0.4%

5.5 Silviculture History (defining existing managed stands)

For growth and yield modeling, stands are classified into two categories based on their management status: natural/unmanaged stands and managed stands (2nd growth). Natural stands typically regenerated with no silviculture treatments that would have ensured full stocking and/or a good distribution of stems. Managed stands have had silviculture treatments and are assumed to be full stocked and well distributed. The area considered managed and natural is summarized in Table 36

Table 36. Managed and natural stand area

Management Status	Definition	THLB (ha)
Natural	Cw leading >19 yrs and others > 25 yrs	105,999
Managed	Cw leading <=19 yrs (est 1989) and others <= 25 yrs (Est 1983)	29,343
Total THLB Area		**135,342**

5.6 Backlog and current not satisfactorily restocked areas (NSR)

Backlog NSR is any area that was denuded prior to 1987 (when basic silviculture became the obligation of licensees) and is not yet fully stocked. There is no backlog NSR remaining in the Mid Coast TSA.
All other NSR areas are considered current NSR. Current NSR was assigned to existing managed stand analysis units and any delay in restocking these sites was reflected in the regeneration delays assigned to these analysis units. These sites have either been reforested but are not yet confirmed in the inventory file, or will be reforested because licenses are under a legal obligation to do so.

5.7 Incremental Silviculture and Commercial Thinning

In the Mid Coast TSA, approximately 1,000 ha of fertilization occurred in the early 1990's but little to no incremental silvicultural practices have occurred since. Commercial thinning is not occurring or planned.

6.0 Timber Harvesting

6.1 Minimum Harvestable Age / Merchantability Standards

In order for a stand within the timber supply model to be considered for harvesting, it must achieve a minimum harvest age that ensures it meets reasonable economic criteria and emulates what is generally current practice by forest licensees. Note that these are minimum criteria, not the actual ages at which stands are forecast for harvest. Some stands may be harvested at the minimum thresholds to meet forest-level objectives while other stands may be not be harvested until well past their "optimal" timber production ages due to management objectives for other resource values such as old forest retention requirements, or ungulate winter range.

For this analysis, minimum harvestable ages were defined using the following criteria:

- Existing stands: Minimum volume of 350 m^3/ha and 45cm dbh (Cw) or 35 cm dbh (others) for the largest 250 trees.
- Future stands: Minimum volume of 350 m^3/ha and 45cm dbh (Cw) or 35 cm dbh (others) for the largest 250 trees. Must also be within 90% of the culmination MAI.

These criteria were developed in the Economic Operability project (Forsite 2009) and carried forward here. The diameter thresholds are consistent with TSR2.

The minimum harvest age to be utilized for each analysis unit is defined in Table 37. For a detailed description of all analysis unit definitions, see Table 25.

Table 37. Minimum harvest ages

Existing Stands			Future Stands			
AU #	AU Description	Min Harvest Age	AU #	AU Description	Min Harvest Age	
					Group Retn	Disp Retn
Natural Stands						
101	Douglas fir good <=140yrs	75	**201**	Douglas fir good <=140yrs	55	55
102	Douglas fir medium <=140yrs	90	**202**	Douglas fir medium <=140yrs	65	70
103	Douglas fir poor <=140yrs	135	**203**	Douglas fir poor <=140yrs	110	140
104	Cedar good <=140yrs	105	**204**	Cedar good <=140yrs	80	75
105	Cedar medium <=140yrs	115	**205**	Cedar medium <=140yrs	80	80
106	Cedar poor <=140yrs	195	**206**	Cedar poor <=140yrs	90	90
107	Cedar low <=140yrs	235	**207**	Cedar low <=140yrs	80	75
108	Hemlock/balsam good <=140yrs	65	**208**	Hemlock/balsam good <=140yrs	60	60
109	Hemlock/balsam medium <=140yrs	85	**209**	Hemlock/balsam medium <=140yrs	60	60
110	Hemlock/balsam poor <=140yrs	135	**210**	Hemlock/balsam poor <=140yrs	65	65
111	Hemlock/balsam low <=140yrs	180	**211**	Hemlock/balsam low <=140yrs	65	65
112	Spruce good <=140yrs	60	**212**	Spruce good <=140yrs	60	60

Existing Stands			Future Stands			
AU #	AU Description	Min Harvest Age	AU #	AU Description	Min Harvest Age	
					Group Retn	Disp Retn
113	Spruce medium <=140yrs	80	**213**	Spruce medium <=140yrs	75	75
114	Spruce poor <=140yrs	135	**214**	Spruce poor <=140yrs	125	150
121	Douglas fir good >140yrs	80	**221**	Douglas fir good >140yrs	55	60
122	Douglas fir medium >140yrs	90	**222**	Douglas fir medium >140yrs	65	80
123	Douglas fir poor >140yrs	115	**223**	Douglas fir poor >140yrs	100	125
124	Cedar good >140yrs	115	**224**	Cedar good >140yrs	90	85
125	Cedar medium >140yrs	135	**225**	Cedar medium >140yrs	80	75
126	Cedar poor >140yrs	165	**226**	Cedar poor >140yrs	95	90
127	Cedar low >140yrs	235	**227**	Cedar low >140yrs	110	105
128	Hemlock/balsam good >140yrs	80	**228**	Hemlock/balsam good >140yrs	60	60
129	Hemlock/balsam medium >140yrs	100	**229**	Hemlock/balsam medium >140yrs	65	65
130	Hemlock/balsam poor >140yrs	125	**230**	Hemlock/balsam poor >140yrs	70	65
131	Hemlock/balsam low >140yrs	170	**231**	Hemlock/balsam low >140yrs	70	70
132	Spruce good >140yrs	60	**232**	Spruce good >140yrs	60	60
133	Spruce medium >140yrs	85	**233**	Spruce medium >140yrs	85	80
134	Spruce poor >140yrs	120	**234**	Spruce poor >140yrs	110	125
Managed Stands						
301	Douglas-fir-good	55	**401**	Douglas-fir-good	55	55
302	Douglas-fir-medium/poor	65	**402**	Douglas-fir-medium/poor	65	75
303	Douglas-fir-poor	150	**403**	Douglas-fir-poor	150	220
304	Cedar-good	80	**404**	Cedar-good	80	80
305	Cedar-medium	90	**405**	Cedar-medium	90	90
306	Cedar-poor	110	**406**	Cedar-poor	110	110
307	Cedar-low	90	**407**	Cedar-low	90	90
308	Hemlock/balsam-good	65	**408**	Hemlock/balsam-good	65	65
309	Hemlock/balsam-medium	60	**409**	Hemlock/balsam-medium	60	65
310	Hemlock/balsam-poor	80	**410**	Hemlock/balsam-poor	80	75
311	Hemlock/balsam-low	80	**411**	Hemlock/balsam-low	80	80
312	Spruce-good	60	**412**	Spruce-good	60	60
313	Spruce-medium	75	**413**	Spruce-medium	75	75
314	Spruce-poor	120	**414**	Spruce-poor	120	145
315	Ex Dispersed Retention	150	**415**	Ex Dispersed Retention	80	80

Managed stands tend to have shortened minimum harvest ages because of the increased yields predicted by the TIPSY model and the site index adjustment (increase) that was applied to Hw and Cw leading stands.

6.2 Harvest Priorities / Target Weightings

Traditional harvest priorities are not being applied in this analysis. The model being utilized (Patchworks) is a goal seeking heuristic model which dynamically explores many potential solutions in an effort to find the one that best meets user defined goals. Thus, the concept of harvest priorities is not relevant.

Within a goal seeking heuristic model, it is necessary to weight various targets or objectives relative to each other so that solutions reflect the desired outcome. In this analysis, the harvest volume target will be weighted substantially lower than all other targets so that non timber objectives will not be sacrificed to deliver volume. The objective is for harvest volume only to be attractive to the model when all other issues have been addressed (old seral objectives, ungulate winter range objectives, watershed disturbance limits, etc).

Patchworks generates millions of alternative solutions and scores them for how well they achieve the users objectives. As long as the model continues to find better solutions, modeling continues. For this analysis, solutions will be considered final once improvements in the objective function are less than 0.1% in 100,000 iterations.

6.3 Harvest Profiles

The TSR2 determination specified a partition for poor-low hemlock/balsam leading stands (SI<17) and performance monitoring objectives for outer coast stands and non conventional harvest stands. Based on the AAC established in the determination (998,000 m^3/yr), at least 200,000 m^3/yr (20%) was expected to come from low and poor site hemlock and balsam stands. In addition, at least 59,000 m^3/yr (5.9%) was expected to come from Outer Coast stands and 178,000 m^3/yr (17.8%) was expected to come from non-conventional harvest areas. As a single stand could belong to all three of these profiles, overlap between them is expected. The AAC reduction that occurred in 2006 proportionately reduced the partition volumes as well (% stayed the same).

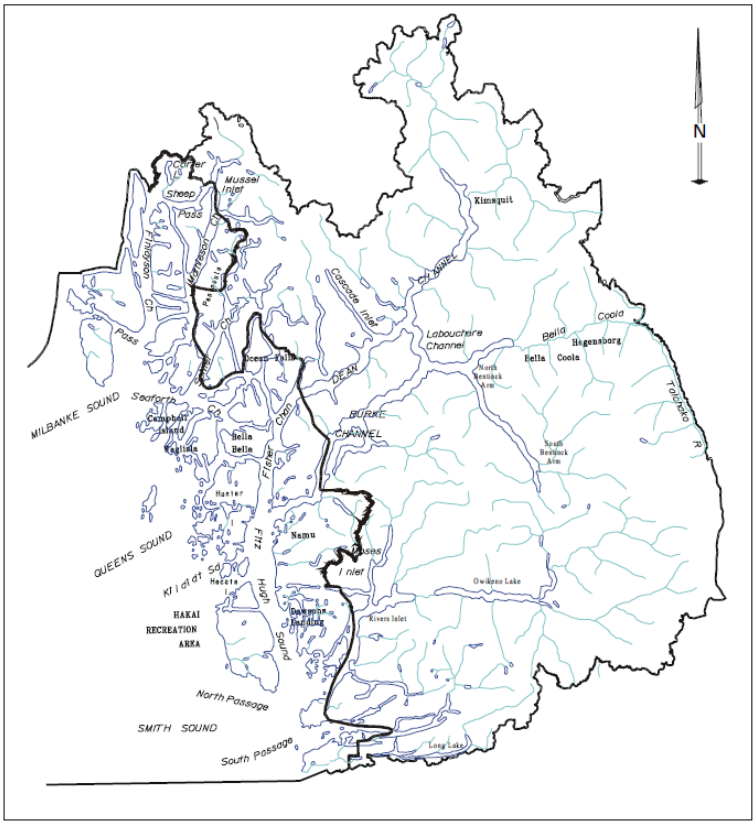
For TSR 3 modeling, the amount of harvest in these profiles will be monitored and regulated as necessary to ensure that harvest volumes were not inordinately dependant on these types in any one harvest period. Actual licensee annual reporting submissions to MFR are presented below to illustrate recent performance (Table 38).

Table 38. Recent harvest performance based on licensee annual reporting submissions to MFR

Year	Total Harvest (m^3)	Outer Coast Harvest (m^3)	Outer Coast (%)	Low/Poor Hembal (m^3)	Low/Poor Hembal (%)	Volume ACC (m^3)
2000	882,586	27,279	3.1	170,694	19.3	1,000,000
2001	760,656	6,267	0.8	191,840	25.2	998,000
2002	618,962	19,490	3.1	92,015	14.9	998,000
2003	295,826	6,348	2.1	68,178	23.0	795,000
2004	618,491	80,794	13.1	108,188	17.5	795,000
2005	906,438	34,098	3.8	111,609	12.3	795,000
2006	546,262	0	0	118,722	21.7	768,000
2007	595,282	119,332	20.0	44,053	7.4	768,000
2008	421,452	74,782	17.7	62,266	14.8	768,000

In spite of all the planning uncertainty associated within the TSA in the past 10 years, performance in the outer coast has been significant with as much as 20% of the harvested volume coming from the area, even though some of the area has not been made available to license holders in the form of chart area – even today some of the Outer Coast has not been assigned to any license holder (but then there are also existing administrative areas have not been utilized). Some of the highest levels of performance have occurred in the last two years (20% in 2007 and 17.7% in 2008). As a result of the new landbase definition reflecting economic operability, new parks, and community forest areas, the area identified as THLB in the outer coast area has the following characteristics:

- It represents 18.9% of the total THLB,
- 75.6% of the area is cedar
- 12.9% of the area is low or poor hemlock
- All of the area was proven to be economic in the economic operability analysis.



Given that not all of the outer coast area is administratively available for harvest activity because it has not been made available to any license holder in the TSA, and the fact that the outer coast stands included in the THLB are part of an economic landbase – the base case will be allowed to have up to 20% of harvest come from the outer coast.

Figure 8. Inner and outer coast landbase definition (TSR2)

Harvesting in the low/poor site hemlock-balsam partition (SI<17) also represents a significant component of the past harvest; between 7.4 and 25.2 percent, frequently greater than 20%. This is consistent with the TSR2 partition of 20% so this level of contribution will be used again in TSR3.

Non-conventional harvest areas as identified in TSR2 will not be duplicated in TSR3 but an effort will be made to track helicopter harvest volumes over time as defined in the 2009 Mid Coast Operability Project.

7.0 Natural Forest Disturbance

It is inevitable that natural disturbances will occur within the forests of the Mid Coast TSA and the implications of these disturbances on forest age classes and volumes are recognized in the timber supply analysis process. Natural disturbances are events caused by factors such as wildfire, wind, landslides, snow press, insects, disease and other forest health considerations. Two approaches to addressing these issues are used during modeling; one on the THLB and one on the remainder of the forested area of the TSA.

7.1 Unsalvaged Losses on the THLB

The purpose of this section is to quantify the average annual volume of timber that, in the future, will be damaged or killed on the THLB and not salvaged or accounted for by other factors. This factor is meant to capture catastrophic natural events like fires. Endemic pest losses are dealt with through factors applied in the growth and yield models as noted below:

TIPSY: Operational Adjustment Factor 2 reduces gross volumes to account for losses toward maturity such as decay, and endemic forest health issues like minor infestations.
VDYP: The model predicts actual average yields from appropriate inventory ground plots. Endemic losses are inherently recognized in the model data.

Expected non-recoverable losses are summarized in Table 39 and have not changed since TSR2, other than to prorate them down based on the size of the THLB change. The THLB in this analysis is ~70% of the TSR2 THLB so all NRL values have been reduced to 70% of the TSR2 values. This volume was added to the annual harvest target in order to remove this volume from the land base and cause an appropriate amount of stand area to have its age set to zero. The unsalvaged loss volume is not included in reported harvest levels for the TSA.

Table 39. Non-recoverable losses

Cause of Loss	TSR2 Annual Unsalvaged Losses (m^3/yr)	TSR3 Annual Unsalvaged Losses (m^3/yr)
Insects	0	0
Fire	7,102	4,971
Windthrow	13,000	9,100
Total	**20,102**	**14,071**

It should be noted that a decline in yellow cedar (Yc) stands has been observed along the BC coast since 2004 at specific elevation bands. It is believed to be an endemic issue but is not recognized in the VDYP yield

curves. Insufficient data exists to quantify its impact for inclusion in the unsalvaged losses estimate but it should be considered as an unquantifiable factor at the time of AAC determination.

7.2 Disturbance in the Non-THLB

As forested stands in the non-THLB contribute toward several forest cover objectives (i.e., landscape level biodiversity, visuals, etc.), it is important that the age class distributions in these stands remain consistent with natural processes. By implementing disturbance in these stands, a natural age class distribution can be maintained in the model and a realistic contribution toward seral goals ensured.

The disturbance rate was based on the Range of Natural Variation (RONV) research that is incorporated into the EBM orders (2009). This was necessary to keep the rate of natural disturbance in sync with the old seral retention goals imposed by the EBM orders. Using old seral goals based on RONV studies while implementing disturbance regimes from the Natural Disturbance Types defined in the Biodiversity Guidebook (MFR 1995) would have made it impossible to meet the old seral objectives on the landbase in the long term – even if no harvesting was occurring. In general, the amount of naturally occurring old seral predicted to be on the landbase was much higher under the RONV approach.

The rate of natural disturbance was calculated for each BEC variant/Site Series Surrogate combination using an estimate of the natural amount of old seral that would have occurred in the past (100% RONV numbers from the EBM orders) and the old age definition. An effective rotation age was calculated from the % old from RONV and the old age (250 yrs) definition (Effective rotation age = old age / (1 – proportion old)). This effective rotation age defines the annual rate of disturbance – and indicates that time it takes for an entire area to have been disturbed once. The results are shown in Table 40 and indicate that the rate of stand replacing natural disturbance in these forests is very low – the more typical dynamic is for single trees to die and create gaps that are subsequently filled in by regeneration.

Where a BEC subzone was not present in the EBM order (ESSF, SBPS, SBS, etc), the traditional BEC/NDT disturbance interval was used. This occurred within Tweedsmuir park for the most part and did not impact any LU/BEC variant combinations that contained THLB area.

Once an effective rotation age is known it is then used to define an annual area of disturbance. For example, the CWH vh2 variant is expected to have 97% of its area older than 250 years under natural conditions. This translates into an effective rotation of 7946 years. With 189,124 ha in this variant, it would take 24 ha to be disturbed each year to turn over the entire area within 7946 yr. Because of this very long duration, we would expect stands to renew themselves internally through gap replacement strategies, but the 24 ha per year of stand replacement was also modeled.

The area target was achieved in the modeling by randomly selecting stands (without replacement) to be disturbed in each period and then hardwiring this into the model. Stands of all ages had equal opportunity to be disturbed.

Table 40. Calculation of area to be disturbed annually in forested non-THLB by BEC(variant)/NDT

BEC	Variant	NDT	Disturbance Interval (yrs)	"OLD" Defn (yrs)	% Area > OLD*	Effective Rotation Age (yrs)**	Contributing Non-THLB Area (ha)	Annual Area Disturbed (ha) (area / rot age)
MH	MH wh 1	1	RONV	250	97%	8,333	2,922	0
MH	MH mm 1	1	RONV	250	86%	1,830	23,209	13
MH	MH mm 2	1	RONV	250	84%	1,540	37,172	24
CWH	CWH vh 1	1	RONV	250	97%	7,856	16,097	2
CWH	CWH vh 2	1	RONV	250	97%	7,946	189,124	24
CWH	CWH vm 1	1	RONV	250	88%	2,043	119,995	59
CWH	CWH vm 2	1	RONV	250	89%	2,189	64,636	30
CWH	CWH vm 3	1	RONV	250	84%	1,591	30,242	19
CWH	CWH ds 2	2	RONV	250	68%	790	25,068	32

CWH	CWH ms 2	2	RONV	250	74%	979	64,292	66
CWH	CWH ws 2	2	RONV	250	85%	1,616	57,414	36
ESSF		2	200	250	29%	350	82,622	236
MS		3	150	140	39%	231	15,308	66
SBPS		3	100	140	25%	186	56,732	305
SBS		3	125	140	33%	208	83,106	400
IDF		4	250	250	37%	395	19,954	50
Total							**890,489**	**1,361**

* From RONV or calculated: % area old = exp (-[old age / disturbance interval]), ** Effective rotation age = old age / (1 – % area old)

8.0 Integrated Resource Management

This section of the document describes the range of timber and non-timber management objectives that occur within the Mid Coast TSA and how they will be addressed in the timber supply model. The most common method of inclusion is through the application of forest cover requirements.

Forest cover requirements can:

- Limit disturbance in an area by limiting the amount of forest that can be younger than a specific age (or shorter than a specific height);
- Maintain specific stand types on the land base by ensuring that at least a specified amount of forest older than a certain age (or taller than a certain height) is retained at all times;

Forest cover requirements from several different resource objectives can occur in a common area and result in overlapping constraints within the TSA (e.g. visual constraints inside a community watershed). Each requirement is evaluated independently to ensure that the harvesting of a specific stand does not violate any forest cover requirements.[18]

A summary of all non timber management issues and modeling approaches is provided in Table 41 below. Detail on each can be found in either the netdown section of this document or in the remainder of this section.

Table 41. Summary of Management Issues and Modelling Assumptions

Resource Issue	Modeling Approach
Cutblock Size/Adjacency	Maximum of 25% < 3m tall. Applied to the THLB within each LU using height curves specific to each AU.
Visuals	Preservation and Retention VQO's: Dispersed retention silviculture system modeled in place of maximum disturbance limits. Partial Retention and Modification VQO's: Maximum disturbance limits applied by VQO and VAC to PFLB portion of each VEG polygon. VEG height defined by avg slope of VQO polygon.
Community Watersheds	Maximum of 1% of forested area logged / year (10% every 10 yrs).
Black Tailed Deer	Minimum of 25% > 141 yrs old within 80 yrs for all LU's. Specific LU's have reduced constraints to be applied for first 80 yrs (either 20%>141 yrs or 20%>121 yrs). To be met within the PFLB of the mapped habitat areas in each LU.
Mountain Goat	Reserve 90% of identified habitat areas (see netdown section 3.3.9).
Grizzly Bear WHAs	Reserve legally established WHA's (see netdown section 3.3.8).
Sandhill Crane WHAs	To be addressed with 1% IWMS budget at time of determination.
Marbled Murralet WHAs	To be addressed with 1% IWMS budget at time of determination.
Tailed Frog WHA's	To be addressed with 1% IWMS budget at time of determination.
Goshawk WHA's	To be addressed with 1% IWMS budget at time of determination.

[18] Where a minimum amount of forest is required and does not exist, some harvesting may still occur if there are any stands old enough for harvest once the oldest available stands have been set aside to meet the objective.

Resource Issue	Modeling Approach
Karst	Assumed to be addressed within the existing netdowns and/or the stand level retention budget (Obj. 16).
Recreation	Spatial netdown - see section 3.3.11.
EBM Obj. 3: FN Traditional Forest Resources	1,500 m^3/yr assumed to be harvested outside of the AAC - added as NRL volume.
EBM Obj. 4: FN Traditional Heritage Features	Together, all four objectives are assumed to have a incremental 1.3% impact on THLB. This is in additional to the stand level retention and red/blue listed species impacts discussed below and all other spatial netdowns. Implemented as an aspatial area retention factor in all THLB polygons.
EBM Obj. 5: Culturally Modified Trees	
EBM Obj. 6: Monumental Cedar	
EBM Obj. 7: Stand Level Retention of Cw/Yc	
EBM Obj. 8: Important Fisheries Watersheds	ECA values assessed on the forested portion of each watershed identified in the SCC and NCC Order Schedules. ECA limited to a maximum of 20%. Recovery curves from the 1999 CWAP guidebook were used (function of stand ht).
EBM Obj. 9: High Value Fish Habitat	Spatial netdown - see section 3.3.12.1.
EBM Obj. 10: Non HVFH Aquatic Habitat	Spatial netdown - see section 3.3.12.2.
EBM Obj. 11: Forested Swamps	Assumed to be addressed within the stand level retention budget (Obj. 16), section 3.3.12.3.
EBM Obj. 12: Upland Streams	FRPA riparian removed spatially (netdown section 3.3.10) plus the forested portion of the upland stream area in each watershed was limited to 30% < 9m tall (i.e. hyrdologically recovered). SCC Order: applied only in watersheds identified in Schedule 3 (Important Fisheries) NCC Order: applied in all watersheds (Important Fisheries + MoE 3rd Order WS's).
EBM Obj. 13: Active Fluvial Units	Spatial netdown - see section 3.3.12.4.
EBM Obj. 14: Landscape Level Biodiversity	A minimum amount of old forest was retained in the productive forest of each LU/SSS combination. Amounts were specified in Schedule 4 of the EBM orders. The amount of mid seral forest in each LU/SSS combination was also limited to 50%.
EBM Obj. 15: Red/Blue Listed Plant Communities	Assumed to have a net 3% impact on THLB. Implemented as an aspatial area retention factor in all THLB polygons (section 8.5.13).
EBM Obj. 16: Stand Level Retention	The 15% requirement is assumed to have a net 4.4% impact on THLB. Combined with the FN EBM objectives, EBM Red/Blue impact, and S6 riparian impact, the total stand level volume reduction is 9% (1.3 + 3.0 + 4.4+ 0.3). Implemented as an aspatial area retention factor in all THLB polygons (section 8.5.14). An additional 10% was retained in polygons managed using dispersed retention.
EBM Obj. 17: Grizzly Bear Habitat	Spatial netdown - see section 8.5.15.

Non timber objectives addressed through forest cover constraints are discussed in detail below.

8.1 Cutblock Size and Adjacency

Green-up requirements specify that a logged block must achieve a specific condition called green-up before adjacent areas can be logged. Green-up refers to the average height of the regenerating forest reaching a specified target. Green-up requirements can often be waived if licensees manage for patch size distributions consistent with biodiversity objectives as described in the Landscape Unit Planning Guide (MFR/MoE 1999). Modeling of green-up requirements was done using forest level objectives, as opposed to block specific objectives, because this was consistent with the operational flexibility afforded by patch size management.

The amount of THLB area less than 3m in height was limited to 25% within each landscape unit (refer to Table 42). This is consistent with the objective applied in TSR 2.

Table 42. Green-up requirements

Management Zone	Green-up Requirement	Modeled Green-up Constraint	Area to which it applies
Integrated Resource Management Zone	3 m tall trees	Max 25% < 3m within each LU	THLB area within each LU

8.2 Visual resources

The management of visual resources is based on legally established Visual Quality Objectives (VQO's) assigned to specific areas of the land base. The four VQO ratings considered in this analysis were preservation (P), retention (R), partial retention (PR), and modification (M). Dispersed retention harvesting was implemented in all Preservation and Retention VQO polygons (with associated harvest yield reductions) in order to address the visual concerns on these units. No further constraints were applied to these VQO polygons.

Partial Retention and Modification VQO's had maximum allowable disturbance percentages applied as per Table 43 below. These values reflect higher allowable disturbance limits when VQO polygons have high Visual Absorption Capability (VAC) ratings.

Table 43. Modelling of visual management

VQO	Maximum allowable disturbance (%)		
	VAC = L	VAC= M	VAC = H
P	0.0%	0.5%	1%
R	1%	3%	5%
PR	5%	10%	15%
M	15%	20%	25%

Visually effective green-up (VEG) height requirements vary by slope class as per Table 44. An average slope class was calculated for each VQO-VAC polygon. The average slope defines the required tree height (and age) to reach visually effective greenup. This VEG height was used to model height based disturbance limits within each VQO polygon. Age to reach greenup heights were derived for each AU and used in the model.

Table 44. Visually Effective Green-up (VEG) heights and ages by slope class

Slope (%)	0-5	6-10	11-15	16-20	21-25	26-30	31-35	36-45	46-50	51-55	56-60	60+
Tree Ht (m)	3	3.5	4	4.5	5	5.5	6	6.5	7	7.5	8	8.5
Derived Age	6	7	9	10	11	13	14	15	16	17	18	19

The area impacted by visual constraints is summarized below.

Table 45. Areas with visual quality objectives

VQO	VAC	Forested Non THLB Area (ha)	THLB Area (ha)	Total PFLB Area (ha)
P	L	531	197	729
	M	49	-	49
	H	-	-	-
R	L	16,110	3,948	20,057
	M	7,573	1,250	8,823
	H	142	43	186
PR	L	33,506	9,202	42,708
	M	29,854	8,018	37,873
	H	1,483	249	1,732
M	L	21,851	9,345	31,196
	M	32,083	8,701	40,784
	H	2,702	682	3,384
Total		**145,886**	**41,634**	**187,520**

8.3 Community Watersheds

Community watersheds are managed by limiting the amount of disturbance that can occur in each year. As in TSR 2, harvesting will be limited to a maximum of 1% of the forested area per year – modeled as a maximum 10% per decade. This translates into the following maximum annual harvests shown in Table 46.

Table 46. Harvest limits applied to community watersheds

Community Watershed	Total Area (ha)	PFLB Area (ha)	THLB Area (ha)	1% of PFLB Area (ha)	10% of PFLB Area (ha)
910.001	25	20	-	0.2	2
910.003 (Martin River)	2,204	718	106	7.2	72
910.004 (Snootli Crk)	3,847	657	103	6.6	66
910.005 (Tastsquan Crk)	2,795	668	47	6.7	67
CAM.001	227	100	39	1.0	10
Total	**9,097**	**2,163**	**295**		

8.4 Black Tailed Deer Winter Range

In February 2007, a GAR order was introduced for black tailed deer in the Mid Coast TSA (U-5-005) and it identified specified areas where habitat requirements must be met. Since these cover requirements reflect current management of deer winter range in this TSA, they were applied in the base case. Modeling applied a cover constraint to the specified area in each LU as per the GAR order. Table 47 summarizes the cover constraints applied.

Table 47. Summary of cover constraints for Black Tailed Deer by Landscape Unit

Landscape Unit	Minimum Mature Forest Cover Requirements for first 80 years	Minimum Mature Forest Cover Requirements after 80 years
Kilbella/Chuckwalla, Sumquolt, Lower Kimsquit	20% ≥ 141 years	25% ≥ 141 years **(Implemented in year 40 to ensure target is met by year 80)**
Clayton, Machmell, Nusatsum, Salloompt, Sheemahant, South Bentinck, Smitley/Noeick, Taleomey/Asseek, Upper Kimsquit, Clyak	20% ≥ 121 years	
All other LU's	25% ≥ 141 years	

* Order also indicates that the crown closure must be ≥ 56% and ≤85% and have a leading species of either Douglas-fir, Sitka spruce, or hemlock. It was not possible to assess crown closure or leading species as part of constraints in the model.

The areas impacted by black tailed deer constraints are shown below in Table 48.

Table 48. Areas impacted by black tailed deer cover constraints

Landscape Unit	Forested Non THLB (ha)	THLB Area (ha)	PFLB Area (ha)
Ape	0.2	0	0.2
Atnarko	4	0	4
Bella Coola	595	256	851
Braden	2,490	982	3,472
Clayton	311	262	573
Clyak	1,069	2,405	3,474
Crag	478	0	478
Dean	2,668	264	2,931
Don Peninsula	714	954	1,668
Doos/Dallery	412	227	639
Draney	394	455	849
Ellerslie	2,480	763	3,243
Evans	46	42	89
Johnston	24	24	47
Jump Across	1,230	104	1,333
Kilbella/Chuckwalla	1,616	903	2,519
Kilippi	3	41	44
King Island	1,618	1,343	2,961
Kwatna/Quatlena	1,341	1,105	2,446

Landscape Unit	Forested Non THLB (ha)	THLB Area (ha)	PFLB Area (ha)
Labouchere	1,915	749	2,664
Lower Kimsquit	2,103	1,626	3,728
Machmell	758	711	1,470
Nascall	1,703	109	1,812
Neechanz	425	421	846
Nekite	2,431	1,084	3,514
Nootum/Koeye	3	0	3
Nusatsum	181	0	181
Owikeno	1,394	354	1,747
Roscoe	2,283	270	2,553
Saloompt	885	821	1,705
Sheemahant	1,213	1,296	2,509
Sheep Passage	3,854	609	4,462
Smitley/Noeick	240	510	750
Smokehouse	1,834	930	2,764
South Bentinck	44	0	44
Sumquolt	927	146	1,073
Sutslem/Skowquiltz	2,859	116	2,975
Swindle	318	14	332
Taleomey/Asseek	226	285	511
Twin	438	320	758
Upper Kimsquit	1,845	1,273	3,117
Washwash	672	53	724
Young	26	0	26
Total	**46,067**	**21,823**	**67,890**

8.5 Ecosystem Based Management (EBM) Objectives

Land use orders have been made legal for the South Central Coast and Central and North Coast (March 27, 2009). These orders define land use objectives that implement Ecosystem Base Management (EBM) on the central and north coast of BC and both apply to portions of the Mid Coast TSA (Figure 3 and Table 49). The integration of these objectives into the Mid Coast TSR3 process is discussed in the following sections. The full legal text of the EBM orders can be found here:
http://ilmbwww.gov.bc.ca/slrp/lrmp/nanaimo/cencoast/plan/objectives/index.html

Table 49. Ministerial order areas for the Mid Coast TSA

Ministerial Order Area	Forested non THLB (ha)	THLB * (ha)	Total Productive Forest (ha)
CNC	471,182	95,463	566,646
SCC	419,306	39,879	459,185
Total	**890,489**	**135,343**	**1,025,831**

* Spatial THLB area and does not include TL reversions.

It should be noted that proposed amendments to these EBM Orders were made public in December 2008 and were open to review and comment until Feb 16, 2009. These amendments are recognized here as the current practice in the TSA.

8.5.1 EBM Objective 3 – First Nations Traditional Forest Resources

The intent of this objective is to provide for the maintenance of forest resources traditionally used by First Nations for food, social, or ceremonial purposes. This can include merchantable timber and based on the fact that First Nations can access volume without paying stumpage through Free Use Permits. For the six bands within the TSA (Gwa'sala-'Nakwaxda'xw, Heiltsuk, Kitasoo, Nuxalk, Ulkatcho and Wuikinuxv) a total of 1,500 m³/year was assumed to be harvested within the THLB and in excess of the approved AAC. Additonal volume may also be logged in non THLB areas (parks, riparian, etc) but this does not need to be reflected in the anlaysis. The volume expected to be removed from the THLB was added to the non recoverable losses and

logged in the model on top of the AAC request. This volume also helps to address EBM Objectives 6 and 7 below.

8.5.2 EBM Objective 4 – First Nations Traditional Heritage Features

"The intent of this objective is to provide for the protection of defined First Nation's traditional heritage features that are of continued importance to the First Nation within areas proposed for forest development activities. The objective directs licensees to share information and work with First Nations to protect traditional heritage features." (SCC and CNC Background and Intent Document – April 18 2008)

This objective was addressed through non-spatial netdowns to the THLB (see section 3.4.1). Non spatial netdowns were used because they represent a portion of each of the polygon used during modeling.

8.5.3 EBM Objective 5 – Culturally Modified Trees

"The intent of this objective is to provide for the identification and protection of culturally modified trees that are of continuing importance to First Nations. The objective directs licensees to share information and work with First Nations to identify and protect culturally modified trees within area proposed to be altered or harvested and to reserve culturally modified tree areas where practicable." (SCC and CNC Background and Intent Document – April 18 2008)

This objective was addressed through non-spatial netdowns to the THLB (see section 3.4.1).

8.5.4 EBM Objective 6 – Monumental Cedar

"The intent of this objective is to provide for the maintenance of monumental cedar for First Nations use. The South Central Coast objective directs licensees to share information and collaborate with First Nations to maintain a sufficient volume of monumental cedar to support present and future cultural use. The Central and North Coast objective directs licensees to share information and work with First Nations to identify and protect monumental cedar within areas proposed to be altered or harvested and to reserve monumental cedar areas where practicable." (SCC and CNC Background and Intent Document – April 18 2008)

This objective was addressed through non-spatial netdowns to the THLB (see section 3.4.1).

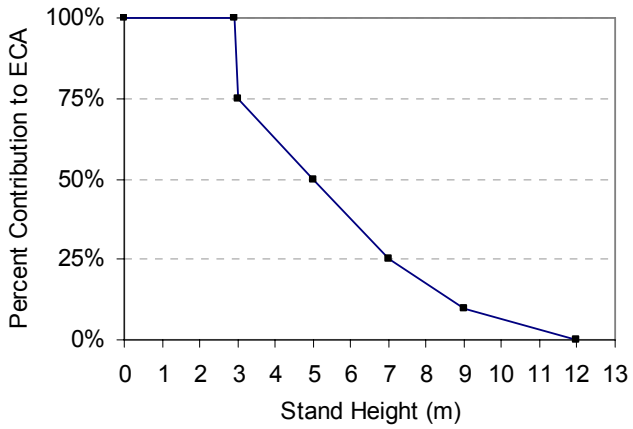
8.5.5 EBM Objective 7 – Stand Level Retention of Cw/Yc

"The intent of this objective is to ensure sufficient Western red and Yellow cedar is maintained to support First Nation's present and future cultural and social uses." (SCC and CNC Background and Intent Document – April 18, 2008)

This objective was addressed through non-spatial netdowns to the THLB (see section 3.4.1).

8.5.6 EBM Objective 8 – Important Fisheries Watersheds

The intent of this objective is to ensure forest development activities do not negatively impact watershed health and/or fish habitat in important fisheries watersheds. Important fisheries watersheds are identified in Schedule 2 of the SCC Order and Schedule 3 of the CNC Order, but are not meant to capture small watersheds composed of S5 and S6 streams flowing directly into the ocean. Identified Important Fisheries Watersheds are to be managed using the concept of Equivalent Clearcut Area (ECA) and hydrologic greenup to limit the amount of disturbance within these watersheds. When evaluated on the forested portion of each watershed area, ECA's are to be kept at <20%. For TSR3 modeling, stands are assumed to recover as per the recovery curve shown below. This curve was adapted from the Coastal Watershed Assessment Procedures Guidebook (v2.1 Apr 1999).



The graph shows that as long as disturbed areas are below 3m in height, they are considered 100% 'clearcut' while only 50% of an area with a height of 5m is considered 'clearcut'.

Modeling applied a maximum 20% ECA to the forested portion of each watershed in Schedule 2 of the SCC Order and Schedule 3 of the CNC Order. Stand height curves assigned to each stand type (AU) were used to calculate ECA percents dynamically in each period for comparison to the target.
The areas impacted by Important Fisheries Watershed constraints are shown below (Table 50).

Table 50. Areas impacted by Important Fisheries Watershed constraints

Ministerial Order Area	Forested Non THLB (ha)	THLB (ha)	PFLB Area (ha)
CNC	228,544	53,853	282,397
SCC	95,057	13,283	108,340
Total	**323,601**	**67,136**	**390,737**

8.5.7 EBM Objective 9 – High Value Fish Habitat (HVFH)

HVFH was treated as a spatial netdown from the THLB (see section 3.3.12.1)

8.5.8 EBM Objective 10 – Aquatic Non High Value Fish Habitat

Aquatic Non-HVFH was treated as a spatial netdown from the THLB (see section 3.3.12.2)

8.5.9 EBM Objective 11– Forested Swamps

The intent of this objective is to maintain the natural ecological function of forested swamps by managing forests that occur adjacent to these areas. As these are rare in coastal BC, it has been assumed that they can be addressed within the impacts attributed to stand level retention strategies (see section 3.3.12.3).

8.5.10 EBM Objective 12 – Upland Streams

The intent of this objective is to maintain the natural ecological function of upland streams and to provide for the maintenance of hydrological and ecological processes within specific watersheds. The objective does not require management of every small upland stream, but does require that functional riparian forest exist on at least 70% of upland portions of watersheds.

Upland streams are to be managed in watersheds identified in Schedule 2 of the SCC order and all watersheds (min 3rd order) in the CNC order. Watershed boundaries beyond those mapped in Schedule 3 for the CNC area were obtained from: ftp://ftpnan.env.gov.bc.ca/pub/outgoing/dist/Coast Implementation/EBM WG/Data/watersheds/ and represent 3rd order or larger watersheds.

Within the relevant watersheds, sufficient functional riparian forest was maintained in upland portions of the watersheds by allowing a maximum of 30% of the upland forest area to be below the hydrologically effective greenup height of 9 m. This height comes from the Coastal Watershed Assessment Procedure guidebook which states that 9 meter tall stands are assumed to be 90% hydrologically recovered (maximum recovery shown in the table).

Upland forest is the portion of the watershed occupied by upland streams. For the analysis this was assumed to be forested areas with a >5% slope outside HVFH, Aquatic Non HVFH, and Active Fluvial areas. This amounted to 97,542 ha in the SCC and 397,925 ha in the CNC (270,539 ha FSW and 127,386 ha other watersheds) as shown in Table 51. This constraint was applied to watersheds with a minimum of 100 ha of upland forest, reducing the original area by 1,735 ha (0.35%), from 495,467 ha to 493,732 ha.

Table 51. Areas managed for upland streams

Ministerial Order Area	Important Fisheries Watersheds	Forested Non THLB (ha)	THLB (ha)	PFLB Area (ha)
CNC	Yes	216,992	53,547	270,539

	No	105,004	22,382	127,386
	Subtotal	**321,996**	**75,929**	**397,925**
SCC	Yes	84,389	13,153	97,542
Total		**406,386**	**89,082**	**495,467**

* The area of the Important Fisheries Watersheds is smaller than in Table 50 because of the slope and riparian exclusions.

8.5.11 EBM Objective 13 – Active Fluvial Units

This objective is present in both the Central and North Coast Order (CNC) and the South Central Coast Order (SCC). The objective intends to maintain the integrity and natural ecological function of active fluvial units (floodplains). Protection will be achieved though the application of a spatial netdown to the THLB (section 3.3.12.4).

8.5.12 EBM Objective 14 – Landscape Level Biodiversity

The intent of this objective is to ensure that a specified amount of forest is maintained in old seral condition in each ecosystem surrogate (TEM mapping not available) based on the relative rarity of the surrogate and the range of natural variation. The CNC and SCC orders define old forest as a stand of trees 250 years or older. To represent this objective, a constraint was applied that maintained a minimum amount of old forest in each Site Series Surrogate (SSS)[19] by LU as per Schedules 4, 4b, 4c, 4d (SCC) and 4, 4b, 4c (CNC) of the EBM orders. These targets were limited to the units with at least 1 ha of THLB in order to simplify modeling. In LU/SSS units where deficits occurred, recruitment was handled on an oldest first basis (no consideration of land base type). A table of all units with areas and targets can be found in Appendix B. There are likely to be units managed to the "risk-managed" targets but we do not know which ones or when this will occur yet – so the plan is to do a sensitivity analyses with the "risk-managed" targets to get an idea of the level of impact.

In addition, the amount of mid seral forest in each LU/SSS was explicitly limited to 50% using accounts that track this seral stage. Mid seral is defined as:

- CWH: 40-80 years old
- ESSF: 40-120 years old
- MH: 40-120 years old

8.5.13 EBM Objective 15 – Red and Blue Listed Plant Communities

The intent for this objective is to protect and maintain the abundance and distribution of existing rare, threatened and endangered ecosystems. All occurrences of red listed plant communities are to be protected, while at least 70% of blue listed plant communities are to be protected.

This objective was addressed through aspatial netdowns to the THLB (see section 3.4.2)

8.5.14 EBM Objective 16 – Stand Level Retention

The intent of this objective is to maintain forest structure and habitat elements at the stand level. Both the SCC and CNC orders require a minimum of 15% of each cutblock to be retained, where 50% of this retention should be internal to the cutblock if it's over 15 ha.

This issue was addressed though the application of aspatial netdowns to the THLB (see section 3.4.3).

8.5.15 EBM Objective 17 – Grizzly Bear Habitat

The intent of this objective is to support the long term viability of this regionally important species through the establishment of spatial reserves that work toward maintaining grizzly bear habitat.

[19] Site Series Surrogate (SSS) are groupings of stand types within BEC variants. There are 13 potential stand groupings that can occur within each BEC variant that are a function of leading species and site index. For example, Stand type#1 = Fd leading with SI > 27.

Protection of identified habitat will be achieved through the application of a spatial netdown to the THLB (see section 3.3.13).

9.0 Timber Supply Modeling

9.1 Timber Supply Model

For forecasting and analysis, the PATCHWORKS™ modeling software will be used. This suite of tools is sold / maintained by Spatial Planning Systems Inc. of Deep River, Ontario (Tom Moore - www.spatial.ca).

Patchworks is a fully spatial forest estate model that can incorporate real world operational considerations into a strategic planning framework. It is unique in its ability to dynamically assess spatial relationships during modeling and adapt solutions to achieve spatial objectives. It utilizes a goal seeking approach and an optimization heuristic to schedule activities across time and space in order to find a solution that best balances the targets/goals defined by the user. Targets can be applied to any aspect of the problem formulation. For example, the solution can be influenced by issues such as mature/old forest retention levels, young seral disturbance levels, patch size distributions, conifer harvest volume, growing stock levels, snag densities, CWD levels, ECA's, specific mill volumes by species, road building/hauling costs, delivered wood costs, net present values, etc. Patchworks continually generates alternative solutions until the user decides a stable solution has been found. Solutions with attributes that fall outside of specified ranges (targets) are penalized and the goal seeking algorithm works to minimize these penalties – resulting in a solution that reflects the user's objectives and priorities.

Patchworks' flexible interactive approach is unique in several respects:

- Patchworks' interface allows for highly interactive analysis of trade-off's between competing sustainability goals.
- Patchworks integrates operational-scale decision-making within a strategic-analysis environment: realistic spatial harvest allocations can be optimized over long-term planning horizons. Patchworks can simultaneously evaluate forest operations and log transportation problems using a multiple-product to multiple-destination formulation. The model can identify in precise detail how wood will flow to mills over a complex set of road construction and transportation alternatives.
- Allocation decisions can be made considering one or many objectives simultaneously and objectives can be weighted for importance relative to each other (softer vs. harder constraints).
- Allocation decisions can include choices between stand treatment types (clearcut vs. partial cut, fertilization, rehabilitation, etc).
- Unlimited capacity to represent a problem – only solution times limit model size.
- Fully customizable reporting on economic, social, and environmental conditions over time. Reports are built web-ready for easy sharing of analysis results – even comparisons of multiple indicators across multiple scenarios.

Because it is up the user to decide when Patchworks should stop searching for a better solution, a specific defined criteria for a 'stable' solution is desirable. This helps ensure that differences between scenario results occur because of model input differences and not from extra effort spent finding a better solution. For the purpose of this project, Patchwork results were accepted once the objective function improved by less than 0.1% in 100,000 iterations.

9.2 Harvest Flow Objectives

Harvest flow objectives used during analysis area consistent with MFR policy[20]. The primary objective is to gradually adjust harvest levels, if required, to arrive at the long-term harvest level (LTHL) for the TSA. A wide range of harvest flows are possible but ideally the flows will:

- Achieve an acceptable short-term harvest level beginning at the current AAC whenever possible;
- Where harvest level changes are required, make steps no larger than 10%;

[20] Harvest Flow Considerations for the Timber Supply Review" http://www.llbc.leg.bc.ca/public/PubDocs/bcdocs/365082/DFAM_harvest_flow_options.pdf

- A medium-term harvest level below the long-term harvest level should be avoided and if present, minimized.
- Do not permit the mid-term harvest level to fall below a level reflecting the productive capacity of the TSA (natural stand yield estimates); and
- Achieve a maximum long-term stable harvest level over a 300-year time horizon reflecting the productive capacity of the TSA (based on TIPSY yield estimates). One indicator of a stable long-term harvest level will be a constant long-term total inventory (growing stock on the THLB).

9.3 Initial Harvest Rate

The base case harvest forecast will use the following initial harvest rates:

Initial Harvest: 768,000 m^3/yr + 14,071 m3/yr (NRL) + 1,500 m^3/yr (EBM Obj. 3) = 783,571 m^3/yr

9.4 Long Run Sustained Yield

Long run sustained yield (LRSY) values calculated on the basis of both natural and managed stand yield curves are shown in Table 52. LRSY is a measure of what the land base is capable of producing if only timber production is considered and can be used to assess the level of impact arising from non timber management issues.

Table 52. LRSY values for natural and managed stands

Description	Stand Type	
	Natural	**Managed**
Current THLB (ha)	123,162	123,162
- Future roads (ha)	2,713	2,713
+ TL Reversions	5,279	5,279
= Long term THLB (ha)	125,728	125,728
* Average MAI at culmination (m^3/ha)	3.3	7.5
= Theoretical Gross LRSY (m^3/yr)	**414,902**	**942,960**
- Non-recoverable losses (m^3/yr)	14,071	14,071
= Theoretical Net LRSY (m^3/yr)	**400,831**	**928,889**

9.5 Sensitivities and Critical Issues

The following list of sensitivities and critical issue analyses planned:

Sensitivities

1. Harvest Flows:
    a. High Initial Harvest Flow
    b. Non Declining Harvest flow
2. Larger THLB (low royalty/stumpage land base)
3. Smaller THLB (high royalty/stumpage land base)
4. Larger THLB (include all previously logged stands)
5. Natural stand yields +- 10%
    a. Natural stand yields plus 10%
    b. Natural stand yields minus 10%
6. Future dispersed retention modelled as 20% (instead of 10%)
7. Minimum Harvest Ages +-10 yrs
    a. Minimum Harvest Ages plus 10 yrs

    b. Minimum Harvest Ages minus 10 yrs
8. Manage Cw Profile (30% for the cedar leading stands)
9. Drop Grizzly EBM requirements
10. Old seral representation using EBM risk managed targets
11. Control partition harvest levels
    a. Drop the maximum Outer harvest level to 10%
    b. Suppress harvest in Owikeno watershed: short term areas for 40 year and perpetual for the rest
12. Pre EBM Scenarios
    a. Pre EBM (no changes to parks)
    b. Pre EBM + 2004 Version of Parks (Tweedmuir, Hakai, Fiordland only)

Actual sensitivity runs completed may vary from this initial plan based on information discovered during the analysis process.

Glossary

Allowable annual cut (AAC)	The rate of timber harvest permitted each year from a specified area of land, usually expressed as cubic meters of wood per year.
Analysis unit	A grouping of types of forest — for example, by species, site productivity, silvicultural treatment, age, and or location — done to simplify analysis and generation of timber yield tables.
Base case harvest forecast	The timber supply forecast which illustrates the effect of current forest management practices on the timber supply using the best available information, and which forms the reference point for sensitivity analysis.
Basic sector	Sectors of the economy, such as forestry, tourism and mining, which create flows of income into the region and are assumed to be drivers of the local economy. Non-basic sectors, such as retail outlets, are supported by basic sectors.
Biodiversity (biological diversity)	The diversity of plants, animals and other living organisms in all their forms and levels of organization, including the diversity of genes, species and ecosystems, as well as the evolutionary and functional processes that link them.
Biogeoclimatic (BEC) variant	A subdivision of a biogeoclimatic subzone. Variants reflect further differences in regional climate and are generally recognized for areas slightly drier, wetter, snowier, warmer or colder than other areas in the subzone.
Biogeoclimatic zones	A large geographic area with broadly homogeneous climate and similar dominant tree species.
Coniferous	Coniferous trees have needles or scale-like leaves and are usually 'evergreen'.
Cutblock	A specific area, with defined boundaries, authorized for harvest.
Cutblock adjacency	The spatial relationship among cutblocks. Most adjacency restrictions require that recently harvested areas must achieve a desired condition (green-up) before nearby or adjacent areas can be harvested. Specifications for the maximum allowable proportion of a forested landscape that does not meet green-up requirements are used to approximate the timber supply impacts of adjacency restrictions.
Deciduous	Deciduous trees shed their leaves annually and commonly have broad-leaves.
Ecosystem Based Management (EBM)	An adaptive approach to managing human activities that seeks to ensure the coexistence of healthy, fully functioning ecosystems and human communities. The intent is to maintain those spatial and temporal characteristics of ecosystems such that component species and ecological processes can be sustained, and human wellbeing supported and improved.
Employment coefficient	The number of person-years of employment supported by every 1,000 cubic meters of timber harvested; for example, a coefficient of 1.0 indicates that every 1,000 cubic meters harvested supports one person-year, or 500,000 cubic meters supports 500 person-years.
Employment multiplier	An estimate of the total employment supported by each direct job, for example a multiplier of 2.0 means that one direct job supports one additional indirect and induced job.
Environmentally sensitive areas (ESA)	Areas with significant non-timber values, fragile or unstable soils, impediments to establishing a new tree crop, or high risk of avalanches.
Forest cover objectives	Specify desired distributions of areas by age or size class groupings. These objectives can be used to reflect desired conditions for wildlife, watershed protection, visual quality and other integrated resource management objectives. General adjacency and green-up guidelines are also specified using forest cover objectives (see **cutblock adjacency and Green–up**).
Forest inventory	An assessment of British Columbia's timber resources. It includes computerized maps, a database describing the location and nature of forest cover, including size, age, timber volume, and species composition, and a description of other forest values such as recreation and visual quality.
Forest and Range Practices Act (FRPA)	Legislation that govern forest practices and planning, with a focus on ensuring management for all forest values.
Forest type	The classification or label given to a forest stand, usually based on its tree species composition. Pure spruce stands and spruce-balsam mixed stands are two examples.
Free-growing	An established seedling of an acceptable commercial species that is free from growth-inhibiting brush, weed and excessive tree competition.
Green-up	The time needed after harvesting for a stand of trees to reach a desired condition (usually a specific height) — to ensure maintenance of water quality, wildlife habitat, soil stability or aesthetics — before harvesting is permitted in adjacent areas.

Growing stock	The volume estimate for all standing timber at a particular time.
Harvest forecast	The flow of potential timber harvests over time. A harvest forecast is usually a measure of the maximum timber supply that can be realized over time for a specified land base and set of management practices. It is a result of forest planning models and is affected by the size and productivity of the land base, the current growing stock, and management objectives, constraints and assumptions.
Higher level plans	Higher level plans establish the broader, strategic context for operational plans, providing objectives that determine the mix of forest resources to be managed in a given area.
Indirect and induced jobs	Indirect jobs are supported by direct business purchases of goods and services. Induced jobs are supported by employee purchases of goods and services; for example, at retail outlets.
Inoperable areas	Areas defined as unavailable for harvest for terrain-related or economic reasons. Operability can change over time as a function of changing harvesting technology and economics.
Integrated resource management (IRM)	The identification and consideration of all resource values, including social, economic and environmental needs, in resource planning and decision-making.
Karst	An area of limestone terrain characterized by sinks, ravines, and underground streams.
Landscape-level biodiversity	The *Landscape Unit Planning Guide* provides objectives for maintaining biodiversity at both the landscape level and the stand level. At the landscape level, guidelines are provided for the maintenance of seral stage distribution, patch size distribution and landscape connectivity.
Landscape unit	A planning area based on topographic or geographic features, that is appropriately sized (up to 100 000 hectares), and designed for application of landscape-level biodiversity objectives.
Long-term harvest level	A harvest level that can be maintained indefinitely given a particular forest management regime (which defines the timber harvesting land base, and objectives and guidelines for non-timber values) and estimates of timber growth and yield.
Mature seral	Forest stands with trees between 80 and 120 years old, depending on species, site conditions and biogeoclimatic zone.
Management assumptions	Approximations of management objectives, priorities, constraints and other conditions needed to represent forest management actions in a forest planning model. These include, for example, the criteria for determining the timber harvesting land base, the specification of minimum harvestable ages, utilization levels, integrated resource guidelines and silviculture and pest management programs.
Mean annual increment (MAI)	Stand volume divided by stand age. The age at which average stand growth, or MAI, reaches its maximum is called the culmination age (CMAI). Harvesting all stands at this age results in a maximum average harvest over the long term.
Minimum harvestable age (MHA)	The age at which a stand of trees is expected to achieve a merchantable condition. The minimum harvestable age could be defined based on maximize average productivity (culmination of mean annual increment), minimum stand volume, or product objectives (usually related to average tree diameter).
Model	An abstraction and simplification of reality constructed to help understand an actual system or problem. Forest managers and planners have made extensive use of models, such as maps, classification systems and yield projections, to help direct management activities.
Natural disturbance type (NDT)	An area that is characterized by a natural disturbance regime, such as wildfires, which affects the natural distribution of seral stages. For example areas subject to less frequent stand-initiating disturbances usually have older forests.
Not satisfactorily restocked (NSR)	An area not covered by a sufficient number of well-spaced trees of desirable species. Stocking standards are set by the B.C. Forest Service. Areas harvested prior to October 1987 and not yet sufficiently stocked according to standards are classified as backlog NSR. Areas harvested or otherwise disturbed since October 1987 are classified as current NSR.
Operational Adjustment Factor (OAF)	OAF1 and OAF2 are TIPSY input parameters that reduce predicted yield to account for factors such as non-productive areas within stands, disease and insects, non-commercial cover, stocking gaps, decay, waste, and breakage.
Operability	Classification of an area considered available for timber harvesting. Operability is determined using the terrain characteristics of the area as well as the quality and quantity of timber on the area.
Person-year(s)	One person working the equivalent of one full year, defined as at least 180 days of work. Someone working full-time for 90 days accounts for 0.5 person-years.

Productive forest land base (PFLB)	All forested crown land in a management unit. Used to support the management of non timber resources. The THLB is a subset of this land base.
Protected area	A designation for areas of land and water set aside to protect natural heritage, cultural heritage or recreational values (may include national park, provincial park, or ecological reserve designations).
Riparian area	Areas of land adjacent to wetlands or bodies of water such as swamps, streams, rivers or lakes.
Scenic area	Any visually sensitive area or scenic landscape identified through a visual landscape inventory or planning process carried out or approved by a district manager.
Sensitivity analysis	A process used to examine how uncertainties about data and management practices could affect timber supply. Inputs to an analysis are changed, and the results are compared to a baseline or base case.
Seral stages	Sequential stages in the development of plant communities that successively occupy a site and replace each other over time.
Site index	A measure of site productivity. The indices are reported as the average height, in meters, that the tallest trees in a stand are expected to achieve at 50 years (age is measured at 1.3 meters above the ground). Site index curves have been developed for British Columbia's major commercial tree species.
Stand-level biodiversity	A stand is a relatively localized and homogeneous land unit that can be managed using a single set of treatments. In stands, objectives for biodiversity are met by maintaining specified stand structure (wildlife trees or patches), vegetation species composition and coarse woody debris levels.
Stocking	The proportion of an area occupied by trees, measured by the degree to which the crowns of adjacent trees touch, and the number of trees per hectare.
Table Interpolation Program for Stand Yields (TIPSY)	A B.C. Forest Service computer program used to generate yield projections for managed stands based on interpolating from yield tables of a model (TASS) that simulates the growth of individual trees based on internal growth processes, crown competition, environmental factors and silvicultural practices.
Timber harvesting land base (THLB)	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, existing timber quality, market values, and applicable technology.
Timber supply	The amount of timber that is forecast to be available for harvesting over a specified time period, under a particular management regime.
Timber supply area (TSA)	An integrated resource management unit established in accordance with *Section 7* of the *Forest Act*.
Tree farm license (TFL)	Provides rights to harvest timber, and outlines responsibilities for forest management, in a particular area.
Ungulate	A hoofed herbivore, such as deer.
Unsalvaged losses	The volume of timber killed or damaged annually by natural causes (e.g., fire, wind, insects and disease) that is not harvested.
Variable Density Yield Prediction (VDYP)	An empirical yield prediction system, supported by the Ministry of Forests and Range, designed to predict average yields and provide forest inventory updates over large areas (i.e., Timber Supply Areas). It is intended for use in unmanaged natural stands of pure or mixed species composition.
Vegetation Resources Inventory (VRI)	An assessment of British Columbia's vegetation resources. It includes computerized maps, a database describing the location and nature of forest information, including timber size, stand age, timber volume, tree species composition, and shrub, herb, and bryoid information. It replaces the older forest inventory.
Visual quality objective (VQO)	Defines a level of acceptable landscape alteration resulting from timber harvesting and other activities. A number of visual quality classes have been defined on the basis of the maximum amount of alteration permitted.
Volume estimates	Estimates of yields from forest stands over time. Yield projections can be developed for stand volume, stand diameter or specific products, and for empirical (average stocking), normal (optimal stocking) or managed stands.
Yield projections	See volume estimates.
Watershed	An area drained by a stream or river. A large watershed may contain several smaller watersheds.
Wildlife tree	A standing live or dead tree with special characteristics that provide valuable habitat for conservation or enhancement of wildlife.
Woodlot licence	An agreement entered into under the *Forest Act*. It allows for small-scale forestry to be practised in a described area (Crown and private) on a sustained yield basis.

Acronyms

AAC	Allowable Annual Cut
Analysis	Timber Supply Analysis
AU	Analysis Unit
BCTS	British Columbia Timber Sales
BEC	Biogeoclimatic Ecosystem Classification
BEO	Biodiversity Emphasis Option
BMTA	Biodiversity, Mining and Tourism Area
CF	Chief Forester
CWAP	Coastal Watershed Assessment Procedure
DFO	Department of Fisheries and Oceans
DM	District Manager
EBM	Ecosystem-Based Management
ESA	Environmentally Sensitive Area
FIP	Forest inventory Planning
FIZ	Forest Inventory Zone
FPC	Forest Practices Code
FPPR	Forest Planning and Practices Regulation
FSP	Forest Stewardship Plan
GAR	Government Action Regulation
GIS	Geographic Information System
HLP	Higher Level Plan
ILMB	Integrated Land Management Bureau (Ministry of Agriculture and Lands)
IP	Information Package
IRM	Integrated Resource Management
LRMP	Land and Resource Management Plan
LU	Landscape Unit
MHA	Minimum Harvestable Age
MOE	Ministry of Environment
MFR	Ministry of Forests and Range
MO	Ministerial Order
NCC	Non-Commercial Cover
NDT	Natural Disturbance Type
NRL	Non-Recoverable Losses
NSR	Not Satisfactorily Restocked
OAF	Operational Adjustment Factor
OGMA	Old Growth Management Area
PSP	Permanent Sample Plot
PFLB	Productive Forest Land Base
PSYU	Public Sustained Yield Unit
QMD	Quadratic Mean Diameter
RFI	Recreation Features Inventory
RMZ	Riparian Management Zone
ROS	Recreation Opportunity Spectrum
RRZ	Riparian Reserve Zone
RVQC	Recommended Visual Quality Class
SI	Site Index
SRMZ	Special Resource Management Zone
TFL	Tree Farm License
THLB	Timber Harvesting Land Base
VAC	Visual Absorption Capability
VQO	Visual Quality Objective
VRI	Vegetation Resources Inventory
WHA	Wildlife Habitat Area
UWR	Ungulate Winter Range

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Appendix A: Yield Curves

	Existing Natural Yields (VDYP)																											
Age	**101**	**102**	**103**	**104**	**105**	**106**	**107**	**108**	**109**	**110**	**111**	**112**	**113**	**114**	**121**	**122**	**123**	**124**	**125**	**126**	**127**	**128**	**129**	**130**	**131**	**132**	**133**	**134**
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
20	1	0	0	3	1	0	0	10	1	0	0	25	10	0	1	0	0	1	0	0	0	3	1	0	0	34	9	1
30	66	26	0	71	27	1	1	122	32	1	1	131	43	12	86	18	2	41	9	1	0	71	9	1	0	128	38	13
40	174	119	17	168	112	19	6	242	122	10	2	255	141	30	217	112	37	130	77	30	3	187	87	20	1	255	114	35
50	266	203	77	257	191	67	37	345	204	58	7	362	238	62	325	199	105	213	150	86	33	288	169	79	11	363	205	87
60	344	274	128	341	264	115	77	434	275	110	41	453	322	112	413	274	163	290	217	140	73	375	241	137	53	455	286	152
70	411	334	172	415	330	159	115	510	337	157	87	530	397	163	488	337	213	360	278	188	111	450	305	189	95	533	357	209
80	470	387	211	485	391	200	151	576	393	199	127	595	463	212	552	393	257	425	333	234	147	516	360	236	133	600	419	262
90	520	431	244	537	438	232	180	630	439	234	163	648	518	256	605	440	294	473	377	270	177	571	408	275	166	655	473	308
100	565	470	273	581	478	260	205	676	479	266	195	693	566	296	650	480	326	513	414	301	203	619	449	310	196	702	519	350
110	605	504	300	619	511	284	227	716	513	294	224	730	608	332	690	515	355	547	446	328	226	660	485	341	222	741	560	387
120	640	533	322	645	535	302	244	749	542	318	250	761	643	364	723	546	379	570	470	347	243	695	515	368	245	774	595	419
130	669	559	342	684	570	325	264	785	573	342	274	793	679	397	754	572	400	606	501	373	264	732	547	395	269	808	630	452
140	692	580	358	720	602	346	283	818	602	366	295	822	713	428	780	595	418	639	530	397	283	765	577	421	290	838	662	483
150	710	597	371	752	630	365	299	848	628	386	315	847	742	456	801	613	432	669	556	418	300	795	603	444	310	865	690	511
160	723	609	381	780	654	381	313	874	651	405	331	870	769	482	817	626	442	695	578	436	314	822	627	464	328	889	716	537
170	732	617	387	803	675	395	324	896	672	422	346	890	793	506	829	634	449	717	596	451	325	845	649	483	344	909	740	560
180	735	621	391	828	697	409	336	917	691	438	359	909	815	529	837	639	452	740	616	467	338	866	669	501	360	928	761	582
190	744	630	398	851	718	423	347	937	710	454	372	926	836	550	848	648	459	762	635	483	350	887	688	517	374	946	781	603
200	752	638	404	874	738	436	358	956	727	468	384	941	855	571	860	657	466	783	652	498	362	905	705	533	388	962	799	623
210	761	646	410	895	757	449	369	974	743	482	395	955	873	590	870	666	473	803	669	512	373	922	721	548	402	977	816	641
220	769	653	415	921	779	464	382	990	758	495	405	968	890	608	881	674	479	828	690	529	387	938	736	562	414	991	832	658
230	777	661	420	947	802	478	395	1,005	772	507	414	980	906	625	890	682	485	851	710	546	400	953	750	575	426	1,003	846	674
240	784	668	425	971	823	492	407	1,019	785	518	423	992	920	642	900	690	491	874	729	563	413	967	763	587	437	1,015	860	689
250	792	674	430	995	844	506	419	1,032	798	529	431	1,002	934	657	908	697	496	896	748	578	426	980	775	598	447	1,026	872	703
260	792	675	431	999	847	509	421	1,039	804	535	437	1,011	945	670	911	698	497	899	751	581	427	987	783	605	454	1,035	883	714
270	793	676	432	1,002	851	512	422	1,045	810	541	443	1,019	954	682	913	698	498	901	754	583	428	995	791	611	460	1,043	893	725
280	794	677	433	1,005	854	514	424	1,051	815	547	448	1,026	963	693	914	699	498	903	757	585	429	1,001	798	617	466	1,050	902	735
290	795	678	434	1,008	857	517	425	1,056	820	552	453	1,033	972	704	916	699	499	905	759	586	430	1,007	804	622	471	1,057	911	744
300	795	678	435	1,010	859	519	426	1,061	824	557	458	1,040	980	715	917	700	499	906	761	588	431	1,012	809	627	476	1,064	919	753
310	796	679	436	1,013	862	521	428	1,065	828	561	462	1,046	987	725	919	700	500	907	763	589	432	1,017	815	632	480	1,070	926	762
320	797	679	437	1,015	864	523	429	1,069	832	565	466	1,052	995	734	920	700	500	909	765	591	433	1,021	819	636	485	1,076	933	770
330	797	680	437	1,016	866	525	430	1,072	835	569	469	1,058	1,002	744	921	700	501	909	767	592	434	1,024	823	640	488	1,082	940	778
340	797	680	438	1,018	868	526	431	1,075	838	573	473	1,063	1,008	752	922	700	501	910	768	593	434	1,027	827	643	492	1,087	946	785
350	798	680	438	1,019	869	528	432	1,078	840	576	476	1,068	1,014	761	922	700	501	910	769	594	435	1,030	830	646	496	1,092	952	792

	Future Managed Yields (TIPSY)																												
Age	**201**	**202**	**203**	**204**	**205**	**206**	**207**	**208**	**209**	**210**	**211**	**212**	**213**	**214**	**221**	**222**	**223**	**224**	**225**	**226**	**227**	**228**	**229**	**230**	**231**	**232**	**233**	**234**
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20	21	4	0	5	3	2	3	1	3	3	2	13	2	0	16	2	0	2	3	1	1	1	2	1	0	9	0	0
30	129	61	12	69	59	37	64	69	71	51	43	119	29	1	108	50	15	51	62	29	20	63	43	33	16	105	18	2
40	257	156	44	185	164	127	179	230	223	190	162	269	106	7	223	133	52	149	170	113	82	217	172	149	103	251	79	15
50	397	246	92	313	289	235	309	381	370	332	292	423	206	30	339	217	106	266	296	219	169	364	307	279	226	396	162	52
60	524	340	142	439	406	338	430	523	513	470	418	579	305	70	457	296	161	374	415	324	261	505	437	402	341	549	249	101
70	641	431	187	558	519	435	547	645	634	586	532	717	402	110	555	377	210	482	531	418	343	622	550	515	450	680	332	154
80	746	508	228	664	627	528	656	763	751	698	637	850	499	156	652	452	254	583	639	507	418	738	654	615	542	810	419	208
90	837	579	265	757	716	615	745	867	857	803	735	966	585	201	735	514	296	670	728	593	491	842	753	710	629	928	501	259
100	914	646	300	850	798	690	837	958	945	891	824	1,062	665	243	808	573	338	746	813	669	560	929	844	800	710	1,024	574	309
110	984	705	336	931	883	752	924	1,046	1,032	973	899	1,149	743	285	870	628	376	824	900	732	624	1,016	919	874	788	1,108	643	355
120	1,049	756	368	1,002	957	817	997	1,130	1,113	1,051	972	1,224	814	324	926	676	411	895	974	791	678	1,096	992	943	853	1,185	709	406
130	1,104	802	397	1,069	1,021	881	1,063	1,207	1,190	1,124	1,039	1,287	879	363	977	719	441	954	1,039	851	723	1,172	1,059	1,010	911	1,249	771	452
140	1,151	842	423	1,128	1,080	935	1,124	1,266	1,250	1,192	1,102	1,341	933	404	1,024	757	468	1,008	1,099	907	762	1,236	1,125	1,071	969	1,305	828	494
150	1,190	878	445	1,178	1,133	982	1,177	1,317	1,301	1,245	1,161	1,382	981	440	1,064	791	494	1,059	1,152	955	805	1,286	1,186	1,130	1,021	1,349	878	532
160	1,223	910	467	1,224	1,179	1,024	1,223	1,369	1,349	1,290	1,210	1,418	1,027	474	1,098	820	517	1,103	1,198	997	847	1,334	1,233	1,182	1,060	1,386	921	567
170	1,254	940	487	1,267	1,220	1,062	1,263	1,418	1,397	1,333	1,250	1,454	1,070	505	1,127	848	538	1,142	1,239	1,036	885	1,382	1,273	1,223	1,086	1,419	960	601
180	1,281	968	505	1,303	1,255	1,096	1,300	1,461	1,441	1,376	1,285	1,484	1,107	533	1,152	873	557	1,176	1,275	1,069	917	1,425	1,309	1,259	1,109	1,450	997	633
190	1,307	992	521	1,338	1,287	1,125	1,332	1,496	1,478	1,414	1,321	1,509	1,142	561	1,176	894	574	1,208	1,306	1,100	944	1,463	1,348	1,291	1,128	1,477	1,032	664
200	1,328	1,014	536	1,369	1,315	1,151	1,364	1,528	1,510	1,448	1,355	1,530	1,173	586	1,196	914	590	1,237	1,335	1,126	969	1,494	1,383	1,325	1,143	1,500	1,063	693
210	1,349	1,032	550	1,399	1,343	1,177	1,394	1,556	1,539	1,477	1,386	1,548	1,201	609	1,216	934	604	1,264	1,364	1,151	993	1,522	1,415	1,356	1,158	1,518	1,091	719
220	1,368	1,050	563	1,430	1,376	1,206	1,428	1,586	1,566	1,504	1,414	1,548	1,223	633	1,235	953	618	1,291	1,398	1,179	1,017	1,549	1,443	1,386	1,173	1,535	1,117	743
230	1,386	1,066	575	1,457	1,407	1,232	1,459	1,613	1,593	1,528	1,439	1,548	1,243	655	1,251	970	630	1,318	1,429	1,206	1,040	1,575	1,467	1,411	1,187	1,535	1,140	767
240	1,405	1,081	585	1,482	1,436	1,255	1,485	1,637	1,618	1,552	1,462	1,548	1,260	675	1,267	985	642	1,343	1,458	1,230	1,061	1,600	1,489	1,433	1,201	1,535	1,162	787
250	1,422	1,094	595	1,505	1,461	1,277	1,510	1,660	1,640	1,575	1,482	1,548	1,274	694	1,280	997	652	1,366	1,483	1,251	1,082	1,622	1,508	1,454	1,213	1,535	1,180	806
260	1,438	1,106	604	1,526	1,484	1,297	1,531	1,679	1,660	1,595	1,500	1,548	1,288	712	1,292	1,008	662	1,387	1,505	1,271	1,100	1,643	1,527	1,472	1,224	1,535	1,194	823
270	1,452	1,118	612	1,545	1,504	1,317	1,551	1,696	1,677	1,613	1,517	1,548	1,301	728	1,303	1,019	670	1,406	1,525	1,288	1,118	1,660	1,545	1,488	1,234	1,535	1,207	839
280	1,464	1,129	620	1,562	1,523	1,336	1,570	1,711	1,692	1,630	1,534	1,548	1,313	743	1,313	1,028	679	1,423	1,544	1,306	1,134	1,676	1,562	1,504	1,242	1,535	1,219	853
290	1,475	1,138	626	1,578	1,539	1,354	1,587	1,725	1,705	1,645	1,549	1,548	1,323	757	1,322	1,036	687	1,439	1,560	1,324	1,149	1,689	1,577	1,519	1,249	1,535	1,229	867
300	1,475	1,138	628	1,582	1,544	1,358	1,592	1,737	1,715	1,654	1,558	1,548	1,324	757	1,322	1,037	689	1,443	1,565	1,330	1,154	1,701	1,588	1,530	1,255	1,535	1,206	867
310	1,475	1,138	628	1,582	1,544	1,358	1,592	1,737	1,715	1,654	1,558	1,548	1,324	757	1,322	1,037	689	1,443	1,565	1,318	1,154	1,701	1,588	1,530	1,255	1,535	1,206	867
320	1,475	1,138	628	1,582	1,544	1,358	1,592	1,737	1,715	1,654	1,558	1,548	1,324	757	1,322	1,037	689	1,443	1,565	1,318	1,154	1,701	1,588	1,530	1,255	1,535	1,206	867
330	1,475	1,138	628	1,582	1,544	1,358	1,592	1,737	1,715	1,654	1,558	1,548	1,323	757	1,322	1,037	689	1,443	1,565	1,318	1,154	1,701	1,588	1,530	1,255	1,535	1,206	867
340	1,475	1,138	628	1,582	1,544	1,358	1,592	1,737	1,715	1,654	1,558	1,548	1,323	757	1,322	1,037	689	1,443	1,565	1,318	1,154	1,701	1,588	1,530	1,255	1,535	1,206	867
350	1,475	1,138	628	1,582	1,544	1,358	1,592	1,737	1,715	1,654	1,558	1,548	1,323	757	1,322	1,037	689	1,443	1,565	1,318	1,154	1,701	1,588	1,530	1,255	1,535	1,206	867

Age	Existing Managed Yields (TIPSY)														DR	Future Managed Yields (TIPSY)														
	301	302	303	304	305	306	307	308	309	310	311	312	313	314	315	401	402	403	404	405	406	407	408	409	410	411	412	413	414	415
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	214	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	214	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20	19	2	0	4	2	1	2	1	2	0	0	15	2	0	214	19	2	0	5	2	1	2	1	2	0	0	15	2	0	1
30	117	51	6	65	42	21	31	47	58	12	10	123	34	1	218	121	53	6	75	47	23	39	47	58	12	10	123	34	1	21
40	241	135	28	175	132	84	120	190	202	78	70	278	118	10	243	246	139	29	189	139	89	130	190	203	78	70	278	118	10	88
50	368	223	58	302	240	169	227	335	345	185	172	437	221	36	286	375	226	59	317	250	176	238	335	346	186	173	437	221	36	175
60	496	304	98	422	344	260	333	472	486	291	275	597	322	79	329	503	309	100	440	353	269	341	472	487	291	275	597	322	79	265
70	601	388	137	539	444	343	428	586	603	389	370	740	424	122	369	610	394	138	561	456	350	437	586	604	390	370	740	424	122	352
80	708	466	172	650	542	417	521	694	715	482	461	876	524	172	405	715	471	174	671	553	426	532	694	716	483	461	876	524	172	437
90	796	529	203	743	631	492	610	799	823	560	538	995	612	220	435	804	534	204	764	642	502	621	799	823	561	538	995	612	220	515
100	874	591	231	829	707	564	688	888	912	636	610	1,094	697	265	462	881	596	232	855	717	573	696	888	913	637	610	1,094	697	265	588
110	941	649	256	916	772	628	752	967	994	706	679	1,183	778	309	487	948	653	258	942	786	637	759	967	994	707	679	1,183	778	309	659
120	1,002	699	280	989	844	684	814	1,044	1,072	775	744	1,260	852	349	512	1,010	703	281	1,014	856	692	823	1,044	1,073	775	744	1,260	852	349	725
130	1,059	743	303	1,055	908	730	878	1,117	1,146	833	804	1,325	917	393	534	1,066	748	304	1,080	919	737	888	1,117	1,147	834	805	1,325	917	393	784
140	1,108	782	325	1,116	962	770	937	1,185	1,216	883	854	1,379	973	435	552	1,113	787	327	1,141	971	776	944	1,185	1,217	883	854	1,379	973	435	834
150	1,149	818	346	1,168	1,010	812	985	1,244	1,272	928	898	1,421	1,023	473	566	1,154	821	347	1,192	1,019	821	992	1,244	1,272	929	898	1,421	1,023	473	876
160	1,184	849	365	1,214	1,054	856	1,029	1,290	1,317	975	941	1,459	1,071	508	580	1,189	853	365	1,237	1,062	864	1,034	1,290	1,317	976	941	1,459	1,071	508	916
170	1,215	878	381	1,256	1,094	894	1,068	1,332	1,359	1,018	983	1,495	1,114	540	593	1,220	881	382	1,277	1,101	901	1,071	1,332	1,360	1,018	983	1,495	1,114	540	959
180	1,242	903	396	1,294	1,128	929	1,103	1,374	1,404	1,057	1,021	1,526	1,152	570	606	1,246	906	396	1,315	1,135	934	1,105	1,374	1,404	1,058	1,021	1,526	1,152	570	997
190	1,265	926	408	1,328	1,159	957	1,134	1,413	1,444	1,096	1,057	1,552	1,188	599	618	1,270	929	409	1,348	1,165	962	1,136	1,413	1,444	1,096	1,058	1,552	1,188	599	1,033
200	1,288	947	422	1,358	1,187	982	1,161	1,448	1,480	1,131	1,092	1,573	1,219	625	629	1,291	950	422	1,378	1,193	987	1,162	1,448	1,480	1,131	1,092	1,573	1,219	625	1,065
210	1,309	968	434	1,388	1,215	1,006	1,188	1,479	1,510	1,162	1,124	1,573	1,247	650	640	1,312	970	434	1,408	1,220	1,010	1,187	1,479	1,510	1,162	1,124	1,573	1,247	650	1,097
220	1,329	988	445	1,421	1,244	1,032	1,218	1,506	1,537	1,188	1,152	1,573	1,269	675	649	1,331	990	446	1,441	1,248	1,035	1,217	1,506	1,537	1,188	1,153	1,573	1,269	675	1,125
230	1,347	1,006	456	1,451	1,271	1,055	1,245	1,531	1,562	1,210	1,177	1,573	1,289	698	658	1,350	1,008	456	1,470	1,274	1,058	1,243	1,531	1,562	1,210	1,177	1,573	1,289	698	1,149
240	1,364	1,021	466	1,478	1,295	1,078	1,269	1,553	1,584	1,231	1,197	1,573	1,306	719	666	1,365	1,022	466	1,496	1,297	1,080	1,267	1,553	1,584	1,231	1,198	1,573	1,306	719	1,170
250	1,378	1,034	476	1,503	1,318	1,099	1,292	1,574	1,607	1,250	1,216	1,573	1,320	738	672	1,380	1,035	476	1,520	1,320	1,100	1,289	1,574	1,607	1,250	1,216	1,573	1,320	738	1,188
260	1,392	1,046	485	1,525	1,341	1,118	1,313	1,594	1,628	1,269	1,233	1,573	1,334	756	677	1,393	1,047	485	1,541	1,342	1,120	1,309	1,594	1,628	1,269	1,233	1,573	1,334	756	1,204
270	1,405	1,057	493	1,545	1,362	1,136	1,332	1,613	1,647	1,286	1,250	1,573	1,348	773	682	1,406	1,057	493	1,561	1,363	1,137	1,328	1,613	1,647	1,286	1,250	1,573	1,348	773	1,220
280	1,418	1,066	500	1,562	1,381	1,153	1,352	1,630	1,664	1,303	1,265	1,573	1,359	788	687	1,419	1,066	501	1,579	1,382	1,153	1,348	1,630	1,664	1,303	1,265	1,573	1,359	788	1,234
290	1,430	1,075	507	1,578	1,399	1,168	1,369	1,645	1,679	1,319	1,280	1,573	1,370	802	692	1,430	1,075	508	1,595	1,400	1,168	1,366	1,645	1,679	1,319	1,280	1,573	1,370	802	1,248
300	1,430	1,075	509	1,581	1,402	1,171	1,374	1,659	1,689	1,330	1,291	1,573	1,364	802	695	1,430	1,075	509	1,593	1,402	1,171	1,369	1,659	1,689	1,330	1,291	1,573	1,364	802	1,251
310	1,430	1,075	509	1,581	1,402	1,171	1,366	1,659	1,689	1,330	1,291	1,573	1,364	802	695	1,430	1,075	509	1,588	1,402	1,171	1,369	1,659	1,689	1,330	1,291	1,573	1,364	802	1,251
320	1,430	1,075	509	1,581	1,402	1,171	1,366	1,659	1,689	1,330	1,291	1,573	1,364	802	695	1,430	1,075	509	1,584	1,402	1,171	1,369	1,659	1,689	1,330	1,291	1,573	1,364	802	1,251
330	1,430	1,075	509	1,581	1,402	1,171	1,366	1,659	1,689	1,330	1,291	1,573	1,364	802	695	1,430	1,075	509	1,580	1,402	1,171	1,369	1,659	1,689	1,330	1,291	1,573	1,364	802	1,251
340	1,430	1,075	509	1,581	1,402	1,171	1,366	1,659	1,689	1,330	1,291	1,573	1,364	802	695	1,430	1,075	509	1,576	1,402	1,171	1,369	1,659	1,689	1,330	1,291	1,573	1,364	802	1,251
350	1,430	1,075	509	1,581	1,402	1,171	1,366	1,659	1,689	1,330	1,291	1,573	1,364	802	695	1,430	1,075	509	1,572	1,402	1,171	1,369	1,659	1,689	1,330	1,291	1,573	1,364	802	1,251

Appendix B: Old Seral Forest Cover Requirements by Ministerial Order Area/LU/Site Series Surrogate

Area summary by MO/LU/SiteSeriesSurrogate for units with THLB area greater than 1 ha in the TSA. The long term THLB area shown here includes TL areas that will revert to the TSA in the future (135,343 ha + 5,279 ha = 140,622 ha) minus 302 ha of deciduous leading stands without site series surrogate classification and minus 22 ha of units with less than 1 ha in the THLB, totaling 140,297 ha. The current condition field describes whether a) Met NTHLB: the old growth target is currently completely satisfied in non THLB areas, b) Met THLB: the old growth target is currently satisfied but needs to include old growth areas from the THLB and, c) Not Met: the current old growth area is not enough to satisfy the target.

MO 2009	Landscape Unit	Site Series Surrogate	THLB (ha)	PFLB non THLB (ha)	Total PFLB (ha)	Old Growth Target (%)	Target Area (ha)	Current Old Growth Area (ha)	Surplus / Deficit	Current Condition
CNC	Braden	CWHvm1 Cw Med	265	1,381	1,646	28	461	1,170	709	Met NTHLB
		CWHvm1 Cw Poor	552	2,673	3,225	28	903	1,546	643	Met NTHLB
		CWHvm1 HB Good	76	44	120	25	30	0	-30	Not Met
		CWHvm1 HB Med	1,052	4,411	5,463	25	1,366	3,665	2,299	Met NTHLB
		CWHvm1 HB Poor	120	3,875	3,995	25	999	2,221	1,223	Met NTHLB
		CWHvm1 S Good	24	68	92	25	23	69	46	Met NTHLB
		CWHvm1 S Med	88	185	272	25	68	134	66	Met NTHLB
		CWHvm1 S PoorPl	10	174	183	28	51	85	34	Met NTHLB
		CWHvm2 Cw Poor	12	131	144	28	40	42	1	Met THLB
		CWHvm2 HB Med	17	353	370	25	92	298	205	Met NTHLB
		CWHvm2 HB Poor	2	903	905	25	226	478	252	Met NTHLB
	Braden Total		2,218	14,198	16,416	26	4,260	9,707	5,447	
	Clyak	CWHvh2 Cw Med	121	65	186	29	54	135	81	Met NTHLB
		CWHvh2 Cw Poor	109	418	527	29	153	439	286	Met NTHLB
		CWHvh2 Fd Med	6	0	6	27	2	0	-2	Not Met
		CWHvm1 Cw Good	133	10	142	25	36	0	-36	Not Met
		CWHvm1 Cw Med	1,315	488	1,803	28	505	991	486	Met THLB
		CWHvm1 Cw Poor	1,150	2,396	3,545	28	993	3,268	2,276	Met NTHLB
		CWHvm1 Fd Med	31	5	36	21	8	0	-8	Not Met
		CWHvm1 Fd Poor	32	5	37	21	8	0	-8	Not Met
		CWHvm1 HB Good	517	389	906	25	226	91	-135	Not Met
		CWHvm1 HB Med	3,038	2,267	5,305	25	1,326	2,432	1,106	Met NTHLB
		CWHvm1 HB Poor	60	272	332	25	83	285	202	Met NTHLB
		CWHvm1 S Good	138	370	509	25	127	291	163	Met NTHLB
		CWHvm1 S Med	87	157	244	25	61	119	58	Met NTHLB
		CWHvm1 S PoorPl	17	64	81	28	23	56	34	Met NTHLB
		CWHvm2 Cw Good	8	0	8	59	5	0	-5	Not Met
		CWHvm2 Cw Med	144	27	170	28	48	68	20	Met THLB
		CWHvm2 Cw Poor	655	3,358	4,012	28	1,123	3,691	2,567	Met NTHLB
		CWHvm2 Fd Med	8	16	24	49	12	0	-12	Not Met
		CWHvm2 Fd Poor	8	1	9	49	4	0	-4	Not Met
		CWHvm2 HB Good	149	98	247	25	62	0	-62	Not Met
		CWHvm2 HB Med	332	916	1,248	25	312	976	664	Met NTHLB
		CWHvm2 HB Poor	111	871	982	25	245	910	664	Met NTHLB
		CWHvm2 S Med	2	1	2	59	1	0	-1	Not Met
		MHmm1 Cw Poor	32	869	900	28	252	821	569	Met NTHLB
		MHmm1 HB Good	4	2	5	59	3	0	-3	Not Met
		MHmm1 HB Med	13	38	52	25	13	36	23	Met NTHLB
		MHmm1 HB Poor	10	234	244	25	61	235	174	Met NTHLB
	Clyak Total		8,228	13,334	21,563	31	5,745	14,842	9,097	
	Dean	CWHds2 Cw Good	22	92	114	50	57	8	-49	Not Met
		CWHds2 Fd Good	96	135	231	42	97	0	-97	Not Met
		CWHds2 Fd Med	77	1,211	1,289	30	387	108	-279	Not Met
		CWHds2 Fd Poor	39	1,114	1,153	36	415	154	-261	Not Met
		CWHds2 HB Good	8	45	53	60	32	0	-32	Not Met
		CWHds2 HB Med	236	1,350	1,586	43	682	217	-465	Not Met
		CWHms2 HB Good	2	129	131	38	50	0	-50	Not Met
		CWHms2 HB Med	158	604	762	38	290	383	93	Met THLB
		CWHws2 Fd Good	18	1	19	42	8	0	-8	Not Met
		CWHws2 HB Good	47	81	127	60	76	0	-76	Not Met
		CWHws2 HB Med	304	3,444	3,748	43	1,612	1,873	262	Met NTHLB
		MHmm2 HB Med	28	1,864	1,892	42	795	514	-281	Not Met
	Dean Total		1,035	10,070	11,104	44	4,499	3,257	-1,242	
	Denny	CWHvh2 Cw Med	349	850	1,199	29	348	287	-61	Not Met
		CWHvh2 Cw Poor	1,246	8,897	10,143	29	2,942	7,055	4,113	Met NTHLB
		CWHvh2 HB Med	373	1,168	1,540	29	447	681	234	Met NTHLB
		CWHvh2 HB Poor	4	1,476	1,480	29	429	1,022	593	Met NTHLB
	Denny Total		1,972	12,391	14,363	29	4,165	9,044	4,879	

MO 2009	Landscape Unit	Site Series Surrogate	THLB (ha)	PFLB non THLB (ha)	Total PFLB (ha)	Old Growth Target (%)	Target Area (ha)	Current Old Growth Area (ha)	Surplus / Deficit	Current Condition
	Don Peninsula	CWHvh2 Cw Med	1,960	711	2,671	29	774	1,595	821	Met THLB
		CWHvh2 Cw Poor	477	4,174	4,651	29	1,349	4,435	3,087	Met NTHLB
		CWHvh2 HB Med	1,063	1,220	2,283	29	662	1,640	977	Met NTHLB
		CWHvh2 HB Poor	457	2,045	2,502	29	726	1,824	1,098	Met NTHLB
		CWHvh2 S Med	15	1	16	59	9	0	-9	Not Met
		CWHvh2 S PoorPl	124	32	156	29	45	133	88	Met THLB
		CWHvm1 Cw Med	603	101	704	28	197	643	446	Met THLB
		CWHvm1 Cw Poor	675	895	1,570	28	440	1,112	672	Met NTHLB
		CWHvm1 HB Med	354	169	523	25	131	490	359	Met NTHLB
		CWHvm1 HB Poor	33	43	76	25	19	76	57	Met NTHLB
		CWHvm1 S Med	195	283	479	25	120	479	359	Met NTHLB
		CWHvm1 S PoorPl	463	161	624	28	175	349	174	Met THLB
		CWHvm2 Cw Med	3	1	4	28	1	4	3	Met THLB
		CWHvm2 Cw Poor	7	4	11	28	3	11	8	Met NTHLB
	Don Peninsula Total		6,430	9,838	16,269	30	4,650	12,790	8,139	
	Doos/Dallery	CWHvh2 Cw Med	152	23	175	29	51	141	91	Met THLB
		CWHvh2 Cw Poor	138	305	443	29	128	420	291	Met NTHLB
		CWHvh2 Fd Med	1	0	1	27	0	0	0	Not Met
		CWHvh2 HB Good	18	7	25	25	6	0	-6	Not Met
		CWHvh2 HB Med	145	60	205	29	59	24	-36	Not Met
		CWHvh2 S Med	30	13	43	59	25	15	-11	Not Met
		CWHvm1 Cw Med	86	866	952	28	267	789	522	Met NTHLB
		CWHvm1 Cw Poor	108	1,055	1,163	28	326	946	620	Met NTHLB
		CWHvm1 HB Good	113	306	419	25	105	63	-41	Not Met
		CWHvm1 HB Med	1,036	3,581	4,617	25	1,154	3,284	2,129	Met NTHLB
		CWHvm1 HB Poor	6	480	485	25	121	367	246	Met NTHLB
		CWHvm1 S Good	25	239	264	25	66	181	115	Met NTHLB
		CWHvm1 S Med	148	65	213	25	53	0	-53	Not Met
		CWHvm2 Cw Med	126	242	368	28	103	329	226	Met NTHLB
		CWHvm2 Cw Poor	329	2,194	2,524	28	707	2,275	1,568	Met NTHLB
		CWHvm2 Fd Med	4	0	4	49	2	0	-2	Not Met
		CWHvm2 HB Good	23	0	23	25	6	0	-5	Not Met
		CWHvm2 HB Med	377	2,016	2,393	25	598	2,016	1,418	Met NTHLB
		CWHvm2 HB Poor	39	1,806	1,845	25	461	1,471	1,009	Met NTHLB
		CWHvm2 S Good	2	0	2	59	1	2	1	Met THLB
		CWHvm2 S Med	43	3	45	59	27	0	-27	Not Met
		MHmm1 Cw Poor	56	645	702	28	196	644	448	Met NTHLB
		MHmm1 Fd Med	2	0	2	0	0	0	0	Met NTHLB
		MHmm1 HB Med	14	282	295	25	74	239	165	Met NTHLB
		MHmm1 HB Poor	13	659	672	25	168	534	366	Met NTHLB
	Doos/Dallery Total		3,032	14,849	17,880	30	4,705	13,737	9,031	
	Ellerslie	CWHvh2 Cw Med	94	294	388	29	112	326	214	Met NTHLB
		CWHvh2 Cw Poor	86	1,478	1,564	29	454	1,010	557	Met NTHLB
		CWHvh2 HB Med	43	388	431	29	125	228	103	Met NTHLB
		CWHvm1 Cw Med	1,588	1,496	3,084	28	864	1,473	610	Met THLB
		CWHvm1 Cw Poor	602	2,752	3,353	28	939	2,067	1,129	Met NTHLB
		CWHvm1 HB Med	439	1,412	1,850	25	463	1,493	1,030	Met NTHLB
		CWHvm1 HB Poor	22	779	802	25	200	411	211	Met NTHLB
		CWHvm1 S Med	41	118	159	25	40	156	117	Met NTHLB
		CWHvm1 S PoorPl	32	169	202	28	56	106	50	Met NTHLB
		CWHvm2 Cw Med	41	41	81	28	23	52	29	Met THLB
		CWHvm2 Cw Poor	19	201	220	28	62	170	108	Met NTHLB
		CWHvm2 HB Med	5	110	115	25	29	74	46	Met NTHLB
		MHwh1 Cw Med	1	25	27	68	18	27	9	Met NTHLB
	Ellerslie Total		3,013	9,262	12,276	30	3,384	7,596	4,212	
	Evans	CWHvh2 Cw Med	481	2,197	2,678	49	1,312	1,690	378	Met NTHLB
		CWHvh2 Cw Poor	862	16,696	17,559	49	8,604	10,816	2,213	Met NTHLB
		CWHvh2 HB Good	3	58	61	42	26	53	27	Met NTHLB
		CWHvh2 HB Med	119	2,231	2,351	49	1,152	1,309	157	Met NTHLB
		CWHvh2 S Good	30	74	104	59	61	0	-61	Not Met
		CWHvh2 S Med	23	72	95	59	56	95	39	Met NTHLB
		CWHvm1 Cw Good	21	2	22	42	9	0	-9	Not Met
		CWHvm1 Cw Med	53	21	74	47	35	38	3	Met THLB
		CWHvm1 Cw Poor	6	294	300	47	141	254	113	Met NTHLB
		CWHvm1 HB Med	13	7	20	42	8	6	-3	Not Met
		CWHvm2 Cw Med	5	134	139	47	65	129	64	Met NTHLB
		CWHvm2 HB Med	3	71	74	42	31	56	24	Met NTHLB
	Evans Total		1,619	21,859	23,478	48	11,501	14,446	2,945	
	Fish Egg	CWHvh2 Cw Good	41	4	45	63	29	0	-29	Not Met
		CWHvh2 Cw Med	2,717	1,678	4,395	68	2,988	2,658	-330	Not Met
		CWHvh2 Cw Poor	4,593	23,189	27,783	68	18,892	25,755	6,863	Met NTHLB
		CWHvh2 HB Good	115	156	271	59	160	0	-160	Not Met
		CWHvh2 HB Med	642	997	1,639	68	1,115	684	-431	Not Met
		CWHvh2 HB Poor	3	106	109	68	74	29	-45	Not Met
		CWHvh2 S Good	19	27	46	59	27	17	-10	Not Met
		CWHvh2 S PoorPl	16	0	16	68	11	0	-11	Not Met

MO 2009	Landscape Unit	Site Series Surrogate	THLB (ha)	PFLB non THLB (ha)	Total PFLB (ha)	Old Growth Target (%)	Target Area (ha)	Current Old Growth Area (ha)	Surplus / Deficit	Current Condition
		MHwh1 Cw Poor	1	221	222	68	151	222	71	Met NTHLB
	Fish Egg Total		8,147	26,379	34,526	65	23,447	29,366	5,919	
	Hunter	CWHvh2 Cw Med	111	195	306	49	150	232	82	Met THLB
		CWHvh2 Cw Poor	329	7,503	7,832	49	3,838	7,136	3,298	Met NTHLB
		CWHvh2 HB Good	4	11	14	42	6	0	-6	Not Met
		CWHvh2 HB Med	228	490	718	49	352	105	-247	Not Met
		CWHvh2 HB Poor	84	250	334	49	164	300	136	Met NTHLB
		CWHvh2 S Med	24	0	24	59	14	0	-14	Not Met
	Hunter Total		779	8,449	9,228	50	4,523	7,772	3,249	
	Johnston	CMAunp Cw Poor	20	80	100	26	26	100	74	Met NTHLB
		CWHvh2 Cw Med	1,201	804	2,004	29	581	1,855	1,273	Met NTHLB
		CWHvh2 Cw Poor	2,571	5,016	7,587	29	2,200	7,186	4,986	Met NTHLB
		CWHvh2 HB Good	68	150	217	25	54	19	-35	Not Met
		CWHvh2 HB Med	1,071	867	1,938	29	562	1,671	1,109	Met NTHLB
		CWHvh2 S Good	35	56	91	59	54	74	20	Met THLB
		CWHvh2 S PoorPl	2	31	32	29	9	32	23	Met NTHLB
		CWHvm1 Cw Med	43	10	53	28	15	53	38	Met THLB
		CWHvm1 Cw Poor	194	309	503	28	141	455	315	Met NTHLB
		CWHvm1 HB Good	42	7	48	25	12	4	-9	Not Met
		CWHvm1 HB Med	242	95	336	25	84	218	134	Met THLB
		CWHvm1 HB Poor	8	50	58	25	15	53	38	Met NTHLB
		CWHvm1 S Good	4	4	8	25	2	0	-2	Not Met
		CWHvm2 Cw Med	124	85	209	28	59	208	150	Met NTHLB
		CWHvm2 Cw Poor	745	2,547	3,292	28	922	3,071	2,150	Met NTHLB
		CWHvm2 HB Good	2	0	2	25	1	0	-1	Not Met
		CWHvm2 HB Med	192	328	520	25	130	476	346	Met NTHLB
		CWHvm2 HB Poor	1	231	232	25	58	208	150	Met NTHLB
		MHmm1 Cw Poor	36	339	374	28	105	372	267	Met NTHLB
		MHwh1 Cw Med	5	1	6	68	4	6	2	Met THLB
		MHwh1 Cw Poor	84	630	714	29	207	710	503	Met NTHLB
		MHwh1 HB Med	3	63	66	68	45	56	11	Met NTHLB
	Johnston Total		6,692	11,701	18,393	32	5,285	16,827	11,542	
	Jump Across	CWHms2 Cw Good	81	13	94	53	50	0	-50	Not Met
		CWHms2 Cw Med	13	50	63	53	33	0	-33	Not Met
		CWHms2 Fd Good	23	6	29	53	15	0	-15	Not Met
		CWHms2 Fd Poor	6	195	201	41	82	86	4	Met NTHLB
		CWHms2 HB Good	55	164	219	53	116	0	-116	Not Met
		CWHms2 HB Med	102	2,613	2,714	53	1,439	1,281	-157	Not Met
		CWHvm3 HB Med	12	1,551	1,563	59	922	1,056	134	Met NTHLB
		CWHws2 Cw Good	13	0	13	50	7	0	-7	Not Met
		CWHws2 HB Good	3	76	78	60	47	0	-47	Not Met
		CWHws2 HB Med	25	2,119	2,145	60	1,287	1,004	-283	Not Met
	Jump Across Total		333	6,786	7,118	54	3,998	3,428	-570	
	Kilbella/Chuckwalla	CWHvh2 Cw Med	8	22	30	29	9	9	0	Not Met
		CWHvh2 Fd Med	22	0	22	27	6	0	-6	Not Met
		CWHvm1 Cw Good	42	15	57	25	14	0	-14	Not Met
		CWHvm1 Cw Med	788	609	1,397	28	391	972	581	Met NTHLB
		CWHvm1 Cw Poor	1,052	1,800	2,851	28	798	2,730	1,932	Met NTHLB
		CWHvm1 Fd Good	16	5	21	21	4	0	-4	Not Met
		CWHvm1 Fd Med	15	0	16	21	3	0	-3	Not Met
		CWHvm1 HB Good	418	482	900	25	225	6	-219	Not Met
		CWHvm1 HB Med	1,841	4,167	6,008	25	1,502	4,550	3,048	Met NTHLB
		CWHvm1 HB Poor	38	565	603	25	151	558	408	Met NTHLB
		CWHvm1 S Good	246	1,058	1,304	25	326	247	-79	Not Met
		CWHvm1 S Med	219	242	461	25	115	18	-98	Not Met
		CWHvm2 Cw Med	86	115	201	28	56	143	87	Met NTHLB
		CWHvm2 Cw Poor	537	2,799	3,336	28	934	3,168	2,234	Met NTHLB
		CWHvm2 Fd Good	3	0	3	49	1	0	-1	Not Met
		CWHvm2 Fd Med	3	0	3	49	2	0	-2	Not Met
		CWHvm2 HB Good	73	21	95	25	24	0	-24	Not Met
		CWHvm2 HB Med	507	2,342	2,849	25	712	2,536	1,823	Met NTHLB
		CWHvm2 HB Poor	88	1,347	1,435	25	359	1,344	985	Met NTHLB
		CWHvm2 S Good	3	1	3	59	2	0	-2	Not Met
		MHmm1 Cw Poor	134	1,188	1,322	28	370	1,225	855	Met NTHLB
		MHmm1 HB Med	28	400	428	25	107	392	286	Met NTHLB
		MHmm1 HB Poor	18	920	938	25	235	838	604	Met NTHLB
	Kilbella/Chuckwalla Total		6,185	18,099	24,283	29	6,347	18,737	12,390	
	Kilippi	CWHms2 Fd Med	7	0	7	17	1	0	-1	Not Met
		CWHms2 Fd Poor	13	0	13	17	2	0	-2	Not Met
		CWHms2 HB Good	9	13	21	23	5	0	-5	Not Met
		CWHms2 HB Med	508	264	772	23	178	607	430	Met NTHLB
		CWHms2 S Good	3	23	25	61	15	8	-8	Not Met
		CWHms2 S Med	26	4	30	61	19	30	12	Met THLB
		CWHws2 Fd Poor	13	0	13	22	3	0	-3	Not Met
		CWHws2 HB Good	66	57	123	60	74	39	-34	Not Met
		CWHws2 HB Med	843	1,683	2,526	26	657	2,352	1,696	Met NTHLB

MO 2009	Landscape Unit	Site Series Surrogate	THLB (ha)	PFLB non THLB (ha)	Total PFLB (ha)	Old Growth Target (%)	Target Area (ha)	Current Old Growth Area (ha)	Surplus / Deficit	Current Condition
		CWHws2 HB Poor	63	882	945	26	246	861	615	Met NTHLB
		CWHws2 S Med	4	3	7	60	4	7	3	Met THLB
		MHmm2 HB Good	7	0	7	25	2	0	-2	Not Met
		MHmm2 HB Med	132	1,026	1,157	25	289	925	636	Met NTHLB
		MHmm2 HB Poor	1	3,657	3,659	49	1,793	3,394	1,601	Met NTHLB
	Kilippi Total		1,695	7,612	9,306	35	3,287	8,224	4,937	
	King Island	CWHms2 Cw Med	154	254	408	38	155	378	223	Met NTHLB
		CWHms2 Cw Poor	174	314	489	44	215	215	0	Met THLB
		CWHms2 Fd Med	9	7	16	29	5	7	2	Met NTHLB
		CWHms2 HB Med	301	1,622	1,923	38	731	849	118	Met THLB
		CWHms2 HB Poor	6	490	496	38	189	76	-113	Not Met
		CWHms2 S Med	6	1	7	61	4	7	3	Met THLB
		CWHvm1 Cw Good	77	6	83	42	35	0	-35	Not Met
		CWHvm1 Cw Med	427	890	1,317	47	619	733	114	Met THLB
		CWHvm1 Cw Poor	634	2,910	3,544	47	1,666	1,272	-394	Not Met
		CWHvm1 Fd Med	2	6	8	35	3	6	3	Met NTHLB
		CWHvm1 Fd Poor	106	12	117	35	41	0	-41	Not Met
		CWHvm1 HB Good	481	190	671	42	282	0	-282	Not Met
		CWHvm1 HB Med	2,184	2,602	4,785	42	2,010	2,013	3	Met THLB
		CWHvm1 HB Poor	327	1,902	2,229	42	936	1,290	354	Met NTHLB
		CWHvm1 S Good	78	14	92	42	39	0	-39	Not Met
		CWHvm1 S Med	70	61	132	42	55	13	-42	Not Met
		CWHvm1 S PoorPl	9	2	11	47	5	0	-5	Not Met
		CWHvm2 Cw Med	75	151	226	47	106	141	35	Met NTHLB
		CWHvm2 Cw Poor	132	1,110	1,242	47	584	595	11	Met THLB
		CWHvm2 Fd Poor	12	0	12	49	6	0	-6	Not Met
		CWHvm2 HB Good	118	67	185	42	78	0	-78	Not Met
		CWHvm2 HB Med	328	1,307	1,635	42	687	827	140	Met NTHLB
		CWHvm2 HB Poor	24	2,419	2,444	42	1,026	1,178	151	Met NTHLB
		CWHvm2 S Good	2	0	2	59	1	0	-1	Not Met
		CWHvm2 S Med	9	1	10	59	6	0	-6	Not Met
		CWHvm3 Cw Med	20	3	23	47	11	23	12	Met THLB
		CWHvm3 Cw Poor	2	0	2	47	1	0	-1	Not Met
		CWHvm3 HB Med	101	410	511	42	215	414	199	Met NTHLB
		MHmm1 Cw Med	3	0	3	65	2	0	-2	Not Met
		MHmm1 HB Med	29	323	351	42	148	150	2	Met THLB
		MHmm1 HB Poor	10	411	420	42	176	66	-111	Not Met
	King Island Total		5,911	17,485	23,397	45	10,036	10,253	217	
	Kwatna/Quatlena	CWHvh2 Cw Good	1	0	1	63	1	0	-1	Not Met
		CWHvh2 Cw Med	45	90	135	29	39	80	41	Met NTHLB
		CWHvh2 Cw Poor	278	2,030	2,307	29	669	1,481	812	Met NTHLB
		CWHvh2 HB Good	127	146	273	25	68	0	-68	Not Met
		CWHvh2 HB Med	280	588	868	29	252	515	264	Met NTHLB
		CWHvh2 HB Poor	8	278	287	29	83	131	48	Met NTHLB
		CWHvm1 Cw Good	313	95	408	25	102	0	-102	Not Met
		CWHvm1 Cw Med	279	472	751	28	210	187	-23	Not Met
		CWHvm1 Cw Poor	338	1,157	1,494	28	418	922	504	Met NTHLB
		CWHvm1 Fd Med	2	0	2	21	0	0	0	Not Met
		CWHvm1 HB Good	871	694	1,564	25	391	0	-391	Not Met
		CWHvm1 HB Med	1,856	3,794	5,651	25	1,413	2,446	1,033	Met NTHLB
		CWHvm1 HB Poor	220	1,636	1,856	25	464	1,006	542	Met NTHLB
		CWHvm1 S Good	335	396	731	25	183	0	-183	Not Met
		CWHvm1 S Med	260	311	572	25	143	251	108	Met NTHLB
		CWHvm1 S PoorPl	5	27	32	28	9	27	18	Met NTHLB
		CWHvm2 Cw Med	64	105	169	28	47	4	-43	Not Met
		CWHvm2 Cw Poor	17	1,386	1,403	28	393	1,069	676	Met NTHLB
		CWHvm2 Fd Med	22	0	22	49	11	0	-11	Not Met
		CWHvm2 HB Good	52	71	123	25	31	0	-31	Not Met
		CWHvm2 HB Med	434	2,235	2,669	25	667	1,891	1,224	Met NTHLB
		CWHvm2 HB Poor	44	3,199	3,243	25	811	2,122	1,311	Met NTHLB
		CWHvm2 S Good	6	0	6	59	4	0	-4	Not Met
		MHmm1 Cw Med	9	5	14	65	9	0	-9	Not Met
		MHmm1 HB Med	12	339	352	25	88	284	196	Met NTHLB
		MHmm1 HB Poor	6	860	866	25	216	540	324	Met NTHLB
	Kwatna/Quatlena Total		5,884	19,916	25,800	31	6,723	12,956	6,233	
	Lower Kimsquit	CWHms2 Cw Med	5	18	23	38	9	0	-9	Not Met
		CWHms2 Fd Med	201	83	284	29	82	25	-57	Not Met
		CWHms2 Fd Poor	24	253	276	29	80	44	-36	Not Met
		CWHms2 HB Good	417	312	729	38	277	0	-277	Not Met
		CWHms2 HB Med	1,398	2,317	3,715	38	1,412	1,340	-72	Not Met
		CWHms2 HB Poor	84	678	763	38	290	351	61	Met THLB
		CWHms2 S Good	4	49	53	61	32	5	-27	Not Met
		CWHvm3 HB Med	5	1	6	42	3	5	2	Met THLB
		CWHws2 Fd Med	46	33	79	42	33	30	-3	Not Met
		CWHws2 Fd Poor	20	262	283	36	102	227	126	Met NTHLB
		CWHws2 HB Good	394	78	472	60	283	0	-283	Not Met

MO 2009	Landscape Unit	Site Series Surrogate	THLB (ha)	PFLB non THLB (ha)	Total PFLB (ha)	Old Growth Target (%)	Target Area (ha)	Current Old Growth Area (ha)	Surplus / Deficit	Current Condition
		CWHws2 HB Med	487	2,363	2,850	43	1,226	1,895	670	Met NTHLB
		CWHws2 HB Poor	38	3,391	3,429	43	1,474	1,097	-377	Not Met
		CWHws2 S Med	43	75	118	60	71	0	-71	Not Met
		MHmm2 HB Med	4	293	297	42	125	197	72	Met NTHLB
	Lower Kimsquit Total		3,169	10,207	13,377	43	5,498	5,218	-280	
	Machmell	CWHms2 Cw Good	46	63	109	53	58	46	-11	Not Met
		CWHms2 Cw Med	126	175	301	23	69	38	-31	Not Met
		CWHms2 Cw Poor	1	5	6	26	2	6	5	Met NTHLB
		CWHms2 Fd Good	253	359	612	53	325	81	-244	Not Met
		CWHms2 Fd Med	285	139	424	17	72	73	1	Met THLB
		CWHms2 Fd Poor	62	97	160	17	27	1	-26	Not Met
		CWHms2 HB Good	382	218	600	23	138	76	-62	Not Met
		CWHms2 HB Med	1,860	1,798	3,658	23	841	2,094	1,252	Met NTHLB
		CWHms2 HB Poor	77	327	404	23	93	117	24	Met THLB
		CWHms2 S Good	120	225	345	61	210	143	-68	Not Met
		CWHms2 S Med	15	40	55	61	33	28	-5	Not Met
		CWHvm3 Cw Poor	88	149	237	28	66	230	164	Met NTHLB
		CWHvm3 Fd Good	29	1	29	21	6	0	-6	Not Met
		CWHvm3 HB Med	175	359	534	25	134	463	329	Met NTHLB
		CWHws2 Cw Med	42	12	54	50	27	39	12	Met THLB
		CWHws2 Fd Good	9	27	37	42	15	3	-12	Not Met
		CWHws2 Fd Med	30	15	45	42	19	0	-19	Not Met
		CWHws2 Fd Poor	15	15	30	22	7	0	-7	Not Met
		CWHws2 HB Good	78	14	92	60	55	12	-43	Not Met
		CWHws2 HB Med	879	2,761	3,640	26	946	2,870	1,924	Met NTHLB
		CWHws2 HB Poor	136	1,006	1,142	26	297	1,039	742	Met NTHLB
		MHmm2 HB Med	67	1,189	1,256	25	314	776	462	Met NTHLB
	Machmell Total		4,775	8,994	13,769	34	3,755	8,135	4,380	
	Nascall	CWHms2 Cw Med	22	208	231	53	122	193	70	Met NTHLB
		CWHms2 Cw Poor	25	786	811	61	495	235	-260	Not Met
		CWHms2 HB Med	120	639	758	53	402	459	57	Met THLB
		CWHms2 HB Poor	3	718	721	53	382	241	-141	Not Met
		CWHvm1 Cw Med	11	625	636	65	413	441	27	Met NTHLB
		CWHvm1 HB Med	8	1,475	1,483	59	875	1,035	160	Met NTHLB
		CWHvm3 Cw Med	2	5	7	65	5	7	3	Met NTHLB
	Nascall Total		191	4,457	4,648	58	2,695	2,612	-83	
	Neechanz	CWHms2 Cw Good	51	55	106	53	56	22	-34	Not Met
		CWHms2 Cw Med	354	272	626	23	144	532	388	Met NTHLB
		CWHms2 Cw Poor	4	118	121	26	32	10	-22	Not Met
		CWHms2 Fd Good	165	21	186	53	98	9	-89	Not Met
		CWHms2 Fd Med	348	204	552	17	94	52	-42	Not Met
		CWHms2 Fd Poor	14	105	119	17	20	17	-3	Not Met
		CWHms2 HB Good	116	278	394	23	91	111	21	Met THLB
		CWHms2 HB Med	990	2,134	3,124	23	718	2,100	1,381	Met NTHLB
		CWHms2 HB Poor	5	75	80	23	18	32	14	Met NTHLB
		CWHvm1 Cw Med	5	10	15	28	4	15	11	Met NTHLB
		CWHvm2 HB Med	39	17	56	25	14	38	24	Met THLB
		CWHvm3 Cw Med	232	489	721	28	202	652	450	Met NTHLB
		CWHvm3 Cw Poor	11	47	58	28	16	42	26	Met NTHLB
		CWHvm3 Fd Good	40	5	45	21	9	0	-9	Not Met
		CWHvm3 Fd Med	147	37	185	21	39	0	-39	Not Met
		CWHvm3 Fd Poor	16	38	54	21	11	38	27	Met NTHLB
		CWHvm3 HB Good	9	57	67	25	17	42	25	Met NTHLB
		CWHvm3 HB Med	1,203	4,000	5,204	25	1,301	4,156	2,855	Met NTHLB
		CWHvm3 HB Poor	197	2,657	2,854	25	713	2,483	1,769	Met NTHLB
		MHmm1 HB Med	17	788	805	25	201	675	474	Met NTHLB
		MHmm1 HB Poor	15	3,159	3,174	25	793	2,530	1,737	Met NTHLB
	Neechanz Total		3,978	14,568	18,545	26	4,594	13,556	8,963	
	Nootum/Koeye	CMAunp Cw Poor	1	41	43	26	11	43	32	Met NTHLB
		CWHvh2 Cw Good	86	18	104	63	65	0	-65	Not Met
		CWHvh2 Cw Med	840	432	1,272	29	369	662	293	Met THLB
		CWHvh2 Cw Poor	1,341	4,977	6,319	29	1,832	6,111	4,278	Met NTHLB
		CWHvh2 Fd Poor	16	8	24	0	0	0	0	Met NTHLB
		CWHvh2 HB Good	329	42	371	25	93	12	-81	Not Met
		CWHvh2 HB Med	509	735	1,243	29	361	990	630	Met NTHLB
		CWHvh2 HB Poor	47	367	414	29	120	291	171	Met NTHLB
		CWHvh2 S Good	29	64	93	59	55	53	-2	Not Met
		CWHvh2 S Med	7	2	8	59	5	5	0	Not Met
		CWHvh2 S PoorPl	24	2	26	29	8	26	18	Met THLB
		CWHvm1 Cw Med	28	107	135	28	38	102	64	Met NTHLB
		CWHvm1 Cw Poor	33	111	145	28	41	145	104	Met NTHLB
		CWHvm2 Cw Med	45	26	70	28	20	23	3	Met THLB
		CWHvm2 Cw Poor	123	596	718	28	201	697	496	Met NTHLB
		CWHvm2 Fd Poor	7	5	12	49	6	0	-6	Not Met
		CWHvm2 HB Good	16	0	16	25	4	0	-4	Not Met
		CWHvm2 HB Med	65	73	138	25	34	100	65	Met NTHLB

MO 2009	Landscape Unit	Site Series Surrogate	THLB (ha)	PFLB non THLB (ha)	Total PFLB (ha)	Old Growth Target (%)	Target Area (ha)	Current Old Growth Area (ha)	Surplus / Deficit	Current Condition
		CWHvm2 HB Poor	14	38	52	25	13	8	-6	Not Met
		MHmm1 HB Med	4	7	10	25	3	9	6	Met NTHLB
		MHwh1 Cw Med	1	0	1	68	1	1	0	Met THLB
		MHwh1 Cw Poor	27	323	350	29	101	344	243	Met NTHLB
		MHwh1 HB Med	10	15	25	68	17	25	8	Met THLB
		MHwh1 HB Poor	3	108	111	29	32	98	66	Met NTHLB
	Nootum/Koeye Total		3,604	8,095	11,699	35	3,428	9,744	6,315	
	Outer Coast Islands	CWHvh2 Cw Poor	166	6,208	6,374	97	6,183	5,662	-521	Not Met
		CWHvh2 HB Med	106	42	148	97	143	20	-124	Not Met
	Outer Coast Islands Total		273	6,249	6,522	97	6,326	5,682	-644	
	Owikeno	CWHms2 Cw Med	16	12	29	23	7	18	11	Met THLB
		CWHms2 Fd Good	7	104	111	53	59	0	-59	Not Met
		CWHms2 Fd Med	236	325	561	17	95	203	108	Met THLB
		CWHms2 Fd Poor	1	352	353	17	60	13	-47	Not Met
		CWHms2 HB Good	113	409	522	23	120	0	-120	Not Met
		CWHms2 HB Med	527	1,077	1,604	23	369	999	630	Met NTHLB
		CWHms2 HB Poor	3	233	236	23	54	179	125	Met NTHLB
		CWHvm1 Cw Med	33	366	398	28	112	303	191	Met NTHLB
		CWHvm1 Cw Poor	110	636	746	28	209	679	471	Met NTHLB
		CWHvm1 Fd Med	16	267	283	21	60	83	23	Met NTHLB
		CWHvm1 HB Good	7	285	292	25	73	83	10	Met NTHLB
		CWHvm1 HB Med	32	2,859	2,890	25	723	1,711	989	Met NTHLB
		CWHvm2 Cw Poor	15	872	887	28	248	869	621	Met NTHLB
		CWHvm3 HB Med	192	1,056	1,249	25	312	1,114	802	Met NTHLB
		CWHvm3 HB Poor	35	964	999	25	250	817	568	Met NTHLB
	Owikeno Total		1,344	9,815	11,159	26	2,750	7,071	4,321	
	Price	CWHvh2 Cw Poor	98	5,109	5,207	68	3,541	1,912	-1,629	Not Met
	Price Total		98	5,109	5,207	68	3,541	1,912	-1,629	
	Roderick	CWHvh2 Cw Med	262	251	513	29	149	497	348	Met NTHLB
		CWHvh2 HB Med	195	138	333	29	97	160	63	Met THLB
	Roderick Total		457	389	846	29	245	656	411	
	Roscoe	CWHvh2 Cw Med	690	1,587	2,276	49	1,115	1,825	709	Met NTHLB
		CWHvh2 Cw Poor	353	4,612	4,964	49	2,433	3,197	765	Met NTHLB
		CWHvh2 HB Med	514	1,846	2,360	49	1,156	1,826	670	Met NTHLB
		CWHvh2 HB Poor	40	1,503	1,543	49	756	559	-197	Not Met
		CWHvh2 S Med	5	101	107	59	63	105	42	Met NTHLB
		CWHvm1 Cw Med	108	1,161	1,269	47	597	805	208	Met NTHLB
		CWHvm1 Cw Poor	124	1,716	1,840	47	865	1,023	158	Met NTHLB
		CWHvm1 HB Med	223	2,454	2,677	42	1,124	2,054	930	Met NTHLB
		CWHvm1 HB Poor	117	1,883	2,001	42	840	1,396	556	Met NTHLB
		CWHvm2 Cw Med	8	82	89	47	42	68	26	Met NTHLB
		CWHvm2 HB Med	25	240	265	42	111	231	120	Met NTHLB
		CWHvm2 HB Poor	37	801	837	42	352	435	84	Met NTHLB
	Roscoe Total		2,243	17,985	20,229	47	9,454	13,524	4,070	
	Sheemahant	CWHms2 Cw Good	33	76	109	53	58	15	-42	Not Met
		CWHms2 Cw Med	419	277	696	23	160	211	51	Met THLB
		CWHms2 Cw Poor	29	85	114	26	30	81	52	Met NTHLB
		CWHms2 Fd Good	269	213	482	53	255	40	-216	Not Met
		CWHms2 Fd Med	570	312	882	17	150	228	79	Met THLB
		CWHms2 Fd Poor	73	657	729	17	124	194	70	Met NTHLB
		CWHms2 HB Good	284	208	493	23	113	0	-113	Not Met
		CWHms2 HB Med	1,847	1,167	3,015	23	693	1,255	562	Met THLB
		CWHms2 HB Poor	39	371	410	23	94	353	259	Met NTHLB
		CWHms2 S Good	40	381	421	61	257	291	34	Met NTHLB
		CWHms2 S Med	34	67	101	61	61	23	-38	Not Met
		CWHvm3 Cw Med	4	0	4	28	1	0	-1	Not Met
		CWHvm3 Fd Med	25	5	31	21	6	25	19	Met THLB
		CWHvm3 HB Good	65	5	70	25	18	0	-18	Not Met
		CWHvm3 HB Med	141	188	329	25	82	238	156	Met NTHLB
		CWHvm3 HB Poor	18	265	283	25	71	265	194	Met NTHLB
		CWHws2 Cw Med	17	7	24	50	12	19	6	Met THLB
		CWHws2 Fd Med	111	164	275	42	115	32	-83	Not Met
		CWHws2 Fd Poor	4	137	141	22	31	26	-5	Not Met
		CWHws2 HB Good	96	24	119	60	72	0	-72	Not Met
		CWHws2 HB Med	754	1,577	2,331	26	606	1,768	1,162	Met NTHLB
		CWHws2 HB Poor	241	2,001	2,242	26	583	2,090	1,507	Met NTHLB
		MHmm1 HB Good	14	1	15	59	9	0	-9	Not Met
		MHmm1 HB Med	3	31	34	25	9	34	26	Met NTHLB
		MHmm2 HB Med	103	592	695	25	174	686	512	Met NTHLB
		MHmm2 HB Poor	17	3,064	3,081	49	1,510	2,900	1,391	Met NTHLB
	Sheemahant Total		5,248	11,877	17,125	34	5,294	10,775	5,481	
	Sheep Passage	CMAunp Cw Poor	1	2	4	26	1	4	3	Met NTHLB
		CWHvm1 Cw Med	298	1,210	1,508	28	422	897	475	Met NTHLB
		CWHvm1 Cw Poor	1,260	5,508	6,768	28	1,895	6,045	4,150	Met NTHLB

MO 2009	Landscape Unit	Site Series Surrogate	THLB (ha)	PFLB non THLB (ha)	Total PFLB (ha)	Old Growth Target (%)	Target Area (ha)	Current Old Growth Area (ha)	Surplus / Deficit	Current Condition
		CWHvm1 HB Med	427	3,802	4,229	25	1,057	2,814	1,757	Met NTHLB
		CWHvm1 HB Poor	8	2,694	2,702	25	676	2,235	1,560	Met NTHLB
		CWHvm1 S Med	77	513	590	25	147	438	291	Met NTHLB
		CWHvm2 Cw Med	1	143	144	28	40	53	12	Met NTHLB
		CWHvm2 Cw Poor	101	721	822	28	230	815	585	Met NTHLB
		CWHvm2 HB Med	33	470	503	25	126	365	239	Met NTHLB
		CWHvm2 S Med	3	41	44	59	26	44	18	Met NTHLB
	Sheep Passage Total		2,211	15,103	17,313	30	4,620	13,710	9,089	
	Sumquolt	CWHms2 Cw Med	65	8	73	38	28	73	45	Met THLB
		CWHms2 Cw Poor	9	3	12	44	5	0	-5	Not Met
		CWHms2 Fd Med	38	40	77	29	22	0	-22	Not Met
		CWHms2 HB Good	111	70	181	38	69	0	-69	Not Met
		CWHms2 HB Med	350	961	1,310	38	498	598	100	Met THLB
		CWHms2 S Good	4	71	76	61	46	35	-11	Not Met
		CWHws2 Cw Med	51	21	72	50	36	72	36	Met THLB
		CWHws2 HB Good	65	24	88	60	53	0	-53	Not Met
		CWHws2 HB Med	430	2,436	2,866	43	1,232	1,692	460	Met NTHLB
		CWHws2 HB Poor	3	2,069	2,073	43	891	1,029	138	Met NTHLB
		MHmm2 HB Med	16	393	409	42	172	274	102	Met NTHLB
	Sumquolt Total		1,142	6,095	7,237	44	3,053	3,773	720	
	Sutslem/Skowquiltz	CWHms2 Cw Good	16	0	16	53	8	0	-8	Not Met
		CWHms2 Cw Med	6	509	515	38	196	435	239	Met NTHLB
		CWHms2 Cw Poor	50	508	558	44	246	371	125	Met NTHLB
		CWHms2 Fd Good	17	0	17	53	9	0	-9	Not Met
		CWHms2 Fd Poor	15	878	893	29	259	247	-12	Not Met
		CWHms2 HB Good	17	152	169	38	64	0	-64	Not Met
		CWHms2 HB Med	68	3,952	4,020	38	1,528	2,056	529	Met NTHLB
		CWHms2 HB Poor	4	1,273	1,278	38	486	837	351	Met NTHLB
		CWHms2 S Med	20	53	73	61	45	55	10	Met THLB
		CWHvm3 Cw Poor	2	470	472	47	222	383	161	Met NTHLB
		CWHvm3 Fd Poor	49	160	209	35	73	39	-34	Not Met
	Sutslem/Skowquiltz Total		265	7,955	8,220	43	3,135	4,422	1,287	
	Swindle	CMAunp HB Med	3	0	3	59	2	0	-2	Not Met
		CWHvh2 Cw Med	702	441	1,144	68	778	148	-629	Not Met
		CWHvh2 Cw Poor	1,264	7,530	8,794	68	5,980	5,137	-842	Not Met
		CWHvh2 HB Med	481	761	1,243	68	845	537	-308	Not Met
		CWHvh2 HB Poor	17	1,859	1,876	68	1,276	1,575	299	Met NTHLB
		CWHvm1 Cw Poor	209	981	1,190	65	773	767	-6	Not Met
	Swindle Total		2,676	11,573	14,249	66	9,653	8,165	-1,488	
	Upper Kimsquit	CWHws2 Cw Good	22	8	30	50	15	0	-15	Not Met
		CWHws2 Cw Med	10	25	34	50	17	0	-17	Not Met
		CWHws2 Fd Poor	8	35	43	36	16	43	28	Met NTHLB
		CWHws2 HB Good	531	250	781	60	469	101	-368	Not Met
		CWHws2 HB Med	1,485	3,970	5,456	43	2,346	3,725	1,379	Met NTHLB
		CWHws2 HB Poor	235	3,519	3,754	43	1,614	1,652	38	Met THLB
		CWHws2 S Good	21	120	141	60	85	43	-41	Not Met
		CWHws2 S Med	69	197	266	60	160	61	-98	Not Met
		MHmm2 HB Good	7	0	7	42	3	0	-3	Not Met
		MHmm2 HB Med	43	359	402	42	169	338	170	Met NTHLB
		MHmm2 HB Poor	1	2,956	2,957	49	1,449	1,063	-386	Not Met
	Upper Kimsquit Total		2,433	11,438	13,872	49	6,341	7,028	686	
	Washwash	CWHms2 Cw Med	1	278	279	53	148	50	-98	Not Met
		CWHms2 Fd Good	47	69	116	53	61	57	-4	Not Met
		CWHms2 Fd Med	44	347	391	41	160	168	8	Met NTHLB
		CWHms2 HB Good	94	401	495	53	262	11	-251	Not Met
		CWHms2 HB Med	88	2,634	2,722	53	1,443	1,386	-56	Not Met
		CWHvm3 Cw Med	24	9	33	65	22	7	-15	Not Met
		CWHvm3 Cw Poor	17	145	162	65	105	159	54	Met NTHLB
		CWHvm3 Fd Med	65	24	88	49	43	18	-25	Not Met
		CWHvm3 HB Good	30	20	51	59	30	0	-30	Not Met
		CWHvm3 HB Med	134	2,268	2,402	59	1,417	1,760	343	Met NTHLB
		CWHvm3 HB Poor	1	2,136	2,138	59	1,261	1,769	508	Met NTHLB
		MHmm1 HB Med	47	317	364	59	215	271	57	Met NTHLB
		MHmm1 HB Poor	14	2,383	2,397	59	1,414	2,057	643	Met NTHLB
	Washwash Total		607	11,031	11,638	56	6,582	7,715	1,133	
	Yeo	CWHvh2 Cw Med	92	565	657	29	191	486	295	Met NTHLB
		CWHvh2 Cw Poor	584	4,151	4,735	29	1,373	3,439	2,066	Met NTHLB
		CWHvh2 HB Good	25	2	27	25	7	0	-7	Not Met
		CWHvh2 HB Med	630	2,090	2,720	29	789	2,313	1,524	Met NTHLB
		CWHvh2 HB Poor	16	900	916	29	266	671	406	Met NTHLB
	Yeo Total		1,347	7,708	9,054	28	2,625	6,909	4,284	
CNC Total			99,231	390,878	490,108	38	190,144	323,587	133,442	
SCC	Allison	CWHvh1 Cw Poor	37	27	64	29	19	64	46	Met NTHLB
	Allison Total		37	27	64	29	19	64	46	
	Bella Coola	CWHds2 Cw Good	24	7	31	22	7	0	-7	Not Met

MO 2009	Landscape Unit	Site Series Surrogate	THLB (ha)	PFLB non THLB (ha)	Total PFLB (ha)	Old Growth Target (%)	Target Area (ha)	Current Old Growth Area (ha)	Surplus / Deficit	Current Condition
		CWHds2 Cw Med	214	166	380	22	83	106	23	Met THLB
		CWHds2 Cw Poor	62	38	100	60	60	33	-27	Not Met
		CWHds2 Fd Good	45	68	113	42	47	0	-47	Not Met
		CWHds2 Fd Med	62	176	238	18	43	45	2	Met THLB
		CWHds2 Fd Poor	43	399	442	22	97	55	-42	Not Met
		CWHds2 HB Good	66	58	124	60	75	0	-75	Not Met
		CWHds2 HB Med	149	724	873	26	227	114	-113	Not Met
		CWHds2 S Med	19	9	28	60	17	1	-16	Not Met
		CWHds2 S PoorPl	5	164	170	12	20	2	-18	Not Met
		CWHms2 Cw Med	50	21	71	53	38	0	-38	Not Met
		CWHms2 HB Med	23	139	162	23	37	30	-7	Not Met
		CWHws2 Cw Med	14	0	14	50	7	0	-7	Not Met
		CWHws2 Cw Poor	23	24	47	60	28	0	-28	Not Met
		CWHws2 Fd Med	4	27	31	18	6	1	-5	Not Met
		CWHws2 Fd Poor	12	46	58	22	13	0	-13	Not Met
		CWHws2 HB Med	5	229	234	26	61	43	-18	Not Met
		MHmm2 Fd Med	4	0	4	49	2	0	-2	Not Met
		MHmm2 Fd Poor	11	1	13	49	6	0	-6	Not Met
	Bella Coola Total		836	2,297	3,133	37	875	431	-444	
	Clayton	CWHms2 Cw Med	31	67	98	53	52	31	-21	Not Met
		CWHms2 Fd Good	17	4	21	22	5	8	3	Met THLB
		CWHms2 Fd Med	183	52	235	17	40	73	33	Met THLB
		CWHms2 Fd Poor	257	397	654	17	111	88	-23	Not Met
		CWHms2 HB Good	27	5	33	23	8	0	-8	Not Met
		CWHms2 HB Med	2	75	78	23	18	56	38	Met NTHLB
		CWHws2 Cw Med	8	0	8	50	4	0	-4	Not Met
		CWHws2 Fd Good	1	0	1	18	0	1	1	Met THLB
		CWHws2 Fd Med	7	6	13	18	2	12	10	Met NTHLB
		CWHws2 Fd Poor	24	209	233	22	51	10	-41	Not Met
		CWHws2 HB Good	14	19	34	26	9	0	-9	Not Met
		CWHws2 HB Med	245	241	486	26	126	313	187	Met NTHLB
		CWHws2 HB Poor	20	178	198	26	52	4	-48	Not Met
		MHmm2 Cw Med	4	0	4	65	2	0	-2	Not Met
		MHmm2 Fd Poor	3	21	24	49	12	0	-11	Not Met
		MHmm2 HB Med	57	264	321	59	189	104	-85	Not Met
		MHmm2 HB Poor	7	639	646	25	161	14	-147	Not Met
	Clayton Total		909	2,178	3,087	32	843	715	-128	
	Draney	CWHvh2 Cw Good	492	22	514	63	324	0	-324	Not Met
		CWHvh2 Cw Med	2,998	1,153	4,151	29	1,204	2,452	1,249	Met THLB
		CWHvh2 Cw Poor	5,521	13,710	19,231	29	5,577	18,089	12,512	Met NTHLB
		CWHvh2 HB Good	342	331	673	25	168	0	-168	Not Met
		CWHvh2 HB Med	1,493	1,275	2,768	29	803	464	-339	Not Met
		CWHvh2 HB Poor	1	44	45	29	13	20	7	Met NTHLB
		CWHvh2 S Good	20	5	26	25	6	16	9	Met THLB
		CWHvh2 S Med	50	15	65	59	38	2	-36	Not Met
		CWHvh2 S PoorPl	2	0	2	12	0	2	2	Met THLB
		CWHvm1 Cw Good	15	0	15	25	4	0	-4	Not Met
		CWHvm1 Cw Med	304	502	806	28	226	643	418	Met NTHLB
		CWHvm1 Cw Poor	908	812	1,720	28	482	1,603	1,122	Met NTHLB
		CWHvm1 HB Med	134	286	419	25	105	57	-48	Not Met
		CWHvm2 Cw Good	24	0	24	25	6	0	-6	Not Met
		CWHvm2 Cw Med	259	120	379	28	106	351	244	Met THLB
		CWHvm2 Cw Poor	1,631	3,246	4,877	28	1,366	4,715	3,349	Met NTHLB
		CWHvm2 HB Med	124	226	350	25	88	254	167	Met NTHLB
		CWHvm2 S PoorPl	2	0	2	29	1	2	1	Met THLB
		MHmm1 Cw Med	26	1	27	65	18	27	10	Met THLB
		MHmm1 Cw Poor	68	192	259	28	73	259	187	Met NTHLB
		MHwh1 Cw Med	19	25	44	68	30	44	14	Met THLB
		MHwh1 Cw Poor	376	391	767	29	222	744	522	Met NTHLB
		MHwh1 HB Med	6	47	53	68	36	53	17	Met NTHLB
	Draney Total		14,818	22,401	37,219	35	10,894	29,797	18,903	
	Labouchere	CWHms2 Cw Med	260	555	815	53	432	628	196	Met NTHLB
		CWHms2 Cw Poor	206	832	1,038	43	446	608	162	Met NTHLB
		CWHms2 HB Good	15	37	51	38	19	0	-19	Not Met
		CWHms2 HB Med	663	2,274	2,938	38	1,116	1,558	442	Met NTHLB
		CWHms2 HB Poor	43	834	877	38	333	577	244	Met NTHLB
		CWHms2 S Med	49	64	112	61	69	112	44	Met THLB
		CWHvm3 Cw Med	15	177	192	47	90	94	4	Met THLB
		CWHvm3 Cw Poor	26	307	332	47	156	175	19	Met NTHLB
		CWHvm3 HB Med	374	2,291	2,665	42	1,119	1,764	644	Met NTHLB
		CWHvm3 HB Poor	14	1,353	1,367	42	574	1,039	464	Met NTHLB
		CWHvm3 S Med	5	77	82	0	0	76	76	Met NTHLB
	Labouchere Total		1,670	8,799	10,470	41	4,356	6,630	2,274	
	Nekite	CWHvm1 Cw Good	60	3	63	58	36	0	-36	Not Met
		CWHvm1 Cw Med	1,076	1,817	2,893	65	1,880	2,435	555	Met THLB
		CWHvm1 Cw Poor	1,317	3,496	4,813	65	3,128	4,677	1,549	Met NTHLB

MO 2009	Landscape Unit	Site Series Surrogate	THLB (ha)	PFLB non THLB (ha)	Total PFLB (ha)	Old Growth Target (%)	Target Area (ha)	Current Old Growth Area (ha)	Surplus / Deficit	Current Condition
		CWHvm1 HB Good	180	266	446	58	259	82	-177	Not Met
		CWHvm1 HB Med	1,645	3,421	5,066	58	2,938	3,356	417	Met THLB
		CWHvm1 HB Poor	42	330	372	58	216	207	-9	Not Met
		CWHvm1 S Good	44	469	513	58	298	404	106	Met NTHLB
		CWHvm1 S Med	59	182	241	58	140	170	31	Met NTHLB
		CWHvm1 S PoorPl	1	5	6	29	2	6	5	Met NTHLB
		CWHvm2 Cw Med	129	655	784	65	510	776	266	Met NTHLB
		CWHvm2 Cw Poor	751	6,248	6,999	65	4,549	6,882	2,332	Met NTHLB
		CWHvm2 HB Good	14	23	36	59	21	13	-8	Not Met
		CWHvm2 HB Med	141	1,863	2,004	59	1,183	1,775	592	Met NTHLB
		CWHvm2 HB Poor	4	998	1,003	59	591	830	238	Met NTHLB
		MHmm1 Cw Med	3	12	15	65	10	15	5	Met NTHLB
		MHmm1 Cw Poor	44	1,239	1,283	65	834	1,225	391	Met NTHLB
		MHmm1 HB Med	9	95	104	59	62	81	20	Met NTHLB
	Nekite Total		5,519	21,123	26,642	59	16,657	22,933	6,276	
	Nusatsum	CWHds2 HB Good	14	0	14	60	8	0	-8	Not Met
		CWHds2 HB Med	9	21	30	26	8	2	-5	Not Met
		CWHws2 HB Good	1	7	9	26	2	0	-2	Not Met
		CWHws2 HB Med	112	1,272	1,384	26	360	233	-127	Not Met
		MHmm2 Fd Med	1	10	11	49	6	0	-6	Not Met
	Nusatsum Total		137	1,310	1,448	37	384	235	-149	
	Saloompt	CWHds2 Cw Med	27	78	104	22	23	20	-3	Not Met
		CWHds2 Cw Poor	5	16	21	60	13	0	-13	Not Met
		CWHds2 Fd Poor	59	17	76	22	17	73	56	Met THLB
		CWHds2 HB Good	8	36	44	60	26	0	-26	Not Met
		CWHds2 HB Med	37	113	151	26	39	86	46	Met NTHLB
		CWHds2 HB Poor	11	25	36	26	9	34	25	Met NTHLB
		CWHms2 Cw Med	30	19	49	53	26	0	-26	Not Met
		CWHms2 Fd Med	41	57	98	17	17	0	-17	Not Met
		CWHms2 Fd Poor	27	92	119	17	20	68	48	Met NTHLB
		CWHms2 HB Good	130	88	219	23	50	0	-50	Not Met
		CWHms2 HB Med	735	1,137	1,871	23	430	825	395	Met NTHLB
		CWHms2 S Good	3	1	4	61	2	0	-2	Not Met
		CWHws2 Cw Med	86	149	235	50	117	199	81	Met THLB
		CWHws2 Cw Poor	33	97	130	60	78	97	20	Met THLB
		CWHws2 Fd Good	16	10	26	18	5	0	-5	Not Met
		CWHws2 Fd Med	2	0	2	18	0	0	0	Not Met
		CWHws2 Fd Poor	27	21	48	22	11	48	38	Met NTHLB
		CWHws2 HB Good	21	18	39	26	10	0	-10	Not Met
		CWHws2 HB Med	898	1,119	2,017	26	524	1,600	1,076	Met NTHLB
		CWHws2 HB Poor	29	1,119	1,148	26	298	1,130	831	Met NTHLB
		CWHws2 S Med	29	9	38	60	23	38	15	Met THLB
		MHmm2 HB Med	7	149	156	59	92	137	45	Met NTHLB
		MHmm2 HB Poor	8	482	490	25	122	490	367	Met NTHLB
	Saloompt Total		2,269	4,852	7,121	35	1,955	4,846	2,892	
	Smith Sound	CWHvh1 Cw Good	22	62	84	27	23	0	-23	Not Met
		CWHvh1 Cw Med	828	1,583	2,411	29	699	1,716	1,017	Met NTHLB
		CWHvh1 Cw Poor	2,078	11,869	13,948	29	4,045	10,611	6,567	Met NTHLB
		CWHvh1 HB Good	90	157	247	25	62	0	-62	Not Met
		CWHvh1 HB Med	135	790	925	29	268	303	35	Met NTHLB
		CWHvh1 HB Poor	54	181	235	68	160	70	-89	Not Met
		CWHvh2 Cw Poor	4	7	10	29	3	10	7	Met NTHLB
		CWHvm1 Cw Poor	4	2	6	28	2	6	4	Met NTHLB
	Smith Sound Total		3,216	14,651	17,867	33	5,261	12,717	7,456	
	Smitley/Noeick	CWHms2 Cw Good	39	4	42	38	16	0	-16	Not Met
		CWHms2 Cw Med	11	4	15	53	8	12	4	Met THLB
		CWHms2 Cw Poor	7	0	7	43	3	0	-3	Not Met
		CWHms2 Fd Good	76	51	128	38	49	0	-49	Not Met
		CWHms2 Fd Med	221	183	405	29	117	42	-75	Not Met
		CWHms2 Fd Poor	55	139	194	29	56	59	2	Met THLB
		CWHms2 HB Good	217	47	263	38	100	0	-100	Not Met
		CWHms2 HB Med	579	728	1,306	38	496	447	-49	Not Met
		CWHms2 HB Poor	1	249	250	38	95	141	46	Met NTHLB
		CWHms2 S Med	14	22	36	61	22	0	-22	Not Met
		CWHms2 S PoorPl	35	57	93	21	19	24	5	Met THLB
		CWHws2 Cw Good	3	0	3	36	1	0	-1	Not Met
		CWHws2 Cw Med	56	46	101	50	51	82	32	Met THLB
		CWHws2 Fd Med	36	131	167	30	50	24	-26	Not Met
		CWHws2 Fd Poor	21	26	48	36	17	0	-17	Not Met
		CWHws2 HB Med	1,119	2,271	3,390	43	1,458	1,768	310	Met THLB
		CWHws2 HB Poor	15	1,138	1,152	43	495	559	64	Met NTHLB
		CWHws2 S Good	5	1	7	43	3	0	-3	Not Met
		CWHws2 S PoorPl	19	145	164	21	34	74	40	Met NTHLB
		MHmm2 HB Med	65	1,117	1,182	59	697	460	-238	Not Met
	Smitley/Noeick Total		2,592	6,359	8,951	39	3,788	3,692	-95	
	Smokehouse	CWHvh1 Cw Med	4	41	45	29	13	41	28	Met NTHLB

MO 2009	Landscape Unit	Site Series Surrogate	THLB (ha)	PFLB non THLB (ha)	Total PFLB (ha)	Old Growth Target (%)	Target Area (ha)	Current Old Growth Area (ha)	Surplus / Deficit	Current Condition
		CWHvh1 Cw Poor	2	3	6	29	2	6	4	Met NTHLB
		CWHvm1 Cw Med	528	1,764	2,292	28	642	1,698	1,056	Met NTHLB
		CWHvm1 Cw Poor	1,552	4,844	6,395	28	1,791	5,987	4,196	Met NTHLB
		CWHvm1 HB Good	5	147	152	25	38	17	-21	Not Met
		CWHvm1 HB Med	189	2,230	2,420	25	605	1,577	972	Met NTHLB
		CWHvm2 Cw Med	20	145	165	28	46	113	67	Met NTHLB
		CWHvm2 Cw Poor	508	4,584	5,092	28	1,426	4,842	3,416	Met NTHLB
		CWHvm2 HB Med	4	1,132	1,136	25	284	979	694	Met NTHLB
		MHmm1 Cw Poor	12	583	596	28	167	566	399	Met NTHLB
	Smokehouse Total		2,824	15,475	18,299	27	5,013	15,825	10,812	
	South Bentinck	CWHms2 Cw Med	8	0	8	53	4	8	4	Met THLB
		CWHms2 Fd Med	35	4	39	29	11	16	5	Met THLB
		CWHms2 Fd Poor	11	28	39	29	11	7	-5	Not Met
		CWHms2 HB Good	20	5	25	38	10	0	-10	Not Met
		CWHms2 HB Med	161	1,232	1,393	38	530	867	338	Met NTHLB
		CWHms2 HB Poor	2	594	596	38	226	344	117	Met NTHLB
		CWHms2 S PoorPl	67	17	84	21	18	75	57	Met THLB
		CWHws2 Cw Med	12	0	12	50	6	12	5	Met THLB
		CWHws2 Fd Med	8	0	8	30	2	7	5	Met THLB
		CWHws2 Fd Poor	38	51	89	36	32	38	6	Met THLB
		CWHws2 HB Med	184	468	652	43	281	384	103	Met THLB
		CWHws2 HB Poor	24	832	855	43	368	421	53	Met NTHLB
		CWHws2 S Med	3	1	4	60	3	1	-1	Not Met
		CWHws2 S PoorPl	35	0	35	21	7	35	28	Met THLB
		MHmm2 Cw Med	9	2	12	65	8	11	3	Met THLB
		MHmm2 Fd Poor	2	24	26	49	13	2	-10	Not Met
		MHmm2 HB Med	12	137	148	59	88	21	-67	Not Met
		MHmm2 S PoorPl	3	0	3	29	1	3	2	Met THLB
	South Bentinck Total		634	3,395	4,029	41	1,617	2,251	633	
	Taleomey/Asseek	CMAunp HB Med	3	32	35	42	15	35	20	Met NTHLB
		CWHms2 Cw Good	17	0	17	38	6	0	-6	Not Met
		CWHms2 Cw Med	6	12	18	53	10	3	-7	Not Met
		CWHms2 Fd Good	5	23	27	38	10	0	-10	Not Met
		CWHms2 Fd Med	411	295	707	29	205	256	51	Met THLB
		CWHms2 Fd Poor	196	396	592	29	172	126	-45	Not Met
		CWHms2 HB Good	111	83	194	38	74	0	-74	Not Met
		CWHms2 HB Med	1,158	1,171	2,329	38	885	370	-515	Not Met
		CWHms2 HB Poor	44	335	378	38	144	233	89	Met NTHLB
		CWHms2 S Med	9	5	14	61	9	14	5	Met THLB
		CWHws2 Cw Good	4	17	21	36	8	0	-8	Not Met
		CWHws2 Cw Med	34	34	69	50	34	17	-18	Not Met
		CWHws2 Cw Poor	8	78	85	60	51	31	-20	Not Met
		CWHws2 Fd Med	122	80	202	30	61	77	16	Met THLB
		CWHws2 Fd Poor	33	264	297	36	107	94	-13	Not Met
		CWHws2 HB Good	28	22	50	43	21	0	-21	Not Met
		CWHws2 HB Med	822	2,049	2,871	43	1,235	1,414	179	Met THLB
		CWHws2 HB Poor	62	1,108	1,170	43	503	639	136	Met NTHLB
		CWHws2 S Med	43	17	60	60	36	17	-19	Not Met
		CWHws2 S PoorPl	7	26	33	21	7	20	13	Met NTHLB
		MHmm2 Cw Poor	2	34	36	65	23	25	2	Met THLB
		MHmm2 Fd Med	15	9	24	49	12	11	-1	Not Met
		MHmm2 HB Med	300	889	1,189	59	701	580	-122	Not Met
		MHmm2 HB Poor	38	2,065	2,103	42	883	976	92	Met NTHLB
		MHmm2 S PoorPl	8	32	39	29	11	4	-8	Not Met
	Taleomey/Asseek Total		3,486	9,077	12,563	43	5,224	4,941	-282	
	Twin	CWHms2 Cw Good	7	0	7	38	3	0	-3	Not Met
		CWHms2 Cw Med	63	32	95	53	50	0	-50	Not Met
		CWHms2 HB Good	151	44	195	38	74	0	-74	Not Met
		CWHms2 HB Med	508	2,115	2,623	38	997	1,760	763	Met NTHLB
		CWHms2 HB Poor	7	874	882	38	335	268	-67	Not Met
		CWHvm1 Cw Med	96	104	200	46	92	0	-92	Not Met
		CWHvm1 Fd Med	1	0	1	35	0	0	0	Not Met
		CWHvm1 HB Good	40	10	50	42	21	0	-21	Not Met
		CWHvm1 HB Med	765	829	1,593	42	669	244	-425	Not Met
		CWHvm1 HB Poor	6	998	1,005	42	422	211	-210	Not Met
		CWHvm1 S Good	4	4	8	42	3	0	-3	Not Met
		CWHvm1 S Med	105	34	140	42	59	0	-59	Not Met
		CWHvm1 S PoorPl	20	21	40	21	8	0	-8	Not Met
		CWHvm2 Cw Med	43	7	50	46	23	0	-23	Not Met
		CWHvm2 HB Good	4	0	4	42	2	0	-2	Not Met
		CWHvm2 HB Med	155	381	536	42	225	251	26	Met THLB
		CWHvm3 HB Med	130	995	1,125	42	473	775	302	Met NTHLB
		CWHvm3 HB Poor	3	1,057	1,060	42	445	365	-80	Not Met
		MHmm1 HB Good	5	0	5	59	3	0	-3	Not Met
		MHmm1 HB Med	4	106	110	42	46	52	5	Met NTHLB
	Twin Total		2,119	7,611	9,729	42	3,951	3,927	-24	

MO 2009	Landscape Unit	Site Series Surrogate	THLB (ha)	PFLB non THLB (ha)	Total PFLB (ha)	Old Growth Target (%)	Target Area (ha)	Current Old Growth Area (ha)	Surplus / Deficit	Current Condition
SCC Total			41,066	119,555	160,621	39	60,835	109,005	48,170	
Total			**140,297**	**510,433**	**650,729**	**38**	**250,979**	**432,591**	181,612	