Merritt TSA
Type 1
Silviculture Strategy

Version 2.0

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British Columbia
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Forests for Tomorrow

FORSITE
Forest Management Specialists

Symmetree
Consulting Group

Mike Fenger and Associates

Strategies at a Glance

General Strategy	The focus of the Merritt TSA Silviculture Strategy over the next five years is to mitigate impacts to non-timber values brought about by the mountain pine beetle epidemic and associated harvesting, while also looking to treat non lodgepole pine stands to improve midterm timber supply. When faced with limited budgets, addressing non-timber issues was seen as the highest priority in the TSA because currently available investments directed at improving timber supply were seen to have little impact, while significant indirect benefits to timber supply were still evident when the focus was placed on non-timber issues. Limited opportunities exist to invest in improving timber supply in this TSA in the next five years because salvage is keeping up with MPB mortality, most burned areas have been reforested, and there are limited non-Pl stands outside the drybelt to fertilize. If allocated budgets cannot be spent on non-timber issues, then an alternative timber focused strategy is also provided in this document.	
Working Targets	Timber Supply:	<u>Short term (0-20)</u> Harvest at a level required to capture MPB mortality <u>Midterm (30-70 years)</u> Minimize the depth and duration of the midterm trough <u>Long term (70+years)</u> Maintain the long term harvest level within 5% of the productivity capacity of the land base.
	Timber Quality:	<u>Midterm</u> (10% premium logs – house logs/peelers/MSR) <u>Long term</u> (10% premium logs – house logs/peelers/MSR)
	Habitat Supply:	<u>Overall Objective</u> - Minimize negative impacts on ecosystems and species: <u>Short Term</u> - Stand and landscape level retention strategy developed (20% of THLB) for short term retention of environmental values. - Reforest a proportion of impacted watershed, WTP / OGMA / RMA's/ or other retention areas to reduced stocking levels where ecologically appropriate.50% of impacted WTP / OGMA / RMA's/ or other retention areas where ecologically appropriate. - Increased levels of broad leaf trees on the land base. <u>Midterm and Long Term</u> Maintain or improve the conservation status of all species where possible (Ensure forestry practices do not make species status worse).
Major Silvicultural Strategies	Timber Supply 1. Planting of THLB sites with no reforestation obligations (TS5) 2. Late Rotation Fertilization of Non-Pl (Fd and Sx) (TS1) 3. Young Stand Fertilizations – Fd/ Sx (TS2) 4. Spacing of clumped drybelt Fd stands (TS4)	
	Timber Quality 1. Manage for larger logs (house logs/peelers) through long rotations in stands constrained by non-timber objectives (VQO's UWR, etc). 2. Manage for MSR lumber through acceptance of higher stand densities on a portion of the land base.	

Strategies at a Glance

Habitat Supply

1. Planting of impacted non-THLB areas with a habitat focus. (HS1)
2. Spacing/thinning in drybelt Fd stands (HS3)
3. Rehabilitation of spur roads and landings (HS7b)
4. Manage tree species for diversity
5. Vary regenerated stand spacing
6. Complete inventories and planning required to maintain habitat of species and ecosystems of conservation concern.

Silviculture Program

Idealized funding level ($22.7 million over five years)

Activity	Year 1 (ha)	Year 2 (ha)	Year 3 (ha)	Year 4 (ha)	Year 5 (ha)	Totals (ha)
Studies/Surveys	-	-	-	-	-	-
Fertilize	3,750	9,150	-	-	-	12,900
Spacing/Thinning (timber)	1,000	1,250	1,250	1,250	1,250	6,000
Spacing/Thinning (habitat)	-	1,250	1,250	1,250	1,250	5,000
Planting (timber - other/MPB)			-	500	500	1,000
Planting (timber - fires)	-	2,000				2,000
Planting (habitat)	1,000	1,000	1,000	3,500	3,500	10,000
Pruning	100	-	-	-	-	100
Brushing	-	-	-	-	-	-
Road Rehab	-	200	-	-	-	200
Totals	5,850	14,850	3,500	6,500	6,500	37,200

Activity	Year 1	Year 2	Year 3	Year 4	Year 5	Totals
Studies/Surveys	$ 335,000	$ -		$ -	$ 20,000	$ 355,000
Fertilize	$ 1,500,000	$ 3,660,000	$ -	$ -		$ 5,160,000
Spacing/Thinning (timber)	$ 600,000	$ 750,000	$ 750,000	$ 750,000	$ 750,000	$ 3,600,000
Spacing/Thinning (habitat)	$ -	$ 750,000	$ 750,000	$ 750,000	$ 750,000	$ 3,000,000
Planting (timber - other/MPB)			$ 10,000	$ 500,000	$ 500,000	$ 1,010,000
Planting (timber - fires)	$ 500,000	$ 2,000,000				$ 2,500,000
Planting (habitat)	$ 600,000	$ 600,000	$ 600,000	$ 2,100,000	$ 2,100,000	$ 6,000,000
Pruning	$ 80,000	$ -	$ -	$ -	$ -	$ 80,000
Brushing	$ -	$ -	$ -	$ -	$ -	$ -
Road Rehab	$ -	$ 1,000,000	$ -	$ -	$ -	$ 1,000,000
Totals	$ 3,615,000	$ 8,760,000	$ 2,110,000	$ 4,100,000	$ 4,120,000	$ 22,705,000

Estimated Timber Supply Outcomes

- 64,600 m^3 made available at the front end of the trough
  - Realized from late rotation fertilization
- 238,550 m^3 made available in the middle of the trough
  - Realized from young stands fertilization and thinning of drybelt Fd stands
- 330,000 m^3 made available in the back end of the trough
  - Realized mainly though planting of sites with no obligations, plus a small gain associated with road rehabilitation.
- An unquantifiable benefit from planting of up to 10,000 ha of sites with a habitat focus, thereby avoiding further set-asides from within the THLB.

If similar benefits could be produced by continuously investing at this level for 20 years (total of $90.8 million), the midterm trough could rise by 46,000 m3/year. This forecast is highly speculative and there is no guarantee that sufficient treatment areas could be found.

Timber Quality Outcomes

- Extremely small increase in clear log volume likely at the back of the trough from completing second lift pruning on 100 ha.

Strategies at a Glance

Habitat Supply Outcomes

- Enhance old forest stand structure on 5,000 ha of drybelt Fd stands (thinned/spaced).
- Regeneration of 10,000 ha of impacted stands with a habitat focus, and regeneration of 3,000 ha of impacted stands with a timber focus. Emphasis on under-planting to speed hydrologic recovery and stream temperature where appropriate.
- Maintain wildlife and recreation values by planting and rehabilitation of 200 ha existing road

Silviculture Program

Constrained Funding: Habitat-focus ($8.2 million over five years) [1]

Activity	Year 1 (ha)	Year 2 (ha)	Year 3 (ha)	Year 4 (ha)	Year 5 (ha)	Totals (ha)
Studies/Surveys	-	-	-	-	-	-
Fertilize	3,400	1,200	-	-	-	4,600
Spacing/Thinning (timber)	-	-	-	-	-	-
Spacing/Thinning (habitat)	-	650	700	400	400	2,150
Planting (timber - other/MPB)			-	300	300	600
Planting (timber - fires)	-	235				235
Planting (habitat)	-	-	1,000	1,000	1,000	3,000
Pruning	-	-	-	-	-	-
Brushing	100	-	100	-	-	200
Road Rehab	-	20	40	20	20	100
Totals	3,500	2,105	1,840	1,720	1,720	10,885

Activity	Year 1 (ha)	Year 2 (ha)	Year 3 (ha)	Year 4 (ha)	Year 5 (ha)	Totals (ha)
Studies/Surveys	225,000	-	10,000	-	-	235,000
Fertilize	1,360,000	480,000	-	-	-	1,840,000
Spacing/Thinning (timber)	-	-	-	-	-	-
Spacing/Thinning (habitat)	-	390,000	420,000	240,000	240,000	1,290,000
Planting (timber - other/MPB)			-	300,000	300,000	600,000
Planting (timber - fires)	100,000	235,000				335,000
Planting (habitat)	-	375,000	975,000	975,000	975,000	3,300,000
Pruning	-	-	-	-	-	-
Brushing	60,000	-	60,000	-	-	120,000
Road Rehab	-	100,000	200,000	100,000	100,000	500,000
Totals	1,745,000	1,580,000	1,665,000	1,615,000	1,615,000	8,220,000

Estimated Timber Supply Outcomes:

- 44,600 m3 made available at the front end of the trough
  - Realized from late rotation fertilization (40-80 years old)
- 26,000 m3 made available in the mid to back end of the trough
  - Realized mainly though thinning of drybeltt Fd stands.
- 99,500 m3 made available at the back end of the trough
  - Realized from planting THLB areas with no regeneration obligations and road rehabilitation.
- An unquantifiable benefit from planting of up to 3,000 ha of sites for a habitat focus, thereby avoiding further set-asides from within the THLB.

If similar benefits could be produced by continuously investing at this level for 20 years (total of $32.8 million), the midterm trough could rise by 12,000 m3/year. This forecast is highly speculative and there is no guarantee that enough suitable treatment areas could be found.

[1] When historic funding levels are used to constrain the funding scenario, a habitat focus option becomes the priority for funding, since neither timber nor habitat were well-served by a mixing of priorities.

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Timber Quality Outcomes

- None

Habitat Supply Outcomes

- Enhance old forest stand structure on 2150 ha of drybelt Fd stands (thinned/spaced).
- Regeneration of 3000 ha of impacted stands with a habitat focus, and regeneration of 835 ha of impacted stands with a timber focus with emphasis on under-planting to speed hydrologic recovery and stream temperature where appropriate
- Maintain wildlife and recreation values by planting and rehabilitation of 100 ha of road rehabilitation

Silviculture Program

Constrained funding Timber-focus ($8.2 million over five years)[2]

Activity	Year 1 (ha)	Year 2 (ha)	Year 3 (ha)	Year 4 (ha)	Year 5 (ha)	Totals (ha)
Studies/Surveys	-	-	-	-	-	-
Fertilize	3,400	2,700	2,500	500	500	9,600
Spacing/Thinning (timber)	-	-	-	-	-	-
Spacing/Thinning (habitat)	-	-	-	-	-	-
Planting (timber - other/MPB)			-	500	500	1,000
Planting (timber - fires)	-	235				235
Planting (habitat)	-	200	500	500	500	1,700
Pruning	100	-	-	-	-	100
Brushing	100	-	100	-	-	200
Road Rehab	-	20	-	-	-	20
Totals	3,600	3,155	3,100	1,500	1,500	12,855

Activity	Year 1	Year 2	Year 3	Year 4	Year 5	Totals
Studies/Surveys	$ 285,000	$ -		$ -	$ -	$ 285,000
Fertilize	$ 1,360,000	$ 1,080,000	$ 1,000,000	$ 200,000	$ 200,000	$ 3,840,000
Spacing/Thinning (timber)	$ -	$ -	$ 50,000	$ 450,000	$ 450,000	$ 950,000
Spacing/Thinning (habitat)	$ -	$ -	$ -	$ -	$ -	$ -
Planting (timber - other/MPB)			$ 10,000	$ 500,000	$ 500,000	$ 1,010,000
Planting (timber - fires)	$ -	$ 235,000				$ 235,000
Planting (habitat)	$ -	$ 195,000	$ 485,000	$ 485,000	$ 485,000	$ 1,650,000
Pruning	$ 80,000	$ -	$ -	$ -	$ -	$ 80,000
Brushing	$ 60,000	$ -	$ 60,000	$ -	$ -	$ 120,000
Road Rehab	$ -	$ 100,000	$ -	$ -	$ -	$ 100,000
Totals	$ 1,785,000	$ 1,610,000	$ 1,605,000	$ 1,635,000	$ 1,635,000	$ 8,270,000

<u>Estimated Timber Supply Outcomes</u>

- 58,600 m^3 made available at the front end of the trough
  - Realized from late rotation fertilization
- 106,400 m^3 made available in the mid-back end of the trough
  - Realized from young stand fertilization (15-40 years old) and thinning of drybelt Fd.
- 132,500 m^3 made available at the back end of the trough
  - Realized from planting THLB areas with no regeneration obligations and road rehabilitation.
- An unquantifiable benefit from planting of up to 1,700 ha of sites for a habitat focus, thereby avoiding further set-asides from within the THLB.

If similar benefits could be produced by continuously investing at this level for 20

Strategies at a Glance	
	years (total of $32.8 million), the midterm trough could rise by 22,000 m^3/year. This forecast is highly speculative and there is no guarantee that enough suitable treatment areas could be found. Estimated Timber Quality Outcomes • Extremely small increase in clear log volume likely at the back of the trough from completing second lift pruning on 100 ha. Estimated Habitat Supply Outcomes • Regeneration of 1700 ha of impacted stands with a habitat focus, and regeneration of 1,235 ha of impacted stands with a timber focus. • 20 ha of road rehabilitation

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1.0 Introduction

1.1 About This Strategy

Type 1 Silviculture Strategies are currently being created or updated for most management units (TSAs and TFLs) in British Columbia's interior to provide a context for land base investment decisions. The strategies will help guide funding allocations between and within management units where that flexibility exists (i.e. Forests for Tomorrow and federal funds). One of the key motivating factors behind the completion of these strategies is the need to mitigate expected future impacts of the mountain pine beetle (MPB) epidemic and recent large scale fires in the interior of BC. More specifically, there is a need to improve midterm timber supply and mitigate impacts to environmental values.

A Type 1 silviculture strategy compiles existing information to identify issues related to timber supply, timber quality, and habitat supply in the TSA, and then engages stakeholders in a workshop setting to identify silviculture strategies/investments that can be used to address the issues[3]. The strategy is based on readily available information and the knowledge of local forestry and environmental professionals. These potential strategies will need to be quantified and/or refined in a more in-depth Type 2 analysis. The results of a Type 2 analysis will be a better guide for on the ground implementation.

Incremental silviculture is part of a suite of strategies, which together may influence the future quality and quantity of habitat and timber supply. This strategy document broadly analyzes the potential range of silviculture activities in order to identify priority treatments for an incremental silviculture strategy. An incremental silviculture strategy should not be confused with the allowable annual cut (AAC) determination process. AAC's are based on current practices at the time of the determination. This strategy is forward looking and is about creating desired future conditions for our forests. The degree to which the strategy proves appropriate and is achieved may influence future AAC determinations.

1.2 Methods

This strategy was prepared through the following process:

- Prior to the district workshop, Forsite and Symmetree prepared a background document, summarizing all available information relevant to a strategy and identified opportunities to improve the future quantity and quality of timber and habitat supply. Mike Fenger and Associates provided input on habitat related issues on behalf of the Ministry of Environment. This document was provided to local major licensees and First Nations along with an invitation to the workshop.
- A district workshop was held November 8th & 9th, 2005 in Merritt, attended by representatives of the MoFR, MoE and forest licensees within the Merritt TSA. Ken Zielke of Symmetree Consulting Group Ltd and Cam Brown of Forsite Consultants Ltd. led the session. Alison Peatt and Mike Fenger of Mike Fenger and Associates represented MoE's interests in the workshop.

- Participants reviewed the potential opportunities identified in the draft document and provided others as they were discussed. The outcome of the session was a regime table, complete with priorities.
- Three five year budget scenarios were developed; an idealized 'needs' budget, and two constrained 'historical' budgets. The constrained budget forced participants to make choices between the identified strategies/opportunities. In Merritt, a mix of priorities in a constrained budget did not allow for a significant contribution to either habitat or timber supply. For that reason, a constrained budget was developed both for a habitat focus and a timber focus. The habitat focus budget is the priority while the timber focus budget is provided to indicate alternative priorities if dollars could not be spent on habitat related issues.
- The consultants incorporated the results of the working session into this draft document and added forecasts of future harvest quantity and quality and of job outcomes.

1.3 Acknowledgements

We would like to thank all those who participated in the workshop, without their input this strategy would not have been possible. They are as follows:

Attendee	Affiliation
Sean Curry	Weyerhaeuser Canada Ltd.
Bruce Beech	Tolko Forest Products Ltd.
Dave Dobek	Stuwix Resources Ltd.
Ed Nedokus	Ministry of Forests, Merritt District
Peter Stroes	Ministry of Forests, Merritt District
Dave Cornwell	Ministry of Forests, Merritt District
Alison Peatt	Mike Fenger and Associates (MoE Rep)
Mike Fenger	Mike Fenger and Associates (MoE Rep)
Cam Brown	Forsite Consulting Ltd.
Ken Zielke	Symmetree Consulting Group

Mike Fenger and Associates provided summary information on habitat related issues prior to the workshop, participated in the workshop, and helped to craft this document.

The project was managed by Ralph Winter and Nigel Fletcher of the Ministry of Forests, Forest Practices Branch and funding was provided by Forest for Tomorrow BC.

1.4 Limitations and Assumptions

This strategy is focused on silviculture investments not covered by legislative obligations, which can be completed over the next five years (2006-2011). Because of risks associated with the current MPB infestation, investments in Pl stands were avoided. After the MPB epidemic subsides, investment in Pl stands represents a significant opportunity to address many of the TSAs timber supply issues.

Timber supply modeling was not completed in this project and all timber supply projections are from existing published sources or have been estimated based on professional judgment. Sources are indicated with each graph.

This strategy was developed to reflect TSA needs, and proposed strategies were not excluded because they did not fit within existing funding sources. The intent is for the TSA to use whatever funding sources are available to address those issues important to the TSA. The strategy itself is assumed to be funding independent.

2.0 Basic Data

This section provides a summary of basic TSA data that describes the land base and related issues. This information is included to provide context for the resulting strategies that are presented later in the document.

2.1 AAC History

Table 1 provides an overview of the AAC since 1996. The recent TSR3 determination was largely based on the timber supply analysis conducted by the Nicola-Similkameen Innovative Forestry Society (NSIFS) under the Innovative Forestry Practices Agreement (IFPA). The TSR3 determination used the NSFIS innovative scenario as the base case and then included a 1,000,000 m3 uplift to mitigate the effects of the MPB infestation.

Table 1. Historical and current AAC (m3/year).

AAC Type	1996	1999	2001 (TSR2)	2004 IFPA Uplift	2005 TSR3 MPB Uplift
Conventional	1,204,250	1,204,250	1,195,550	1,195,550	1,170,971
Small Diameter Pine Partition	250,000	250,000	312,500	312,500	312,500
IFPA Uplift				330,700	330,700
Fires/MPB Uplifts		550,000			1,000,000
Total	1,454,250	2,004,250	1,508,050	1,838,750	2,814,171

The smallwood pine partition is focused on poor, repressed pine stands and represents 93,500 ha of the THLB (13%). This THLB is treated separately from the conventional harvest until it is harvested, where it then is assumed to contribute toward the regular THLB land base.

2.2 Land Base Characteristics

Approximately 72% of the TSA is considered crown-forested land (Table 2, and Figure 1), while 78% of this area is considered to be available for long term timber harvest (Figure 2).

Table 2. Land base area statistics.

Description	Area (ha)	Area (% of TSA)
Total TSA Area	1,130,064	100%
CFLB	810,412	72%
Current THLB	678,250	60%
Long Term THLB	636,809	56%

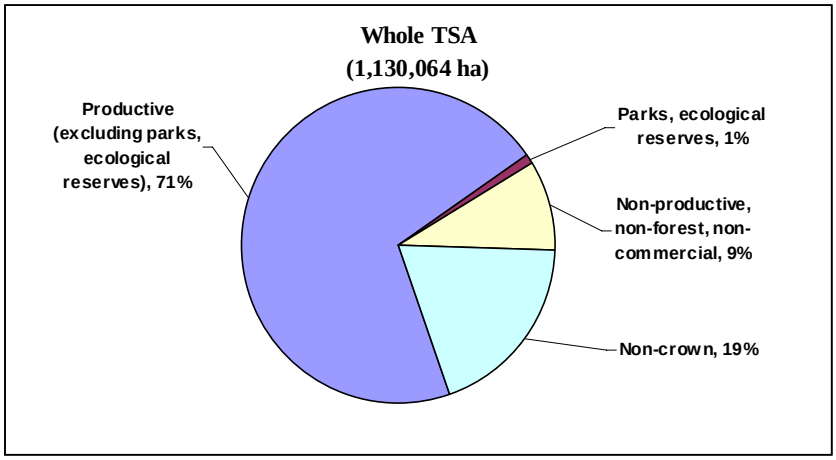

Figure 1. Distribution of landbase for Merritt TSA (IFPA).

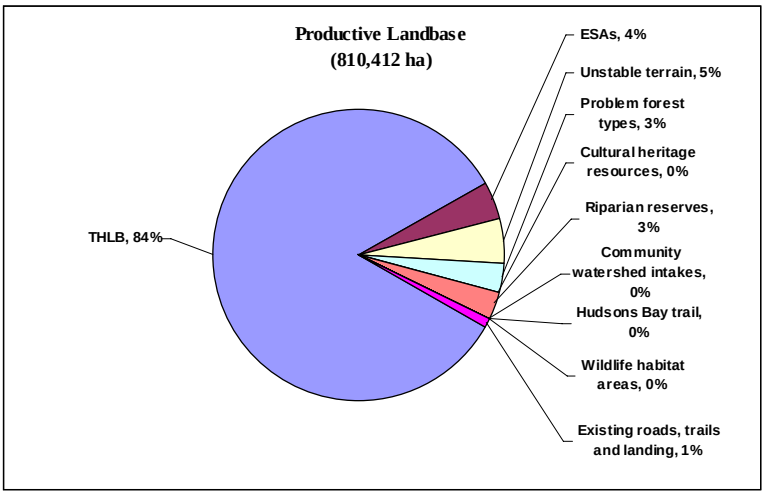

Figure 2. Classification of productive forested land base (IFPA).

2.2.1 Species Profile

The majority of the THLB consists of Pl-dominated forests (Figure 3), which puts the TSA at high risk for MPB infestation. Pl volume exists in 70% of the stands in the THLB,

with 56% of these being Pl-leading. Pl volume makes up over half of the current mature growing stock in the TSA.

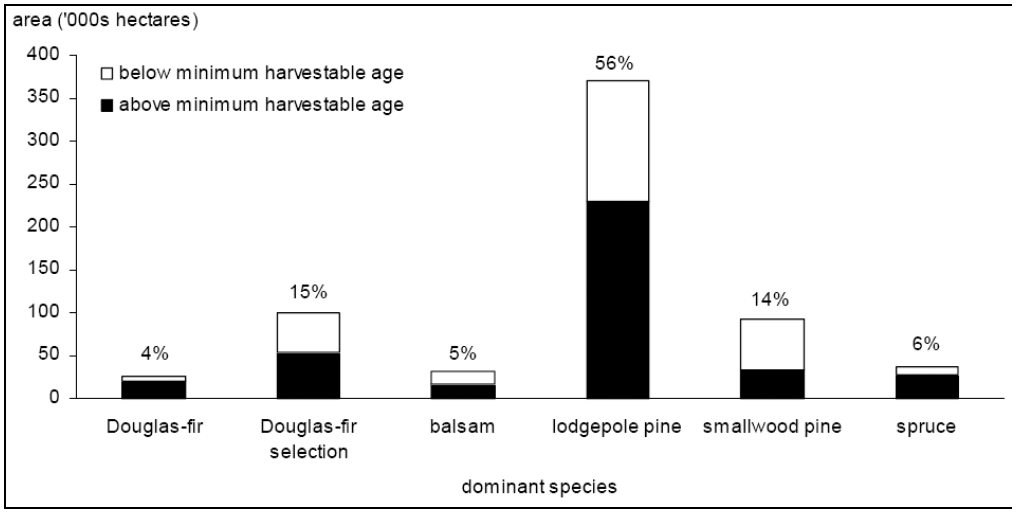

Figure 3. Tree species and site class profile on the THLB (TSR2 – 2001).

2.2.2 Age Class Profile

Approximately 45% of the THLB is between ages 90-140 (Figure 4). Approximately 60% of the stands currently on the landbase are older than Minimum harvest ages (MHA). This includes Pl stands where ~60% are older than their MHA (40-80years). Of particular concern is the lack of THLB area between 41 and 60 years of age.

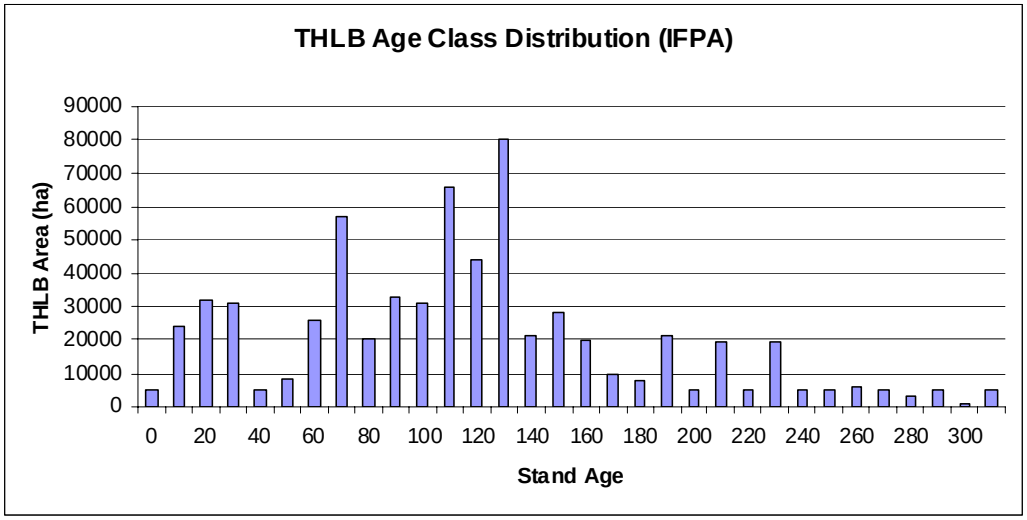

Figure 4. Age class distribution (TSR2 – 2001).

2.2.3 Site Class Profile

Approximately 55% of the THLB is Pl-leading, with almost half of this area in good-medium site productivity. Overall, 37% of the THLB is in good/medium sites, 48% is in poor sites, and 15% in Douglas-fir selection sites (Figure 5).

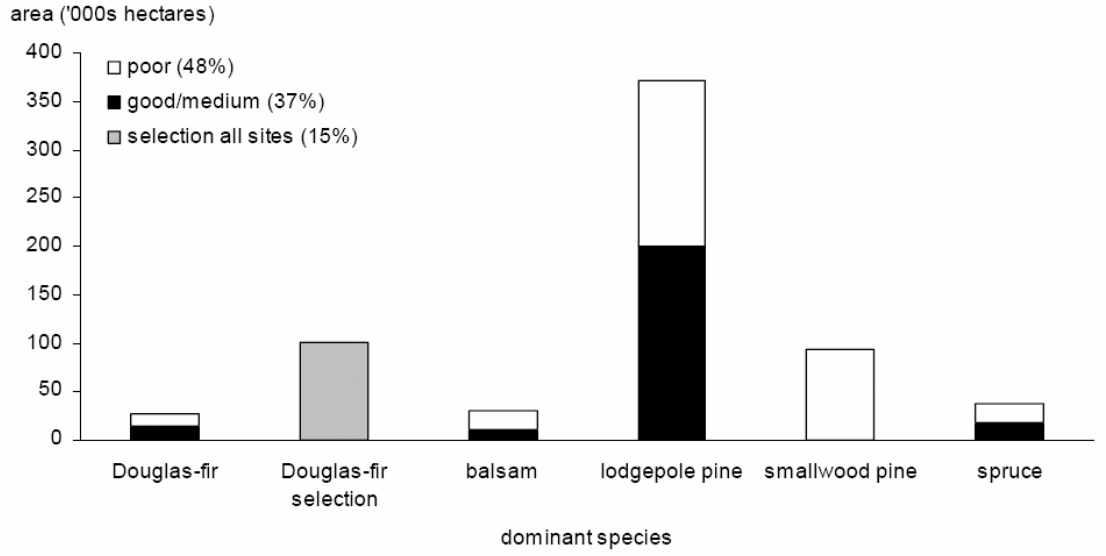

Figure 5. Site class profile (TSR2 – 2001).

2.2.4 Biogeoclimatic Profile

The majority of the THLB falls within the IDFdk (~35%), MSdm2 (~16%), and MSxk (~24%) variants. Drybelt stands were considered to be in the BG/PP/IDF plus the MSxk (63% of the THLB) (Figure 6).

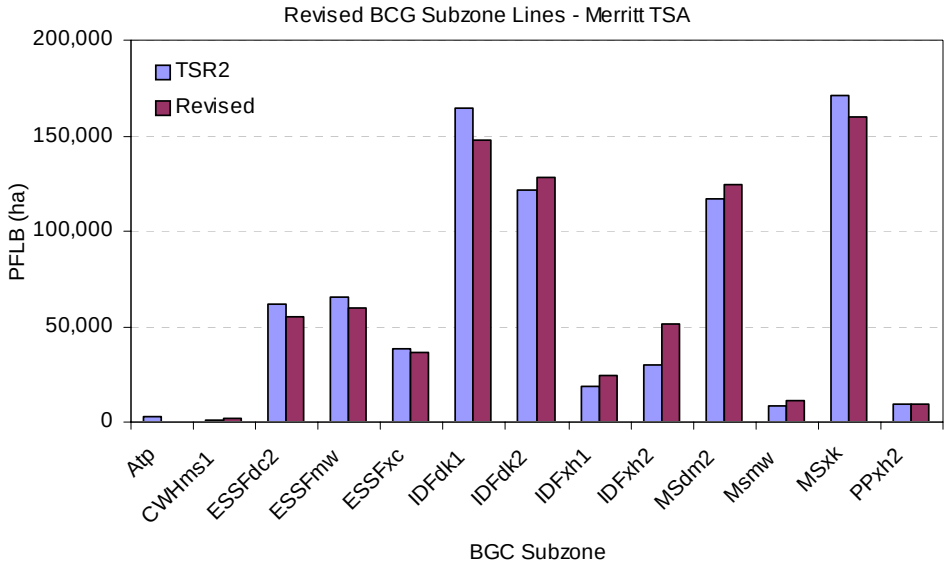

Figure 6. Biogeoclimatic profile (IFPA AAC application).

2.2.5 THLB Management Emphasis

Visual management and ungulate winter range dominate the portions of the THLB with a non-IRM management emphasis, at ~ 7% and~ 11% respectively (Figure 7)

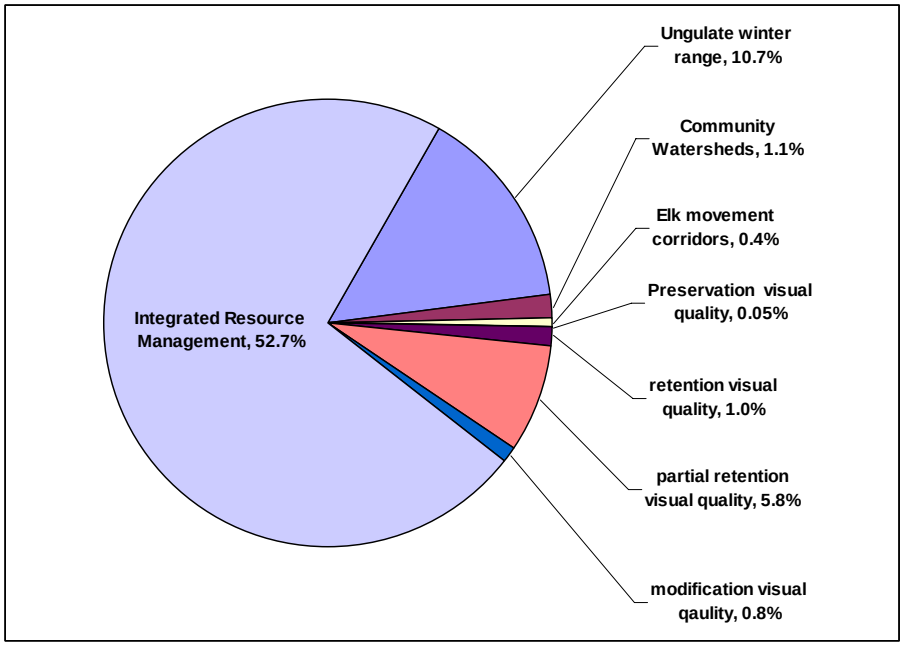

Figure 7. THLB management emphasis.

2.3 Incremental Silviculture History

Table 3 shows the incremental silviculture conducted on the Merritt TSA over the past five years. Juvenile spacing and fertilization are the only treatments that have occurred. Many of these and previous projects were driven by local employment objectives and have been directed at older managed stands.

The previous Type 1 Silviculture strategy recommended/projected a total of 5050 ha/year to be spaced, 1100 ha/year to be fertilized, and 1,103 ha/year to be pruned. Additional treatments were also recommended to regenerate or improve backlog sites.

Table 3. Incremental silviculture history for the Merritt TSA (TSR3) .

Year	Juvenile Spacing (ha)	Fertilization (ha)	Pruning (ha)
2000	59.5	0	0
2001	153.9	0	0
2002	0	0	0
2003	0	0	0
2004	0	36.3	0
TOTAL	213.4	36.3	0

2.4 Basic Silviculture Practices

The TSR3 analysis (IFPA innovative scenario) assigned silviculture regimes based on site series (PEM based). Approximately 100,000 ha of the THLB was assigned to the Fd drybelt single tree selection regime with the remainder assigned clear cutting regimes.

An average regeneration delay of 3.4 was assumed - typically 2-3 years for planted sites and five years for natural regeneration sites. Juvenile spacing to 2500 sph was assumed to occur on the natural regen stands. The analysis assumed no backlog NSR existed although it is likely that some lower productivity sites exist from historical fires.

The IFPA innovative scenario assumed net gains of 0.9-1.2% for Pl stands and 3.2% for Sx stands associated with the use of Class A seed in new plantations. The estimated gains used in the timber supply analysis were recognized as being somewhat conservative relative to slightly higher gains projected for the future by BCFS Tree Improvement Branch.

Actual 2005 seedling requests (Table 4) indicate that almost all Sx seed used is improved (8% gain) and 10.9% of Pl seed used is improved (4% gain). A higher proportion (29.1%) of Pl seedlings are considered at least B+ (typically a 3% gain).

Table 4. Seedlings requested by species and genetic class for the Merritt TSA for 2005.

Species	Class A Seedlings Requested (000s)	Class B+ Seedlings Requested (000s)	Class B Seedlings Requested (000s)	Total Seedlings Requested (000s)	Percent Classs A seedlings Requested (%)	Percent Improved Seed
Bl	-	-	7.5	7.5	0.0%	0.0%
Fd	-	-	524.2	524.2	0.0%	0.0%
Lw	-	-	64.3	64.3	0.0%	0.0%
Pli	808.5	1,343.7	5,249.8	7,402.0	10.9%	29.1%
Py	-	-	37.4	37.4	0.0%	0.0%
Sx	694.6	-	5.4	700.0	99.2%	99.2%
Grand Total:	**1,503.1**	**1,343.7**	**5,888.6**	**8,735.4**	**17.2%**	**32.6%**

Source: Seed Planning and Registry system (SPAR) - 2005 Sowing Year

The previous Type 1 silviculture strategy estimated use of Class A seed at 2000 ha/year (no specification on species). Table 5 shows the forecasted gain for improved seedlings from established seed orchards as well as the forecasted availability. In general, these projections show:

- Pl seed gains of 9-16% in the next 10 years but limited availability during much of this time.
- Sx seed gains of 8-22% in the next 10 years with almost no issues on availability.

Table 5. Forecasted gain in volume and availability for improved seed for the Merritt TSA.

SPU	Elevation (M)	SPU Seedling Need (million)	Gain From Improved Seed/Availability								
			2005				2010		2015		
			Actual Gain	Actual Percent Class A used (%)	Projected Gain	Est. % Avail.	Projected Gain	Est. % Avail.	Projected Gain	Est. % Avail.	Gross Area
PLI TO HIGH	1400-1600	5.3			11%	21%	14%	42%	16%	85%	214,183
PLI TO LOW	700-1400	13.6	4%	11%	9%	18%	12%	38%	13%	64%	248,234
SX TO HIGH	1300-1900	3.3			8%	73%	12%	118%	17%	124%	468,658
SX TO LOW	700-1300	1.2	8%	99%	9%	200%	12%	250%	22%	150%	493,383

Note: Gross areas are provided because THLB areas were not available. Areas can be overlapping between different species SPU's. SPU seedling needs are based on the previous five year average from SPAR and do not reflect forecasted needs.

3.0 Mountain Pine Beetle Situation

Figure 8 graphically illustrates the extent of the mountain pine beetle infestation in the southern interior as mapped from overview flights in 2004. Although not as seriously infested as some of the more northerly TSAs, it is possible that the Merritt TSA will face a similar scenario. Several steps have already been taken to mitigate the MPB including the 1,000,000 m3 uplift in TSR3 discussed below.

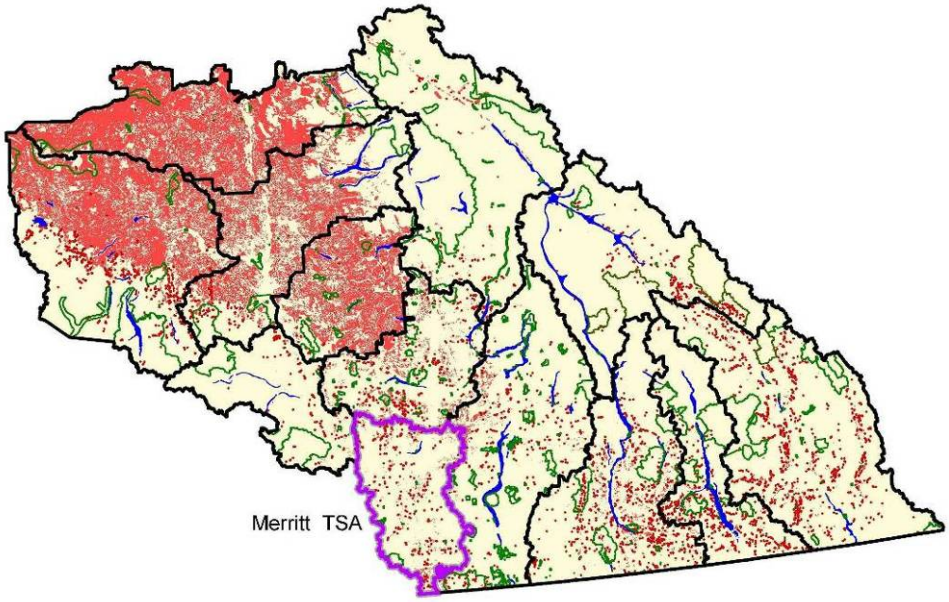

Figure 8. The extent of the mountain pine beetle infestation in the Southern Interior Region as mapped from overview flights in 2004.

Due to the fact that pine-leading stands make up more than 50% of the current growing stock in the Merritt TSA, there are potentially severe implications on timber supply. Figure 9 shows the trend predicted by Marvin Eng for yearly volume killed peeking in 2009 for this TSA at 6.6 million m3 killed/year.

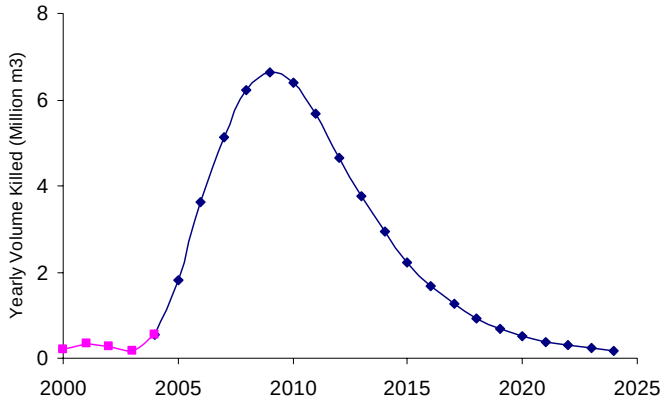

Figure 9. MPB killed volume trend (purple) and predictions of future trend (blue).

Table 6 shows projections of the cumulative pine volume killed by the MPB to 2020 (Marvin Eng 2005)[4] assuming intervention is unsuccessful.

Table 6. MPB infestation projections – cumulative volume killed to 2020 (m^3) (from Eng 2005).

		Projection Year							
		2005			*2010*			2015	2020
	Current AAC	Total Effected Area	Equivalent area dead	Equivalent volume dead	Total Effected Area	Equivalent area dead	Equivalent volume dead	Equivalent volume dead	Equivalent volume dead
THLB > 60 years	2,814,171	324,195	33,087	4,672,981	519,179	172,204	27,286,838	50,848,384	55,946,160

*

4.0 Current TSA Situation

4.1 Timber Supply Issues

4.1.1 TSR3 Base Case Harvest Forecast

The IFPA innovative scenario timber supply forecast was used as the base case for TSR3 (Scenario K in Figure 10).

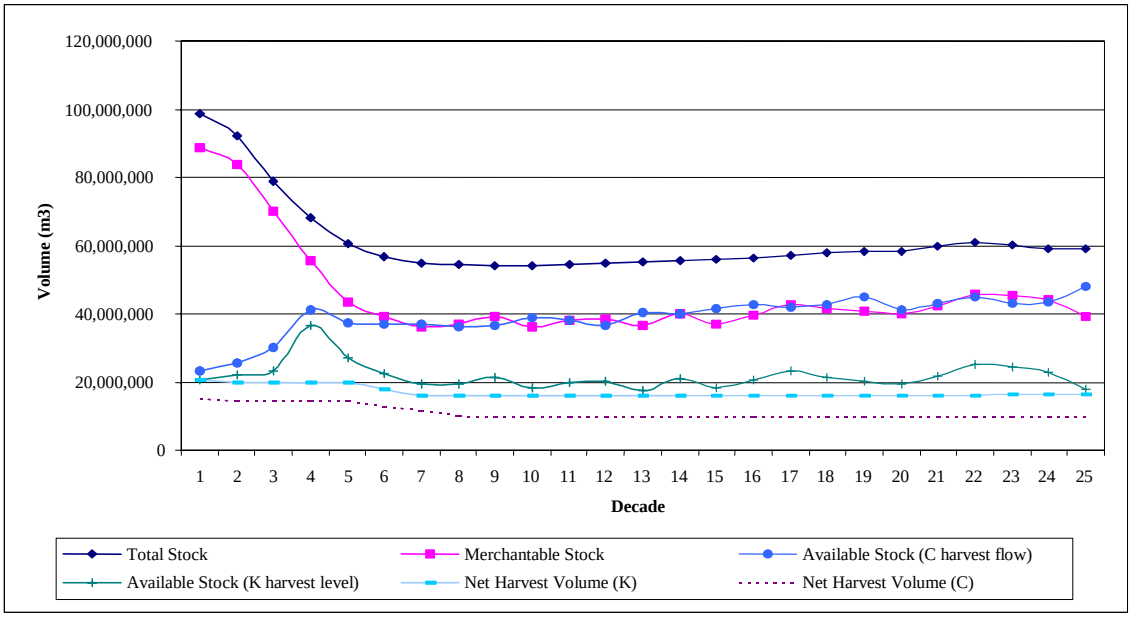

Figure 10. TSR3 base case harvest forecast (IFPA Innovative Scenario K).

Total growing stock on the THLB is ~100 million m3 and about 90% of this volume is currently merchantable (older than min harvest age). Over 50% of this growing stock is mature Pl stands that are at risk to mountain pine beetle.

Figure 11 illustrates the transition from natural to managed stands in the IPFA scenario (TSR3 base case). Timber supply pinch points exists around period 7 when harvest begins to rely more heavily on managed stands. Natural stand volumes must be

metered out for 60 years while managed stands come online. The MPB uplift and unsalvaged mortality from dispersed Pl volumes will liquidate a portion of this natural stand volume and put pressure on managed stands to come online sooner. Depending on the volume killed by MPB, managed stand volumes will be required within 40-60 years from now.

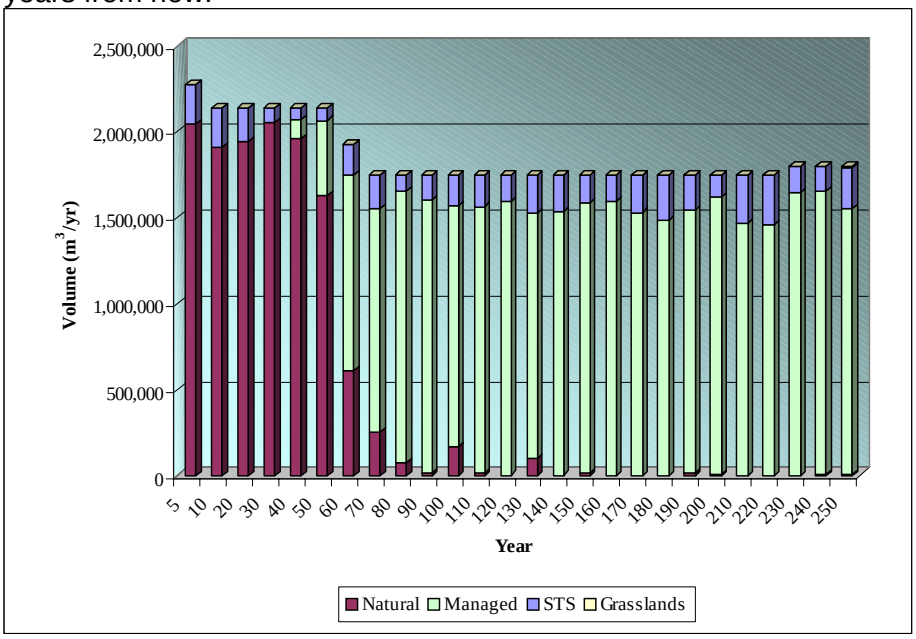

Figure 11. Harvest contribution from managed and unmanaged stands.

Figure 12 illustrates the average harvest age and harvest volume per hectare for the IFPA innovative scenario. Short term volumes are 225 m3/ha from ~12five year old stands on average, while long term volumes are 180 m3/ha from ~5five year old stands on average.

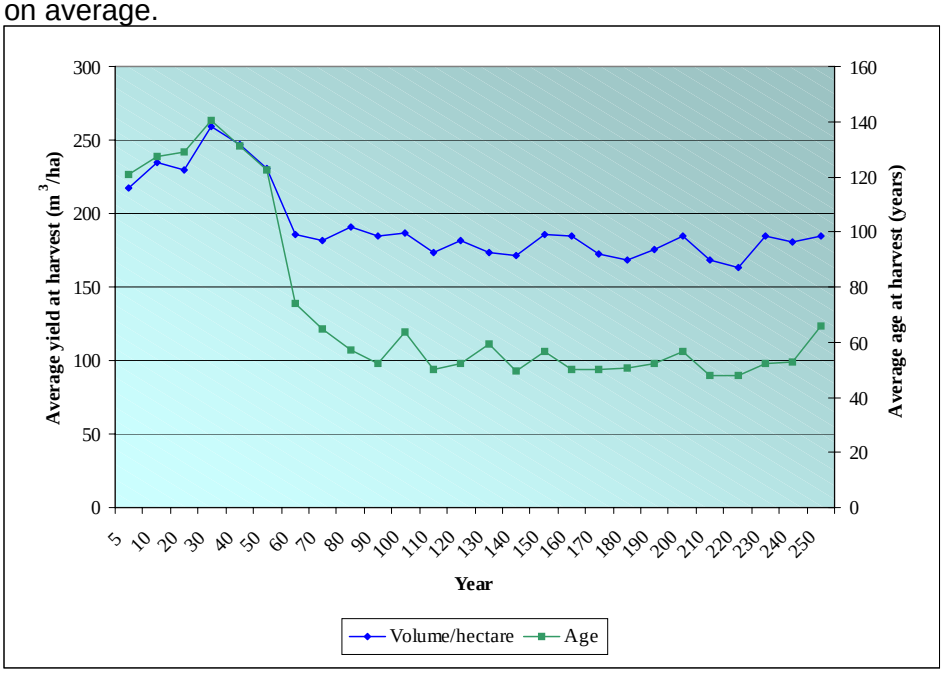

Figure 12. Average age and volume harvested over time - Merritt TSA.

4.1.2 Timber Supply Projection Including MPB Impacts

Figure 13 shows one of the harvest flow scenarios used in the TSR 3 determination. In this scenario, harvest levels are increased to 2.8 m³/year for the next five years then step down significantly over a ten-year period to 1.54 m³/year. Under this scenario a shelf life of five years is used and it is anticipated that 13.4 million m3 will still remain unsalvaged (approx. 13% of current growing stock) on the landbase. This occurs because mortality in lightly attacked stands with Pl as a minor species is not eligible for harvest until the midterm. In this scenario, total MPB mortality is modeled as ~22 million before the epidemic is assumed to stop.

The trough resulting from the short-term elevated harvest is ~ 7% below the Long-Term Harvest Level and lasts for approximately 50 years. This trough would be considerably larger/deeper if the full mortality predicted by Marvin Eng (~55 million m3) becomes a reality.

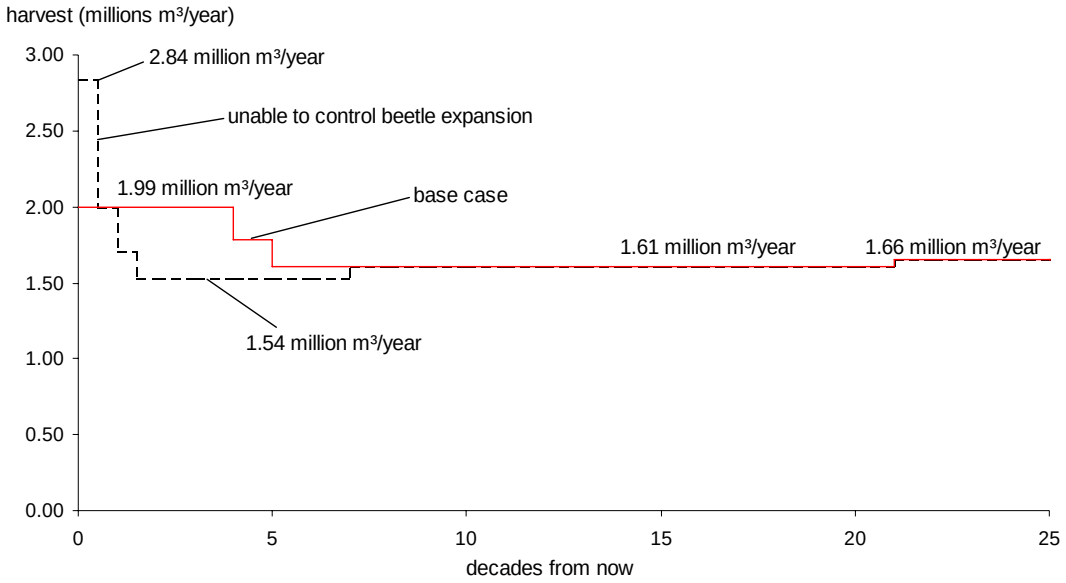

Figure 13. Timber supply outlook considering MPB infestation (TSR3).

Based on 2005 MPB expansion figures, the likely future timber supply may look similar to the projection shown in Figure 13, but could look significantly worse if the full impacts predicted by the Eng model become reality. For the purpose of developing a silviculture investment strategy, it is likely wise to hope for the best and plan for the worst, thus strategies to help fill in a midterm trough will be important.

<u>Timber supply issues to be addressed:</u>

1. Midterm Dip in Harvest Levels.
2. Unsalvaged MPB-killed timber with poor or no regeneration.
3. Reliance on non-pine leading stands.
4. Poor distribution of age classes over the long term with a potential dominance of pine.

4.1.3 Midterm Dip in Harvest Levels

As a result of the reduction in growing stock over the next 10-20 years from MPB, harvest flow will likely exhibit a midterm trough for 50-60 years. The speed at which managed stands can be brought online will have a large impact on the size and depth of this trough.

4.1.4 Unsalvaged MPB-killed timber with poor/No regeneration

As a result of the recent uplift of 1,000,000 m^3, it is anticipated that unsalvaged losses to MPB will be minimized. However, due to mixed species stands and dispersed mortality, it is expected that 13.4 million m3 may be lost over the next 10 years. These stands will have the Pl volume fall out prior to harvest but will likely still be logged and regenerated in the midterm period. It is expected that all stands with significant mortality will be salvaged unless non-timber resource objectives prevent it (WTP areas, Riparian areas, etc). These constrained stands will likely require some intervention to get regeneration established.

Additionally, there will potentially be some immature stands killed by the mountain pine beetle that will not be of merchantable size. This area could also have little or no regeneration and require intervention.

It will be key to ensure these all impacted THLB sites with no reforestation obligations are regenerated to maximum potential. If not regenerated, it will be critical to understand the extent of the impacts as they are represented in non-recoverable losses or stand volume reductions.

4.1.5 Reliance on non-pine leading stands

Harvesting 40-80 years in the future will likely rely more heavily on non-pine leading stands. Many of these stands are constrained (MDWR) or required alternative management techniques (VQO's, Drybelt Fd Selection, etc.)

4.1.6 Poor distribution of age classes over the long term with a potential dominance of pine.

Given the magnitude of area affected by the mountain pine beetle across many age classes (as low as 30 years to 200+ years old) there will be a large shift of area into a narrow age class. This area will in turn become available for harvest again at the same period in the future. As well, if this area is dominated with pine, it will once again become susceptible to a major MPB epidemic.

The previous Type 1 did not address this issue, although it did suggest a greater mix of species be planted to address root disease.

4.2 Timber Quality Issues

The current provincial target for premium sawlog production is 10% of a TSAs AAC. Premium sawlogs in this TSA are considered to be house logs, peelers, or logs that will produce MSR lumber and is presently estimated at less than the 10% provincial target.

In general, the average age of harvested stands is declining over time as we move into the harvest of shorter rotation second growth managed stands. The midterm timber supply deficit caused by the MPB will accelerate this trend because very young managed stands will be the primary source of harvest toward the end of this period. As a result, timber quality will decrease during the deficit period along with average piece size.

The main timber quality issues to be addressed are declining piece size and reduced potential for MSR lumber with shorter rotations.

4.3 Habitat Supply Issues

The rate of change in climate over the last 100 years is equivalent to the rate of change of the preceding 1000 years. Rapid change in climate is an overarching pressure on the forests affecting both timber and environmental values.

Almost all other TSAs in the province have over-arching land use plans (LUP) including established protected areas to provide landscape level protection for environmental values. In Merritt, measures to protect biodiversity have been enacted through policy approaches, and legislation designed to protect specific values, but Provincial Protected Areas Strategy ecosystem representation (Goal 1 areas) and rare ecosystems and features (Goal 2 areas) have not been established. Low biodiversity emphasis has been applied to a majority of the landscape units and zones within the TSA. Low biodiversity is defined as high risk with a low probability of sustaining forest biodiversity.

Changes in hydrology can be estimated by equivalent clear cut area (ECA) and road density. The higher the ECA and the higher the road density, numbers of stream crossings and ditching; the greater the risk to increased peak flows and changes in channel morphology. Risk can be reduced through speeding hydrological green-up and increased emphasis on maintaining vegetation within riparian ecosystems. This is especially important in the following areas.

1. All fish-bearing streams and streams containing Coastal Tailed Frog.
2. Wetlands
3. Temperature sensitive streams
4. Watersheds linked to community and domestic use.

The loss of mature and old forest (pine and pine mixed with other species) over the next 5 – 10 years will have significant impacts on associated aquatic, terrestrial and water values. Old growth areas are being drafted for the Merritt TSA, consistent with the Provincial Old Growth Order (http://srmwww.gov.bc.ca /rmd/oldgrowth/). These areas are being avoided for harvest, but resources are lacking to field check, monitor or respond to forest health considerations in OGMAs. Where possible, OGMAs can be designed to minimize MPB risks by selecting mixed species stands, where these are available. Elsewhere, uniform stands of pure pine (e.g. some Montaine Spruce subzones) limit opportunities for mixed species retention. In sites like these, replacing OGMAs infested by MPB may not be possible. Silviculture strategies may provide an opportunity to improve future condition of OGMAs.

Clearcut harvesting to remove infested pine from mixed stands, extensive clearcuts in pine-dominated watersheds, and intensive large scale fires limit stand structures

that serve to connect suitable habitat across a landscape. Loss of stand structure and habitat can cause disproportionate impacts to species at risk or those confined to isolated pockets of suitable habitat. There are no objectives for maintaining connectivity in the Merritt TSA. Some connectivity was achieved through species specific initiatives such as Elk corridors but since telemetry results showed elk in other areas, the area in elk corridor is being applied to other conservation initiatives. OGMAs can also provide some connectivity, but in low biodiversity landscape units, there will be insufficient connectivity provided by OGMAs. Depending on species composition and clear cut levels, areas managed for moderate or high biodiversity may also require additional management for connectivity. Focused retention and silviculture strategies in riparian areas will help provide connectivity. Mapping pine stands, OGMAs, retained riparian areas, retained WTPs and other reserves by watershed and will help identify deficiencies and focus priorities for both retention and silviculture.

There are no objectives for managing patch size in the Merritt TSA. The large cutblock strategy considers and incorporates patch size considerations, but the strategy was not designed to be implemented at the scale or for the purpose of addressing mountain pine beetle infestations. MPB has the advantage of promoting larger patch sizes in landscapes that traditionally experienced large scale disturbances. However, salvage harvesting is in many ways different from what would occur in nature, and the extent and intensity of current infestations may be exceeding historical scales of disturbance. Managing to maintain a continuous supply of the various patch sizes over space and time poses a daunting task when overlaid by MPB patterns of infestation. Nevertheless, this deserves to be considered as part of silviculture planning.

Wildlife trees are managed in the TSA through provisions in the forest and range practices act and a local Douglas fir retention policy. Direct impacts of MPB infestation can enhance supplies of wildlife trees and CWD, at least in the short to medium term but, actions such as salvage, road building, and safety issues associated with roads, replanting and stand tending may result in the loss of higher value large diameter fir, larch, ponderosa pine and deciduous wildlife trees and CWD. Wildlife trees and CWD are also vulnerable to intensive fires promoted by climate change and large supplies of MPB killed pine. Strategies to retain coarse woody debris, wildlife trees and wildlife tree supply through time are a critical part of silviculture planning.

Many species at risk or of management concern are negatively affected by roads and roads will increase significantly to manage the forest and salvage MPB. The potential for impact to many species including grizzly bear, tailed frog, moose, salmon and various other fish species is of serious concern. Increased emphasis on managing road impacts is warranted. Opportunities to do this have been defined for Grizzly Bears (recovery plan), Moose (policy guidance), Bull Trout and Coastal Tailed Frog(WHA accounts), etc.

Cattle use in association particularly with riparian areas and newly planted areas will continue to be a concern for managing both habitat and timber supply. When designing silviculture treatments, consider, retain and enhance existing barriers to cattle access associated with riparian areas.

Two natural disturbances types (NDTs) characterize the area where pine and fir forests dominate in the Merritt TSA (Biodiversity Guide Book 1995).

1. NDT 3 (Ecosystems with frequent stand-initiating events)

   Absence of fires has increased the mature and old pine component, which provides the MPB a higher than natural level of host trees.

2. NDT 4 (Ecosystems with frequent stand-maintaining fires).

   Absence of understory fires has resulted in a high level of in-growth, resulting in unnaturally high density (especially in the under-storey) Douglas-fir stands. There is also concern that catastrophic wildfires may occur due to the high fuel accumulations associated with dense stands, and a shift from ground fires to crown fires. Spacing in these stands could provide long term habitat and wildfire management benefits.

Table 7 lists representative examples of wildlife species in the Merritt TSA that could be negatively affected by MPB salvage logging.

Table 7. Old and mature forest associated species.

Species/ ecosystems	Forest dependency	Habitat supply implications
Creek resident trout streams	Cool streams	Hydrologic recovery, green up water quality, quantity, riparian and watershed condition
Bull Trout	Cool streams	Hydrologic recovery, green up, water quality, quantity, riparian and watershed condition
Lewis's woodpecker	Stand structure	Mature trees, aspen, supply of deciduous
Williamson's Sapsucker	Stand structure	Mature trees, aspen, supply of deciduous
Grizzly bear	Road sensitive	Access management, rehabilitation roads
Wolverine	Road sensitive	Access management, rehabilitation roads
Fisher	Stand structures CWD Landscape connectivity	Continuity of habitats across landscape through time.
Northern goshawk	Mature forest stands	Larger old mature forest stands
Flammulated owl	Mature forest	Old forest habitats
Pine marten	Stand structure overstory plus CWD Landscape connectivity	Continuity of habitats across landscape through time.
Moose	Riparian condition Hiding cover	Thermal and hiding cover
Mule Deer	Old forest and understory	Old forest stand structures
Elk	Migration cooridors	Loss of hiding cover
Salmon Streams	Cool streams	Hydrologic recovery, green up, Water quality, quantity, riparian and watershed condition
lodgepole pine / trapper's tea / crowberry	CDC red listed	Requirtes identification
lodgepole pine / Pacific rhododendron	CDC red listed	Requires identification
Douglas-fir - lodgepole pine / kinnikinnick Dry Submaritime	CDC red listed	Requires identification
lodgepole pine / Altai fescue / foam lichens	CDC blue listed	Requires identification
lodgepole pine / common juniper - falsebox	CDC blue listed	Requires identification

Douglas-fir - lodgepole pine / kinnikinnick Moist Submaritime	CDC blue listed	Requires identification
Douglas-fir - lodgepole pine / kinnikinnick Moist Submaritime	CDC blue listed	Requires identification
lodgepole pine / kinnikinnick / clad lichens	CDC yellow listed	Requires identification
lodgepole pine / pinegrass - arctic lupine	CDC yellow listed	Requires identification
lodgepole pine / common juniper / arctic lupine	CDC yellow listed	Requires identification
lodgepole pine / peat-mosses	CDC yellow listed	Requires identification
lodgepole pine / grouseberry - kinnikinnick	CDC yellow listed	Requires identification
lodgepole pine / grouseberry - pinegrass	CDC yellow listed	Requires identification
odgepole pine / grouseberry / red-stemmed feathermoss	CDC yellow listed	Requires identification

5.0 Summary of TSA Issues by Period

5.1 Short term

No timber supply issues exist in the short term as the current AAC will be maintained or increased to salvage MPB impacted wood. Timber quality will remain relatively constant with historical levels, although a higher proportion of Pl is expected and could reduce the Fd peeler volume required by certain mills in the TSA.

Habitat supply issues exist in the short term as a result of an AAC uplift and salvage and/or MPB mortality. Pressure will be put on habitat values and watersheds by elevated harvest levels, loss of older Pl stand types, and increases in the amount of active road.

5.2 Midterm

The midterm is likely to experience significant reductions in timber supply relative to TSR3 base case projections. Salvage harvesting will have ended and harvest will be focused on remaining mature non Pl stands. Harvesting of these currently existing natural stands will occur in the front and middle portions of the midterm trough, while the back end will be made up of the first managed stands coming online. These stands will be very young and have small piece size, and thus will put intense pressure on the log quality profile.

The supply of habitat needed to maintain current fish and wildlife populations and maintain biodiversity complexity will be at high risk because the remaining mature and old forests will be diminished in extent and fragmented in distribution. In addition, it is expected that remaining mature and older forests will be under pressure to provide timber harvesting opportunities. At the start of the midterm, many watersheds will have high ECA's from the impacts experienced in the short term and further harvesting will create significant hydrological risks. In addition, some of the tools originally designed to help maintain biodiversity will have been severely impacted by MPB (OGMA's, WTP's, Riparian Areas, Parks, etc). Even areas left unharvested and untreated will go through a

period where there is little remaining CWD. Species such as pine marten will find little suitable habitat. Only the live tree species left today will be available to bridge the midterm habitat supply gap.

5.3 Long term

Long term harvest levels are projected to be above midterm levels but could fall below the potential shown in TSR3 because of poor or no regeneration on MPB impacted sites that have no reforestation obligations. Long term harvest levels are most sensitive to the size of the THLB and estimates of the productive capacity of the land base.

The current TSR3 base case reflected an adjustment of site index for second growth stands based on unique ecosystem combinations (using predictive ecosystem mapping polygons, soil, drainage and elevation class). Site index adjustment processes were completed for three different strata within the Merritt TSA: low elevation even-aged stands, high elevation even-aged stands, and smallwood stands. Only the low elevation stand adjustments were fully accepted by the Chief Forester in his AAC determination and they resulted in significant improvements timber supply.

Timber quality may improve over that experienced at the back end of the midterm trough but it will remain depressed relative to current levels because of short rotations and focus on volume production.

Environmental values, including habitat quality and quantity, will likely have recovered somewhat from the worst period near the front of the midterm trough, but will remain under pressure indefinitely due to an extensively roaded land base growing timber on short rotations (50-100 years). In addition, climate change has the potential to change ecosystems and species habitats in dramatic ways in the long term.

6.0 Opportunities to Address TSA Issues

Prior to the district workshop, background information was used to identify silvicultural strategies having potential to address timber and habitat issues at the TSA level. Each of these potential strategies was discussed during the workshop to clarify or refine them and/or add new strategies. Each strategy was assigned an effective opportunity area based on data and local knowledge. The impact on Timber Supply, Quality and Habitat were estimated and each strategy was given a ranking of High, Medium or Low as shown in Table 8.

Table 8. Summary of potential silviculture strategies to address TSA issues.

Strategy	Opportunity in Next five years (ha)	Timber Supply Effects			Quality	Habitat	Cost/ha ($)	Rank
		Short	Mid	Long				
TS1a-b. Late rotation fertilization (40-80years old) non Pl	3,406	++	++		+	+/-	400	H
TS1c-d. Late rotation fertilization (81+years old) non Pl	23,115	+	+		+	+/-	400	M[5]
TS2 a-b. Young stand fertilization (non Pl)[6]	8525		+++		+	++	400	H
TS3. Space + Fertilize Repressed Pl stands	Limited		+	+++	+	++	1000	L
TS4a. Spacing drybelt Fd thickets [7]	5,000		++	+++	++	++	600	H
TS4b. Spacing young dense Fd or Sx leading stands (non-drybelt)	1000		++	+++	++	+	600	M-L
TS4 e. Spacing high value stands where CT is anticipated	100		++	+++	++	++	600	L
TS5. Planting THLB sites with no reforestation obligations (timber focus)	3,000		+	+++		+++	1000	H
TS7a-b. Address Backlog Issues (NSR and impeded stands)	491		+	+		-	1200	L
TS7c Rehab roads and landings (timber focus)	100			+		++	5000	L
TQ1a Pruning previously pruned Fd	100				++	++	800	H
HS1. Planting NonTHLB sites with no reforestation obligations (habitat focus)	10,000					++	1000	H
HS3. Spacing/thinning in NDT4 to improve habitat (ingress / encroachment)	5,000		+	+	++	++	600	H
HS7. Rehab roads and landings (habitat focus)	200		+	+		++	5000	H[8]
HS8. Treat for invasive species (spray/pull/plant/etc)	2000		+	+		++	100	H

Note: +/- rankings shown above are subjective rankings assigned by the authors after the workshop.

The following sections provide additional detail on the potential strategies.

6.1 Potential Strategies to Improve Timber Supply

The following table (Table 9) provides detail regarding potential timber supply strategies. It reflects discussions within the workshop and is meant to add clarity around the strategy and how it was ranked.

Table 9. Timber supply strategies.

Strategy	Workshop Comments / Discussion	Anticipated Benefits	Timing of Benefit
TS1a-b Late rotation fertilization of near mature Fd and Sx stands (40-80years old stands where moisture is not limiting)	These stands will be candidates for harvesting near the front end of the trough. The intent is to add volume to these stands to reduce the depth of the front end of the trough. Focus is Fd stands first as it has a greater response than Sx. Moisture limited sites (drybelt) should be avoided. Priority = High (one of the few opportunities to influence the front end of the trough)	Fd -17m^3/ha per application.[9] Sx -11 m^3/ha per application. Benefit realized over 10 year period.	Short to Midterm
TS1c-d Late rotation fertilization of older Fd and Sx stands (81-140years old stands where moisture is not limiting)	These stands will be candidates for harvesting near the front end of the trough. The intent is to add volume to these stands to reduce the depth of the front end of the trough. Moisture limited sites (drybelt) should be avoided. Priority = High as a trial. Response is less certain as data is limited on treating older stands; therefore a trial is suggested for stands at the younger end of the range.	No North American data but response could be similar to younger stand benefits described above.	Short to Midterm
TS2a-b Young stand fertilization (Fd and Sx - where moisture is not limiting)	These stands will be candidates for harvesting in the mid-back end of the trough. The intent is to add volume to these stands more quickly through several fertilizations at 10 year intervals. This will make these stands available sooner or have more volume at time of harvest. Moisture limited sites (drybelt) should be avoided. Priority = High. The intent is to focus on Fd first and Sx as a trial, some concerns around terminal weevil. *Once the risks associated with MPB are reduced, treatment of younger Pl stands will become a high priority with very large potential benefits.*	Fd - 17m^3/ha per application. Sx - 11 m^3/ha per application. Benefit realized over 10 year period.	Back end of Midterm
TS3 a-b. Space/fertilize repressed Pl	Several recent small scale studies have shown spacing and fertilization of these stands has the potential to break them out of their stagnant condition and promote height differentiation. Priority = Low due to uncertainty of success.	Bring stands back into the THLB (~150m3/ha) or improve their merchantable volume (~100 m3/ha).	Mid to Long Term
TS4a Spacing (drybelt Fd)	Spacing in layer 3 to thin out stagnant thickets will help to realize more merchantable volume in subsequent entries. Some stands will also require treatment of layer 2 into order to achieve the objective. Priority = High – lots of potential area and both timber and non-timber benefits achieved (habitat, urban interface fuels reductions, etc)	It was assumed that an additional entry into the stand would be possible if treatment occurs (15-30m^3/ha).	Mid to Long Term
TS4b. Spacing young dense Fd or Sx leading stands (non-drybelt)	Spacing of younger even aged stands to realize merchantable volume more quickly, particularly if combined with subsequent fertilization, perhaps several times, further reducing the time to merchantability. In Merritt it is not clear what the actual area is in this category of stands. TSR 3 information and RESULTS provide very different information. While this strategy is included in the desired funding scenario, it is dropped under more constrained funding.	Benefit here is mostly the promotion of a suitable stand for a subsequent fertilization adding 11-17 m3/ha.	Back end of Midterm

Strategy	Workshop Comments / Discussion	Anticipated Benefits	Timing of Benefit
TS4 e. Space high value stands where CT is anticipated	Not many stands available where CT would pay, should try some in non-PI stands. Priority = Low due to limited stand availability.	Opportunity to improve piece size/wood quality and provide a stand entry in the midterm	Mid to Long Term
TS5. Planting THLB sites with no reforestation obligations (timber focus)	Ensuring that all of the THLB is promptly regenerated will have significant timber supply and habitat supply benefits. Candidate areas are stands killed by MPB and/or other natural mechanisms and not salvaged and therefore have no reforestation obligations on them. Planting under dead stems may be an option if done quickly - need to work with WCB to allow access – although there is concern over future access for other treatments (spacing, brushing, etc). Planning will be needed to identify suitable areas and approaches. Priority = High. One of the most cost effective ways to improve timber supply and habitat supply. Habitat supply would benefit most from regeneration in highly impacted/ high risk watersheds.	Maintain productivity of the THLB	Mid to Long Term
TS7a. Address Backlog Issues (NSR and impeded stands)	The current backlog situation is well in hand in Merritt – estimate of the amount of area available for these treatments are small. Priority = Low	Maintain productivity of the THLB.	Mid to Long Term
TS7b Rehab roads and landings	This treatment is aimed at putting more ground into timber production. MoE considers this treatment as a major priority as the around or open road is seen as a major problem for wildlife. Priority = Low from a timber perspective (see HS7 below) because of high cost and poor tree growth on these sites. Better to focus efforts on not creating as much road in the first place and/or develop an access management plan.	Increase the size of the THLB	Mid to Long Term

6.2 Potential Strategies to Improve Timber Quality

The following table provides detail regarding potential timber quality strategies discussed in the workshop.

Table 10. Strategies to improve timber quality.

Strategy	Workshop Comments / Discussion	Anticipated Benefits	Timing of Benefit
TQ1. Pruning	Clear logs are not a priority for the TSA, but the pruning that was done under a previous incremental silviculture program was conducted with the assumption that a second lift would occur to complete the first half lift. Without that second lift the initial investment is viewed as dubious. Priority = High for previously pruned stands needed second lift.	Some high value clear Douglas-fir on a small area.	Mid to long term.

6.3 Potential Strategies to Improve Habitat Quality

The following table provides detail regarding the potential habitat supply strategies discussed in the workshop.

Table 11. Strategies to improve habitat quality.

Strategy	Workshop Comments / Discussion	Anticipated Benefits	Timing of Benefit
HS1. Planting NonTHLB sites with no reforestation obligations (habitat focus)	Reforestation of non-THLB areas impacted by MPB or other natural disturbances can improve habitat quality. The intention is to plant trees and/or shrubs with a habitat focus (use of broadleaves, diverse spacing, etc). Intent is to treat without removal of dead stems so there is a need to address this quickly by working with WCB to allow access. Some danger tree removal may be necessary. Potential candidate areas include heavily impacted protected areas/areas of interest, riparian reserves/management zones[10], WTP's, and potentially OGMA's. Priority = High	Improved habitat quality hydrologic recovery, improved recovery of pine dominated riparian habitats in terms of shade and reductions in stream temperature,	Continuous
HS3 Spacing (drybelt Fd)	An integrated strategy incorporating timber and habitat objectives is needed. Focus on cover objectives (e.g., mule deer winter range) and/or removal of ladder fuels from a habitat perspective. Habitat-specific treatments would aim to reduce ingress / encroachment in historically open stands. Priority = High	Improved stand structure in drybelt Fd types. Reduce crown fire risk, and a shift back towards highly dense stand structures with more understory.	Short to Midterm
HS7 Rehab roads	Restrict access to areas by rehabilitation of dead-end spurs in blocks and landings – especially large landings. Other roads should be looked at within a coordinated access plan. Some screening along access that can't be rehabbed may also help. A priority for MoE in Merritt. May be interest in upsizing culverts in some heavily impacted watersheds, anticipating increased flows. Priority = High	Road density reduced, screening along roads, providing less access for predators and human disturbance, sediment reduced. Also upsizing culverts to improve flow in impacted watersheds.	Continuous
Control of invasive species.	This was not discussed at the workshop but identified by MOE post workshop.	Protection of native species by control of invasive species.	Continuous

6.4 General Stewardship Strategies

The following table provides a list of general strategies that will assist in meeting the TSAs issues (timber supply / timber quality, habitat supply) but are not considered incremental silviculture strategies because they:

- fall under basic licensee silviculture obligations, or
- are considered outside the scope of a silviculture strategy (i.e. harvesting practices), or
- are information gathering requirements.

Table 12. General stewardship strategies.

Strategy	Workshop Comments / Discussion
1. Minimize regen delay	Decrease regeneration delay and get stands online sooner (especially with all previous pine leading stands). Planting instead of relying on naturals may be considered in some ecosystems in the TSA. Considerations - MoE does not want planting to reduce biological complexity, and some local licensees have just started to encourage more natural regeneration.
2. Utilize improved planting stock (best available) whenever possible.	Get stands online sooner or with more volume.
3. Protect growing volume for use in the midterm. (Non Pl species in mature stands and/or advanced regeneration)	Avoid harvest of non Pl during salvage period as this directly affects the midterm trough in wood and habitat supply Retain areas with advanced regeneration as this affect the long term habitat and wood supply. Need to keep green timber growing and available for deficit period (midterm).
4. Partial Harvest during Deficit Period	In constrained areas (Mule deer winter range and visual areas) – to realize some volume sooner in front end of trough.
5. Ensure Flexibility around Minimum Harvest Ages (midterm only)	TSR 3 assumptions suggest there is flexibility to lower minimum harvest age, allowing significant short term flexibility to harvest younger stands which could dramatically improve the midterm timber supply situation with relatively small long term consequences.
6. Protect growing volume from forest health threats	Mostly protecting Fd from budworm and Sx from weevil – to ensure stands are available to contribute to the midterm deficit period. MoE had some concerns about the use of Btk (non-target Lepidopera etc.).
7. Manage Tree Species for Diversity	Retain or establish non Pl species, including broadleafs during spacing, thinning or planting. (relates to timber supply strategies – if not in TSR, it should be considered for the future)
8. Vary regenerated stand spacing	Leave clumps, low and high densities to also encourage a diversity of products and habitats. (relates to timber supply strategies– if not in TSR, it should be considered for the future)
9. Complete an Access Management Plan	Watersheds with high wildlife values or extensive road systems. Need to limit access within forested land base when so much of it will be opened up all at one for salvage purposes.
10. Complete Retention Planning associated with salvage	TSA needs to complete BMP's for salvage of timber and spatially identify areas where salvage is a lower priority than non-timber values.

7.0 Working Targets

The following working targets were created using the current TSA situation as outlined in this document. The targets reflect what the TSA would like to achieve through the implementation of this silviculture strategy. It is recognized that it may not be possible to achieve all of the targets because of limited budgets or conflicts between targets, but they are presented to help frame high level objectives of the TSA.

7.1 Timber Supply Targets – High Concern

Short Term (0-20)

- AAC uplift to a level required to capture most of the MPB mortality.

Midterm (30-70 years)

- Minimize the depth and duration of the midterm trough.

Long Term (70years+)

- Maintain TSR3 long term harvest level at or near the productive capacity of the land base (~1.61 million m3/year).

7.2 Timber Quality Targets – Low Concern

Midterm

- 10% premium logs – house logs/peelers / MSR lumber

Long Term

- 10% premium logs – house logs/peelers/ MSR lumber

Overall the intent is favour timber supply strategies over quality strategies where resources are limited.

7.3 Habitat Supply Targets – High Concern

Overall Objective

- Minimize negative impacts on water resources, ecosystems and species:

Short Term

- Retention strategy developed (20% of THLB). Stand and landscape level retention strategy developed for short-term retention to optimally mitigate impacts to environmental values.
- Reforest 50% of WTP / OGMA / RMA's / other areas identified by retention strategy, to reduced stocking levels and appropriate alternate species where appropriate (highly impacted areas in need of reforestation).
- Increased levels of broadleaf trees and other appropriate species on the land base

Midterm and Long Term

- Maintain or improve the conservation status of all species (ensure forest practices do not make it worse)

8.0 Silviculture Strategy

This section summarizes the preferred silviculture strategy developed at the Merritt TSA workshop. First, the high priority strategies are outlined and then three different 5-year implementation plans/budgets are presented.

The *idealized plan/budget* reflects TSA needs over the next five years and was not constrained by anything other than the availability of stands for treatment, desire to complete the treatments, and logical timelines for treatments. This plan balances well the priorities of the workshop participants for timber supply and habitat.

The original intent was to produce a *constrained plan/budget* reflecting a five year flat-line budget consistent with historical funding levels for incremental silviculture[11]. This plan/budget was meant to illustrate where resources would be allocated if resources were limited. However, participants felt that when the limited funding was spread out between the timber and habitat targets, neither objective would be well-served. As well, many uncertainties exist in Merritt regarding the amount of appropriate and feasible treatment area for timber supply silviculture strategies, and investment in habitat strategies was expected to indirectly provide timber supply benefits in the future. For those reasons, the group designed *two constrained plans/budgets* – one with a habitat focus and one with a timber focus. The habitat focused budget best reflects the investment desires of the TSA. The silviculture focused budget was added to indicate where the TSA would invest dollars if budgets had to be spent on projects directly linked to timber supply.

8.1 High Priority Strategies

The workshop group in the Merritt TSA considered the following strategies to be high priority for implementation in the next five years. The treatment of Pl stands was avoided during this time period because of the risk associated with MPB. The strategies are presented in the order they were considered, not listed in order of importance.

Late Rotation Fertilization (40-80 year old Fd and Sx stands where moisture not limiting)

Late rotation fertilization was identified as one of the only means of making more volume available at the front end of the midterm timber supply trough and is seen as the most cost effective method of fertilization[12]. Fertilization is restricted to the wet belt other than on a trial basis due to moisture limitations in the drybelt. Fd stands were considered more desirable to treat due to the higher volume gains compared with Sx stands. Less than 3,300 ha of prime candidate area (non Pl, non-drybelt, 40-80 years old) exists so this strategy is limited in it impact. There is significantly more opportunity in stands older than 80 years (~23,000 ha) but it was felt that treatment of these stands should be limited to operational trials only.

Young Stand Fertilization (15-40 year old Fd and Sx stands where moisture not limiting)

Fertilization of younger stands was identified as a good opportunity to add volume to the middle and back end of the midterm timber supply trough. Fd was considered the more desirable species to treat due to higher volume gains and the concern of leader weevil attacks in young Sx stands[13]. These stands will provide options for multiple treatments prior to harvest and can therefore provide a larger net impact if funding can be sustained over several decades. The risks

associated with this treatment are the long timeframes over which the investment must be held and protected from loss (i.e. pests or other natural disturbances). There is some question in the Merritt TSA regarding the availability of applicable stand types (likely less than 8,500 ha currently) and there are concerns about weevil damage for Spruce.

Planting for Timber Values

Benefits were identified for planting impacted areas of the THLB that have no reforestation obligations. Planting these sites will provide future volume and ensure timely access to the remaining mature timber in heavily impacted watersheds or landscape units. Initially the focus will be on previously burned areas (i.e. Lawless fire) because salvage in the Merritt TSA is expected to mostly capture concentrations of pine mortality, however marginal economics and other factors may results in some stands being missed. Depending upon the site, natural regeneration may be slow or unable to reforest the site. This includes young Pl stands and plantations impacted by MPB.

There are numerous logistical challenges for this strategy. First, areas have to be identified that will not (likely) be salvage harvested. Second, areas need to be prioritized to identify those that would benefit from artificial regeneration (i.e. not regenerate naturally for a long period) and would best help non-timber values. Third, work must be coordinated with WCB to ensure safe working conditions for planters and those who follow. Fourth, seedlings need to be ordered and paid for. These concerns need to be addressed as soon as possible to allow for timely implementation of this strategy. A staged approach will be required to deliver this strategy: year one and two funding is identified for planning and seedling orders while planting does not begin until year three.

Pruning for Timber Values

Pruning is noted for increasing the amount of clearwood while reducing the proportion of the knotty core. As well, pruning helps to manage the influence of the crown to produce juvenile wood with its associated poor wood properties. Pruning in general is not a huge priority in the Merritt TSA, as the 10% target of quality wood is expected to be realized without any special treatment, merely due to the range of stand types, species mixtures and some long rotations. However, a small area within the TSA was pruned to one-half of a full first lift under FRBC funding. Without finishing that lift, the initial investments would be essentially wasted. Therefore, for this small area, the priority for pruning is high.

Planting for Habitat Values

Benefits were identified for planting heavily impacted areas of the NonTHLB where natural regeneration is not expected to occur in a reasonable amount of time (i.e. portions of parks, study areas, area of interest for future protected areas, riparian areas, WTPs, OGMAs, retention areas, and specific watersheds where hydrologic green will speed recovery and reduce risk to fish). Planting these sites with conifers, broadleaves, and/or shrubs will provide improved habitat values in high risk/high values areas. Licensees also see this strategy as having timber benefits because it could reduce the likelihood that designated reserves, or unlogged areas of interests will be traded off against other areas in the THLB if they are heavily impacted by beetle.

There is a time limit on making decisions for these areas as it is not considered practical if snag falling is required, so a timely under-planting program coordinated with WCB will need to be pursued. Since there are short term benefits to hydrological /aquatic values and long term timber benefits to rapid reforestation this requires coordination of environmental risk and timber salvage.

Spacing / Thinning in Drybelt Fd stands

Large areas of IDF have regenerated naturally with dense thickets under mature overstories. These ecosystems were adapted to some level of fire, which had the ability to thin the understory, reduce ladder fuels, and create more open conditions for surviving trees. With the exclusion of fire, high understory densities limit individual tree growth, increase ladder fuels, potentially increase susceptibility to forest health factors, and generally slow recruitment of trees into larger classes over time.

Both timber supply and habitat supply benefits were recognized with the treatment of these stands. It was determined that an integrated strategy is required in the IDF to determine different approaches to varying densities in the understory layers (layer 2 and 3). Layer 3 is the primary concern but a subset of stands may require that layer 2 be addressed. Also, the strategy must be part of a long-term plan for uneven-aged management that considers forest health agents (e.g., spruce budworm), ungulate winter range objectives, and long term sustainable timber flows as each layer recruits into successive layers. This strategy is a high priority as it will yield habitat and timber supply benefits. It also has the potential to integrate with wildland/urban interface fuel treatments. The extent of this stand type is not clear in this TSA, so a focus in the first year will be data collection.

Retention Strategy Planning

The retention strategy will provide clarity on available harvest/salvage areas, as well as identification of long-term retention areas that may benefit from under-planting. Identifying areas for planting (i.e. dead, unsalvaged areas) will be problematic until a retention strategy is in place.

Use of Improved Seed

Continuing to maximize use of improved seed will improve timber supply forecasts in subsequent timber supply analyses.

Rehabilitation of Roads

Protecting recreation and wildlife values sensitive to disturbance by removing access opportunities on selected portions of the land base.

Treat Invasive Plants

The extensive nature of MPB harvesting, fires from 2003, and burning to promote habitat values in the NDT4 areas in the TSA create will create sites that are prime candidates for invasive plant establishment. Aggressive treatments are required to ensure that treatment benefits are realized and that invasive plant problems are managed effectively. This item is not reflected in the budget because it was added by MoE after the workshops were completed.

8.2 Silviculture Strategy Program (Idealized Funding Level)

This section describes an idealized (no constraints on $ or manpower) silviculture program in terms of ha treated, budget requirements, and job outcomes. It assumes 35.4 million dollars are needed and available over the next five years.

Proposed Area Treated (ha)

Activity	Year 1 (ha)	Year 2 (ha)	Year 3 (ha)	Year 4 (ha)	Year 5 (ha)	Totals (ha)
Studies/Surveys	-	-	-	-	-	-
Fertilize	3,750	9,150	-	-	-	12,900
Spacing/Thinning (timber)	1,000	1,250	1,250	1,250	1,250	6,000
Spacing/Thinning (habitat)	-	1,250	1,250	1,250	1,250	5,000
Planting (timber - other/MPB)			-	500	500	1,000
Planting (timber - fires)	-	2,000				2,000
Planting (habitat)	1,000	1,000	1,000	3,500	3,500	10,000
Pruning	100	-	-	-	-	100
Brushing	-	-	-	-	-	-
Road Rehab	-	200	-	-	-	200
Totals	5,850	14,850	3,500	6,500	6,500	37,200

Proposed Budget ($)

Activity	Year 1 (ha)	Year 2 (ha)	Year 3 (ha)	Year 4 (ha)	Year 5 (ha)	Totals (ha)
Studies/Surveys	335,000	-		-	20,000	355,000
Fertilize	1,500,000	3,660,000	-	-		5,160,000
Spacing/Thinning (timber)	600,000	750,000	750,000	750,000	750,000	3,600,000
Spacing/Thinning (habitat)	-	750,000	750,000	750,000	750,000	3,000,000
Planting (timber - other/MPB)			10,000	500,000	500,000	1,010,000
Planting (timber - fires)	500,000	2,000,000				2,500,000
Planting (habitat)	600,000	600,000	600,000	2,100,000	2,100,000	6,000,000
Pruning	80,000	-	-	-	-	80,000
Brushing	-	-	-	-	-	-
Road Rehab	-	1,000,000	-	-	-	1,000,000
Totals	3,615,000	8,760,000	2,110,000	4,100,000	4,120,000	22,705,000

Job Outcomes

Activity	Year 1 Person Days	Year 2 Person Days	Year 3 Person Days	Year 4 Person Days	Year 5 Person Days	Totals Person Days
Studies/Surveys	1,117	-	-	-	67	1,183
Fertilize	375	915	-	-	-	1,290
Spacing/Thinning (timber)	3,390	4,238	4,238	4,238	4,238	20,340
Spacing/Thinning (habitat)	-	4,250	4,250	4,250	4,250	17,000
Planting (timber - other/MPB)			-	1,000	1,000	2,000
Planting (timber - fires)	-	4,000				4,000
Planting (habitat)	2,000	2,000	2,000	7,000	7,000	20,000
Pruning	825	-	-	-	-	825
Brushing	-	-	-	-	-	-
Road Rehab	-	200	-	-	-	200
Totals	7,707	15,603	10,488	16,488	16,554	66,838

In addition to the above strategies/investments, a retention strategy plan was considered as high priority for completion (currently underway). The studies/surveys listed in the tables above reflect the initial setup of specific programs (e.g. identify and prioritize fertilization candidates), and the confirmation for the amount of area suitable for habitat or timber strategies. Ongoing survey and layout costs associated with specific strategies are included in the strategy costs.

8.2.1 Expected Outcomes (Idealized Funding Level)

If 22.7 million was invested over a 5-year period, the following outcomes could be expected:

Estimated Timber Supply Outcomes

- 64,600 m^3 made available at the front end of the trough
    - Realized from late rotation fertilization
- 238,550 m^3 made available in the middle of the trough
    - Realized from young stands fertilization and thinning of drybelt Fd stands
- 330,000 m^3 made available in the back end of the trough
    - Realized mainly though planting of sites with no obligations, plus a small gain associated with road rehabilitation.
- An unquantifiable benefit from planting of up to 10,000 ha of sites with a habitat focus, thereby avoiding further set-asides from within the THLB.

Timber Quality Outcomes

- Extremely small increase in clear log volume likely at the back of the trough from completing second lift pruning on 100 ha.

Habitat Supply Outcomes

- Enhance old forest stand structure on 5,000 ha of drybelt Fd stands (thinned/spaced).
- Regeneration of 10,000 ha of impacted stands with a habitat focus, and regeneration of 3,000 ha of impacted stands with a timber focus to speed hydrologic recovery and mitigate stream temperatures by regeneration.
- Maintain wildlife and recreation values by removal of 200 ha of road rehabilitation
- Protect native plants through removal of invasive/noxious weed species from 500 ha.

8.2.2 Expected Outcomes for 20year Investment (Idealized Funding Level)

If similar benefits could be produced by continuously investing at this level for 20 years (total of $90.8 million), the midterm trough could rise by 46,000 m3/year (Figure 14). This forecast is highly speculative and there is no guarantee that enough suitable treatment areas could be found.

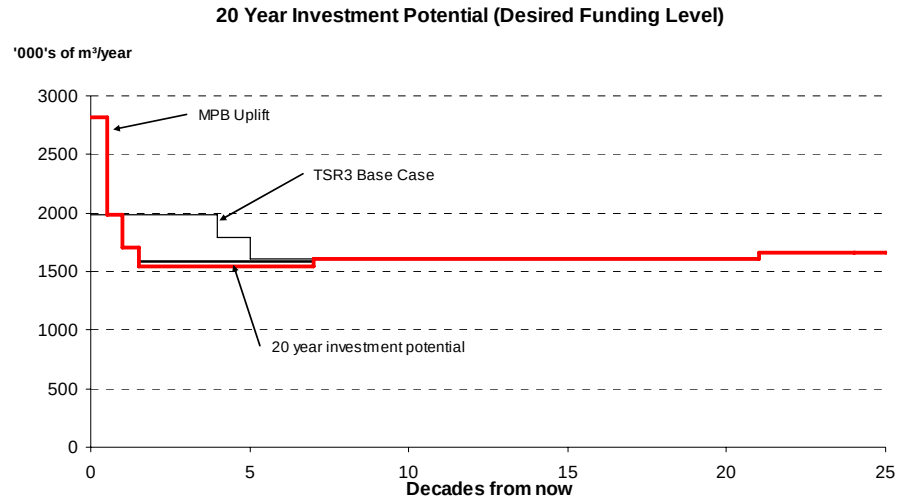

Figure 14. 20 year continuous investment (idealized funding level).

8.3 Habitat-focus Silviculture Strategy Program (Historical Funding Level)

This section describes a silviculture program constrained to approximately 8 million dollars over five years in terms of ha treated, budget requirements, and job outcomes to achieve objectives aimed at habitat. This strategy best reflects the TSAs desires for investment if dollars are limited – see discussion under section 8.0. The investment in timber related activities in this strategy (ie. fertilization) occur only because it was perceived that there were not enough habitat related opportunities on which to spend all of the budget.

Proposed Area Treated (ha)

Activity	Year 1 (ha)	Year 2 (ha)	Year 3 (ha)	Year 4 (ha)	Year 5 (ha)	Totals (ha)
Studies/Surveys	-	-	-	-	-	-
Fertilize	3,400	1,200	-	-	-	4,600
Spacing/Thinning (timber)	-	-	-	-	-	-
Spacing/Thinning (habitat)	-	650	700	400	400	2,150
Planting (timber - other/MPB)			-	300	300	600
Planting (timber - fires)	-	235				235
Planting (habitat)	-	-	1,000	1,000	1,000	3,000
Pruning	-	-	-	-	-	-
Brushing	100	-	100	-	-	200
Road Rehab	-	20	40	20	20	100
Totals	3,500	2,105	1,840	1,720	1,720	10,885

Proposed Budget ($)

Activity	Year 1	Year 2	Year 3	Year 4	Year 5	Totals
Studies/Surveys	$ 225,000	$ -	$ 10,000	$ -	$ -	$ 235,000
Fertilize	$ 1,360,000	$ 480,000	$ -	$ -	$ -	$ 1,840,000
Spacing/Thinning (timber)	$ -	$ -	$ -	$ -	$ -	$ -
Spacing/Thinning (habitat)	$ -	$ 390,000	$ 420,000	$ 240,000	$ 240,000	$ 1,290,000
Planting (timber - other/MPB)			$ -	$ 300,000	$ 300,000	$ 600,000
Planting (timber - fires)	$ 100,000	$ 235,000				$ 335,000
Planting (habitat)	$ -	$ 375,000	$ 975,000	$ 975,000	$ 975,000	$ 3,300,000
Pruning	$ -	$ -	$ -	$ -	$ -	$ -
Brushing	$ 60,000	$ -	$ 60,000	$ -	$ -	$ 120,000
Road Rehab	$ -	$ 100,000	$ 200,000	$ 100,000	$ 100,000	$ 500,000
Totals	$ 1,745,000	$ 1,580,000	$ 1,665,000	$ 1,615,000	$ 1,615,000	$ 8,220,000

Job Outcomes

Activity	Year 1 Person Days	Year 2 Person Days	Year 3 Person Days	Year 4 Person Days	Year 5 Person Days	Totals Person Days
Studies/Surveys	750	-	33	-	-	783
Fertilize	340	120	-	-	-	460
Spacing/Thinning (timber)	-	-	-	-	-	-
Spacing/Thinning (habitat)	-	2,210	2,380	1,360	1,360	7,310
Planting (timber - other/MPB)	-	470	-	600	600	1,670
Planting (timber - fires)						
Planting (habitat)	-	-	2,000	2,000	2,000	6,000
Pruning	-	-	-	-	-	-
Brushing	260	-	260	-	-	520
Road Rehab	-	20	40	20	20	100
Totals	1,350	2,820	4,680	3,980	3,980	16,060

In addition to the above strategies/investments, a retention strategy plan was considered as high priority for completion. The studies/surveys listed in the tables above reflect the initial setup of specific programs (e.g. identify and prioritize fertilization candidates), and the confirmation for the amount of area suitable for habitat or timber strategies. Ongoing survey and layout costs associated with specific strategies are included in the strategy costs.

8.3.1 Expected Outcomes (Habitat-focus Historical Funding Level)

If approximately 8 million was invested over a 5-year period, the following outcomes could be expected:

Estimated Timber Supply Outcomes

- 44,820 m^3 made available at the front end of the trough
  - Realized from late rotation fertilization
- 26,000 m^3 made available in the mid to back end of the trough
  - Realized though thinning of drybelt Fd stands.
- 99,500 m^3 made available at the back end of the trough
  - Realized from planting THLB areas with no regeneration obligations and road rehabilitation.
- An unquantifiable benefit from planting of up to 3,000 ha of sites for a habitat focus, thereby avoiding further set-asides from within the THLB.

Timber Quality Outcomes

- None

Habitat Supply Outcomes

- Enhance old forest stand structure on 2150 ha of drybelt Fd stands (thinned/spaced).
- Regeneration of 3000 ha of impacted stands with a habitat focus, and regeneration of 835 ha of impacted stands with a timber focus to speed hydrologic recovery and mitigate stream temperatures by regeneration..
- Maintain wildlife and recreation values by removal of 100 ha of road rehabilitation
- Protect native plants through removal of invasive/noxious weed species from 2000 ha.

8.3.2 Expected Outcomes for 20year Investment (Habitat-focus Historical Funding Level)

If similar benefits could be produced by continuously investing at this level for 20 years (total of $32.8 million), the midterm trough could rise by 12,000 m^3/year (Figure 15). This forecast is highly speculative and there is no guarantee that enough suitable treatment areas could be found.

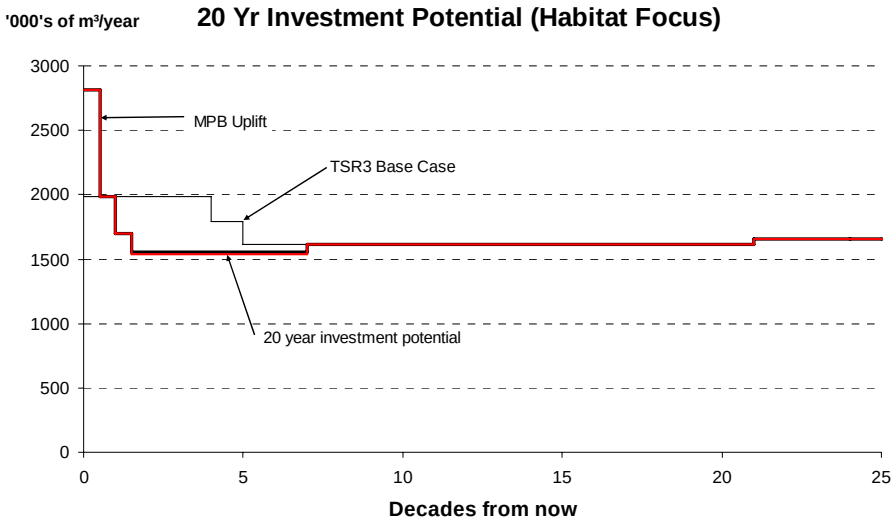

Figure 15. 20 year continuous investment (habitat focus - historical funding level).

8.4 Timber-focus Silviculture Strategy Program (Historical Funding Level)

This section describes a silviculture program constrained to approximately 8 million dollars over five years in terms of ha treated, budget requirements, and job outcomes to achieve objectives focused on timber supply. This strategy is presented as an alternative to the habitat focused strategy and is to be used in the event that funding must be predominately allocated to timber supply related projects.

Proposed Area Treated (ha)

Activity	Year 1 (ha)	Year 2 (ha)	Year 3 (ha)	Year 4 (ha)	Year 5 (ha)	Totals (ha)
Studies/Surveys	-	-	-	-	-	-
Fertilize	3,400	2,700	2,500	500	500	9,600
Spacing/Thinning (timber)	-	-	-	-	-	-
Spacing/Thinning (habitat)	-	-	-	-	-	-
Planting (timber - other/MPB)			-	500	500	1,000
Planting (timber - fires)	-	235				235
Planting (habitat)	-	200	500	500	500	1,700
Pruning	100	-	-	-	-	100
Brushing	100	-	100	-	-	200
Road Rehab	-	20	-	-	-	20
Totals	3,600	3,155	3,100	1,500	1,500	12,855

Proposed Budget ($)

Activity	Year 1	Year 2	Year 3	Year 4	Year 5	Totals
Studies/Surveys	$ 285,000	$ -		$ -	$ -	$ 285,000
Fertilize	$ 1,360,000	$ 1,080,000	$ 1,000,000	$ 200,000	$ 200,000	$ 3,840,000
Spacing/Thinning (timber)	$ -	$ -	$ 50,000	$ 450,000	$ 450,000	$ 950,000
Spacing/Thinning (habitat)	$ -	$ -	$ -	$ -	$ -	$ -
Planting (timber - other/MPB)			$ 10,000	$ 500,000	$ 500,000	$ 1,010,000
Planting (timber - fires)	$ -	$ 235,000				$ 235,000
Planting (habitat)	$ -	$ 195,000	$ 485,000	$ 485,000	$ 485,000	$ 1,650,000
Pruning	$ 80,000	$ -	$ -	$ -	$ -	$ 80,000
Brushing	$ 60,000	$ -	$ 60,000	$ -	$ -	$ 120,000
Road Rehab	$ -	$ 100,000	$ -	$ -	$ -	$ 100,000
Totals	$ 1,785,000	$ 1,610,000	$ 1,605,000	$ 1,635,000	$ 1,635,000	$ 8,270,000

Job Outcomes

Activity	Year 1 Person Days	Year 2 Person Days	Year 3 Person Days	Year 4 Person Days	Year 5 Person Days	Totals Person Days
Studies/Surveys	950	-	-	-	-	950
Fertilize	340	270	250	50	50	960
Spacing/Thinning (timber)	-	-	-	-	-	-
Spacing/Thinning (habitat)	-	-	-	-	-	-
Planting (timber - other/MPB)	-	470	-	1,000	1,000	2,470
Planting (timber - fires)						
Planting (habitat)	-	400	1,000	1,000	1,000	3,400
Pruning	825	-	-	-	-	825
Brushing	260	-	260	-	-	520
Road Rehab	-	20	-	-	-	20
Totals	2,375	1,160	1,510	2,050	2,050	8,195

In addition to the above strategies/investments, a retention strategy plan was considered as high priority for completion. The studies/surveys listed in the tables above reflect the initial setup of specific programs (e.g. identify and prioritize fertilization candidates), and the confirmation for the amount of area suitable for habitat or timber strategies. Ongoing survey and layout costs associated with specific strategies are included in the strategy costs.

8.4.1 Expected Outcomes (Timber-focus Historical Funding Level)

If approximately 8 million was invested in timber focused projects over a 5-year period, the following outcomes could be expected:

Estimated Timber Supply Outcomes

- 58,600 m^3 made available at the front end of the trough
    - Realized from late rotation fertilization
- 106,400 m^3 made available in the mid-back end of the trough
    - Realized from young stand fertilization (15-40 years old) and thinning of drybelt Fd.
- 132,500 m^3 made available at the back end of the trough
    - Realized from planting THLB areas with no regeneration obligations and road rehabilitation.
- An unquantifiable benefit from planting of up to 1,700 ha of sites for a habitat focus, thereby avoiding further set-asides from within the THLB.

Timber Quality Outcomes

- Extremely small increase in clear log volume likely at the back of the trough from completing second lift pruning on 100 ha.

Habitat Supply Outcomes

- Enhance old forest stand structure on 1500 ha of drybelt Fd stands (thinned/spaced).
- Regeneration of 1700 ha of impacted stands with a habitat focus, and regeneration of 1,235 ha of impacted stands with a timber focus to speed hydrologic recovery and mitigate stream temperatures by regeneration...
- Maintain wildlife and recreation values by removal of 100 ha of road rehabilitation

8.4.2 Expected Outcomes for 20year Investment (Timber-focus Historical Funding Level)

If similar benefits could be produced by continuously investing at this level for 20 years (total of $32.8 million), the midterm trough could rise by 22,000 m^3/year (Figure 16). This forecast is highly speculative and there is no guarantee that enough suitable treatment areas could be found.

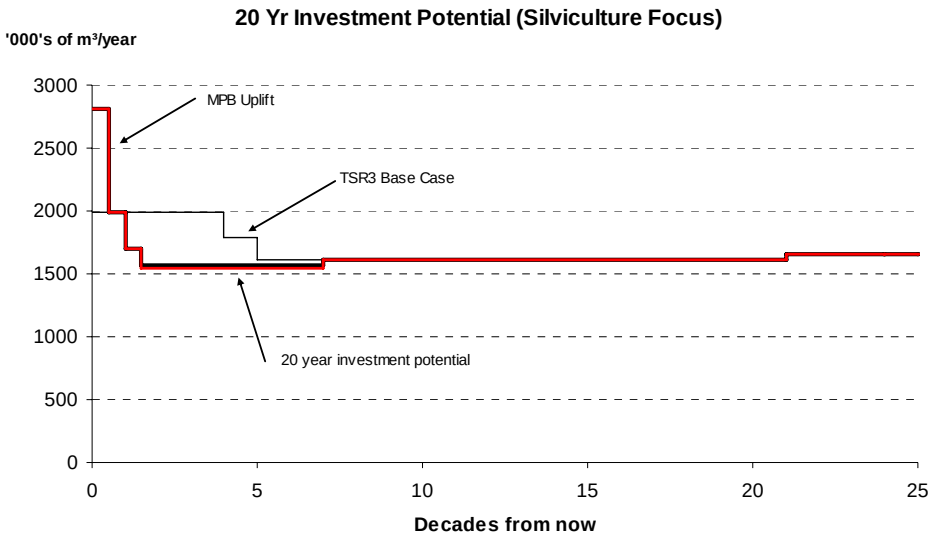

Figure 16. 20 year continuous investment (timber focus - historical funding level).

9.0 Summary of Information and Research Needs

During the preparation of this document, the following needs for further information and/or research were identified in support of meeting TSA objectives for timber supply, timber quality, and habitat supply.

1. Retention planning is required to identify areas where salvage will not occur and to provide guidance around increased retention at the stand level. This could combine with some decisions on the conservation status of current set-asides and study areas.
2. There is a desire to look at changing stocking standards / free growing standards to include more broadleaves.
3. Inventory for locations of species of conservation concern so that management, including incremental silviculture activities, can better address these species.
4. Develop a forest health strategy that looks beyond MPB in order to protect growing volume that will be critical in the midterm trough.
5. Develop an access management plan to limit the amount of open road within the TSA.
6. Develop a seed strategy that identifies seed inventories (natural stand and orchard), seed gaps and seed mitigation strategies over the short and long term.
7. A study to determine if enough Douglas-fir is being regenerated in appropriate ecosystems.
8. A Type 2/3 Silviculture Strategy is needed to clarify the outcomes for opportunities presented here and to identify sensitive watersheds and riparian areas for treatment as well as the stands to treat for enhancement to stand structure. All of the potential opportunities presented here require refinement in terms of areas, timing and impacts.

10.0 References

Brockley, R.B.2001a. *Fertilization of lodgepole pine in western Canada*. In C. Bamsey (ed.). Enhanced Forest Management: Fertilization and Economics Conference, March 1-2, 2001, Edmonton, AB. pp. 44-55

Brockley, R.P. 2001b. *Foliar sampling guidelines and nutrient interpretative criteria for lodgepole pine*. B.C. Ministry of Forests, Research Branch, Victoria. Extension Note 52.

Brockley, R.P. and D.G. Simpson. 2004. *Effects of intensive fertilization on the foliar nutrition and growth of young lodgepole pine and spruce forests in the interior of British Columbia (E.P. 886.13): establishment and progress report*. B.C. Min. For., Res. Br., Victoria, B.C. Tech. Rep. 018. http://www.for.gov.bc.ca/hre/standman/maxprod/gryld.htm

Desrosiers, J. 1993. *The Pacific Rhododendron (Rhododendron macrophyllum D. DON ex G. DON) communities of the Skagit River Watershed, British Columbia*. Unpubl. rep. produced for the Skagit Environ. Endowment Comm., and Conserv. Data Centre, Wildl. Branch, B.C. Minist. Environ., Lands and Parks, Victoria.

Eng, M.; A. Fall; J. Hughes; Shore, T; Riel, B. and Hall, P. 2005. *Provincial-Level Projection of the Current Mountain Pine Beetle Outbreak: An Overview of the Model (BCMPB v2) and Results of Year 2 of the Project*. http://www.for.gov.bc.ca/hre/bcmpb/

Farnden, C. and L. Herring. *Severely repressed lodgepole pine responds to thinning and fertilization: 19-year results*. For. Chron. 78(3) 404-414.

Forsite et al. 2005. *Fertilization Backgrounder*, Unpublished report compiled by Prizm Environmental, Symmetree Consulting, and Forsite as part of the Type 1 Silviculture Strategy project completed 2005/2006.

Green, R.N., and K. Klinka. 1994. *A field guide to site identification and interpretation for the Kamloops Forest Region*. B.C. Minist. For., Res. Branch, Victoria, B.C. Land Manage. Handb. No. 28.

Ministry of Environment Lands and Parks, 2000. *Environmental Risk Assessment (ERA): An approach to assessing and reporting environmental conditions*, Habitat Branch Technical Bulletin #1.

Lloyd, D., K. Angove, G. Hope, and C. Thompson. 1990. A guide to site identification and interpretation for the Kamloops Forest Region. B.C. Minist. For., Res. Branch, Victoria, B.C. Land Manage. Handb. No. 23. 399pp.

MoF, 2005. *Urgent Timber Supply Reivew for the Merritt TSA: Technical Summary for the Allowable Cut Determination Meeting for Section 8 and Section 59.1 Decisions*, Cascades Forest District, Merritt BC, May 18-19, 2005.

MoF, 2005. *Merritt Timber Supply Area – Rationale for Annual Allowable Cut (AAC) Determination*. Larry Peterson – Chief Forester, Victoria, BC.

MoF, 2001. *Merritt Timber Supply Area Analysis Report*. Timber Supply Branch, Victoria, BC.

MoF, 2000, Merritt TSA Silviculture Strategy (Type 1)., http://www.for.gov.bc.ca/hfp/silstrat/map/kamloops-tsa-merritt.htm

Newsome, T.A. and J.L. Perry. 2003. *Stand-tending and rehabilitation treatment options for 36-year-old, height-repressed lodgepole pine*. Res. Br., B.C. Min. For., Victoria, B.C. Tech. Rep. 007. www.for.gov.bc.ca/hfd/pubs/Docs/Tr/Tr007.htm

Timberline Forest Inventory Consultants, 2003. *NSIFS IFPA Innovative Timber Supply Analysis - Final Report*, Victoria ,BC

Appendix A: Abbreviations

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	Subalpine fir
BMP	Best Management Practices
CF	Chief Forester
CFLB	Crown Forested Land base
CT	Commercial Thinning
CW	Western Red Cedar
DBH	Diameter at breast height (1.3m)
DEO	Designated Environment Official
DFO	Department of Fisheries and Oceans
DM	District Manager
ECA	Equivalent Clearcut Area
ESA	Environmentally Sensitive Area
Fd	Douglas Fir
FES	Forest Ecosystem Specialist
FIP/FC1	Old Forest Cover Digital Files
FMER	Fire Maintained Ecosystem Restoration
FIZ	Forest Inventory Zone
FPC	Forest Practices Code
FRBC	Forest Renewal British Columbia
FSSIM	Forest Service Simulation Model
GIS	Geographic Information System
HLPO	Higher Level Plan Order
Hw	Western Hemlock
ICH	Interior Cedar Hemlock
IWAPS	Interior Watershed Assessment Procedure System
La	Alpine Larch
LRMP	Local Resource Management Plan
LTHL	Long Term Harvest Level
LU	Landscape Unit
Lw	Western Larch
MoFR	Ministry of Forests and Range
MoE	Ministry of Environment
MPB	Mountain Pine Beetle
MSR	Machine Stress Rated
MSY	Maximum Sustained Yield
MSYT	Managed Stand Yield Tables
NCC	Non-Commercial Cover
NDT	Natural Disturbance Type
NP	Non Productive
Pl	Lodgepole Pine
PSP	Permanent Sample Plot
PSYU	Public Sustained Yield Unit
Pw	White Pine
Py	Ponderosa Pine (tree species) or person years (economics)
RM	Regional Manager
RMZ	Riparian Management Zone
ROS	Recreation Opportunity Spectrum
THLB	Timber Harvesting Land base
TIPSY	Table Interpolation Program for Stand Yields (growth and yield model)
TSA	Timber Supply Area
TSR	Timber Supply Review
UREP	Use, Recreation, and Enjoyment of Public
VDYP	Variable Density Yield Predictor (growth and yield model)
VEG Ht	Visually Effective Greenup Height
VQO	Visual Quality Objective
WTP	Wildlife Tree Patch