Integrated Silviculture Strategy for the Merritt TSA

Situation Analysis

Version 1.0

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Project 419-36

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BRITISH COLUMBIA

Executive Summary

In support of government objectives to mitigate forest health impacts on mid-term timber supply, this Integrated Silviculture Strategy project aims to facilitate a respectful and collaborative planning process that supports the delivery of defined stewardship outcomes - which, in turn, improves business certainty for licensees operating within the Merritt Timber Supply Area (TSA).

The Situation Analysis is the first of nine documents to make up the Integrated Silviculture Strategy. It describes the status of the resources within the Merritt TSA and the issues that affect their sustainable use.

The Merritt TSA is home or traditional territory to four First Nations including: Nlaka'pamux Nation, Okanagan Nation, Secwepemc Nation, Sto:Lo Nation. The majority of timber harvested within Merritt TSA is through replaceable forest licences held by: Ardew Wood Products, Aspen Planers, Tolko, Weyerhaeuser, Stuwix Resources, Lower Nicola and BC Timber Sales.

The First Nations, licensees, interest groups, and public stakeholders will play a vital role ensuring that all relevant and recent information is compiled for use in the planned analyses. In particular, we welcome First Nations' active participation to provide traditional knowledge on ecosystems, wildlife and lands and to help develop more robust and appropriate management scenarios that will be examined in future phases of this project.

While a timber supply review account for many factors in determining the AAC, exploring alternative land use options are typically outside its scope. In recent years, government agencies and licensees operating within the Merritt TSA have developed an array of strategies and plans, including:

a. Provincial timber management goals and objectives
b. Designations and objectives set by government
c. BC Mountain Pine Beetle model (BCMPB)
d. Mid-Term Timber Supply Action Plan
e. Multiple Resource Value Assessment
f. Provincial Stewardship/Timber Harvesting Land Base Stabilization
g. Forest Health Strategy
h. Silviculture Strategies
i. Grassland Conversion and Ecosystem Restoration
j. Cumulative Effects Framework
k. Nicola-Similkameen Innovative Forestry Society
l. Nicola-Thompson Fraser Sustainable Forest Management Plan

The MPB infestation in the Merritt TSA increased dramatically in 2004, peaked in 2007, and has since declined sharply. Presently, only about 2.5M m^3/year of dead pine remain on the THLB; dispersed throughout stands that include significant volumes of live timber. According to the BCMPBv12 model projections, approximately 68% of the dead pine in the Merritt TSA THLB is in stands where the dead pine component is 50% or less of the total volume of the stand. This suggests that the salvage period is coming to an end.

Increases to the allowable annual cut (AAC) have been implemented since 1999 to salvage timber damaged by wildfire and stands impacted by insects - primarily MPB. The ongoing timber supply review is expected to significantly reduce the current AAC of 2.4M m^3/year to a level that is closer to the AAC prior to these uplifts.

MPB-killed pine stands that were not salvaged in time will require assessments to determine whether to rehabilitate or leave them to regenerate naturally - since some stands may have sufficient advanced regeneration.

MPB is not the only forest health impact to these forests. Significant tree mortality has been observed with, spruce beetle attacking live spruce trees, western spruce budworm defoliating Douglas-fir stands, decline of older balsam trees and the ever-increasing risk of fire as the dead wood dries.

Silviculture strategies completed to date for the Merritt TSA have focused on achieving timber quantity objectives and have not substantially addressed timber quality. Opportunities exist to explore product flow objectives to address log quality from future stands.

Specific changes in seasonal weather have been modelled and are available by region. Climate change adaptation strategies are being developed for the Province but specific silvicultural treatments for the Merritt TSA are not available at this time.

Other key values identified in this document include parks, archaeological and First Nations cultural use, watershed health, visual quality objectives, recreation, guide outfitters and trappers, and ranching. Other specific issues considered are road density and access, and herbicide use.

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List of Acronyms

AAC	Allowable Annual Cut
BCMPB	BC Mountain Pine Beetle model
BEC	Biogeoclimatic Ecosystem Classification
CSA	Canadian Standards Association
Dbh	Diameter at Breast Height
FFT	Forests for Tomorrow
FLNR	Ministry of Forests, Lands and Natural Resource Operations
FREP	Forest and Range Evaluation Program
GAR	Government Action Regulation
IFPA	Innovative Forest Practices Agreement
ISS	Integrated Silviculture Strategy
MPB	Mountain Pine Beetle
MRVA	Multiple Resource Value Assessment
NSIFS	Nicola-Similkameen Innovative Forest Society
OGMA	Old Growth Management Area
RESULTS	Reporting Silviculture Updates and Land status Tracking System
SFM	Sustainable Forest Management
THLB	Timber Harvesting Land Base
TSA	Timber Supply Area
TSR	Timber Supply Review
UWR	Ungulate Winter Range
VQO	Visual Quality Objective
VRIMS	Vegetation Resource Inventory Management System
WHA	Wildlife Habitat Area

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1 Introduction

The British Columbia Ministry of Forests, Lands and Natural Resource Operations (FLNR) have initiated an Integrated Silviculture Strategy (ISS) for the Merritt Timber Supply Area (TSA). The ISS is an evolving planning process that aims to provide context for management decisions necessary to achieve forest level objectives. It integrates other planning processes that have historically been separate or disjointed, such as:

- Wildfire Management Planning
- Forest Health
- Wildlife Reserve Location Planning
- Biodiversity Habitat Planning
- Cumulative Effects
- Silviculture Strategies

Aligning these plans and strategies within a common process will focus landbase investments, improve planning outcomes and enhance communications with stakeholders and First Nations – resulting in increased efficiency and effectiveness to stewardship planning relative to status quo.

1.1 Integrated Silviculture Strategy Objectives

In support of government objectives to mitigate forest health impacts on mid-term timber supply, this ISS project aims to:

> *Facilitate a respectful and collaborative planning process that supports the delivery of defined stewardship outcomes - which in turn improves business certainty for licensees operating within the Merritt Timber Supply Area.*

This improved certainty will be achieved through the creation of:

1. A common understanding among participants of the goals, values, issues, and challenges facing the Merritt TSA.
2. A well designed Landscape Reserve Strategy that minimizes impacts to the timber harvesting land base (THLB) while addressing as many stewardship issues as possible. This includes First Nation's interest and will ultimately help indicate the areas of the landbase that are currently suitable for harvesting by licensees.
3. A Silviculture Strategy that provides clear direction on how to achieve improved timber and habitat outcomes in the future through investments in silviculture.
4. A coordinated Harvest Strategy that identifies approaches to harvest scheduling aimed at addressing common interests (MPB salvage, equitable access to green timber, landscape level fuel breaks, etc.).
5. An effective plan for monitoring and evaluating progress towards meeting key goals and objectives that support future management decisions in the Merritt TSA.

These objectives are meant to align with Provincial Timber Management Goals and Objectives (FLNR 2014), the Chief Forester's Provincial Stewardship Optimization/Timber Harvesting Land Base (THLB) Stabilization Project (FLNR 2015) and FLNR staff.

1.2 Context

The situation analysis is the first of nine documents developed through the ISS process:

1. **Situation Analysis** – describes in general terms the situation for the unit – this could be in the form of a PowerPoint presentation with associated notes or a compendium document.
2. Landscape Reserve Strategy – review and analyze existing and proposed management zonation and develop strategy options that provide for the sustainable management of non-timber values.
3. Landscape Harvest Strategy – review and analyze current and planned timber harvesting plans, infrastructure, and capabilities in the context of the distribution of MPB-killed pine salvage opportunities and the landscape reserve strategy. This must consider the current salvage period and the transition into the mid-term timber supply.
4. Silviculture Strategy –provides treatment options, associated targets, timeframes and benefits to minimize the impact of the MPB infestation over the mid-term timber supply.
5. Data Package - describes the information that is material to the analysis including the model used, data inputs and assumptions.
6. Analysis Report –provides modeling outputs and rationale for choosing a preferred scenario.
7. Operational plan – direction for the implementation of the preferred scenario.
8. Final Report – summary of all project work completed.
9. Monitoring Plan – direction on monitoring the implementation of the ISS; establishing a list appropriate performance indicators, developing monitoring responsibilities and timeframe and a reporting format and schedule.

This particular document aims to provide brief summaries of the current situation for a very wide range of forest resource values and issues of concern that pertain to the Merritt TSA. Ultimately this reference is not expected to provide answers but rather invite questions and stimulate ideas for the next phases of the ISS project.

In some cases the authors have extracted or paraphrased sections from existing material and referenced the appropriate sources for the reader to explore further. This list of topics was limited to those being considered - at this time - for the project as other topics may be currently outside of the project scope.

1.3 Project Area

The Merritt TSA is situated in south-central BC (Figure 1) and is approximately 1.13 million hectares in size. It is within the Thompson Okanagan Forest Region and is administered from the Cascades Natural Resource District office located in the town of Merritt. It is bounded on the north by the Kamloops TSA, on the west by the Lillooet and Fraser TSAs, and on the east by the Okanagan TSA. Manning Park, Cathedral Park and the border between Canada and the United States of America is on the south.

The Merritt TSA includes the mountainous terrain and steep river valleys of the Cascade Mountains in the west and the relatively dry, flat Thompson Plateau in the east. The TSA encompasses two major river systems: the Similkameen and the Nicola.

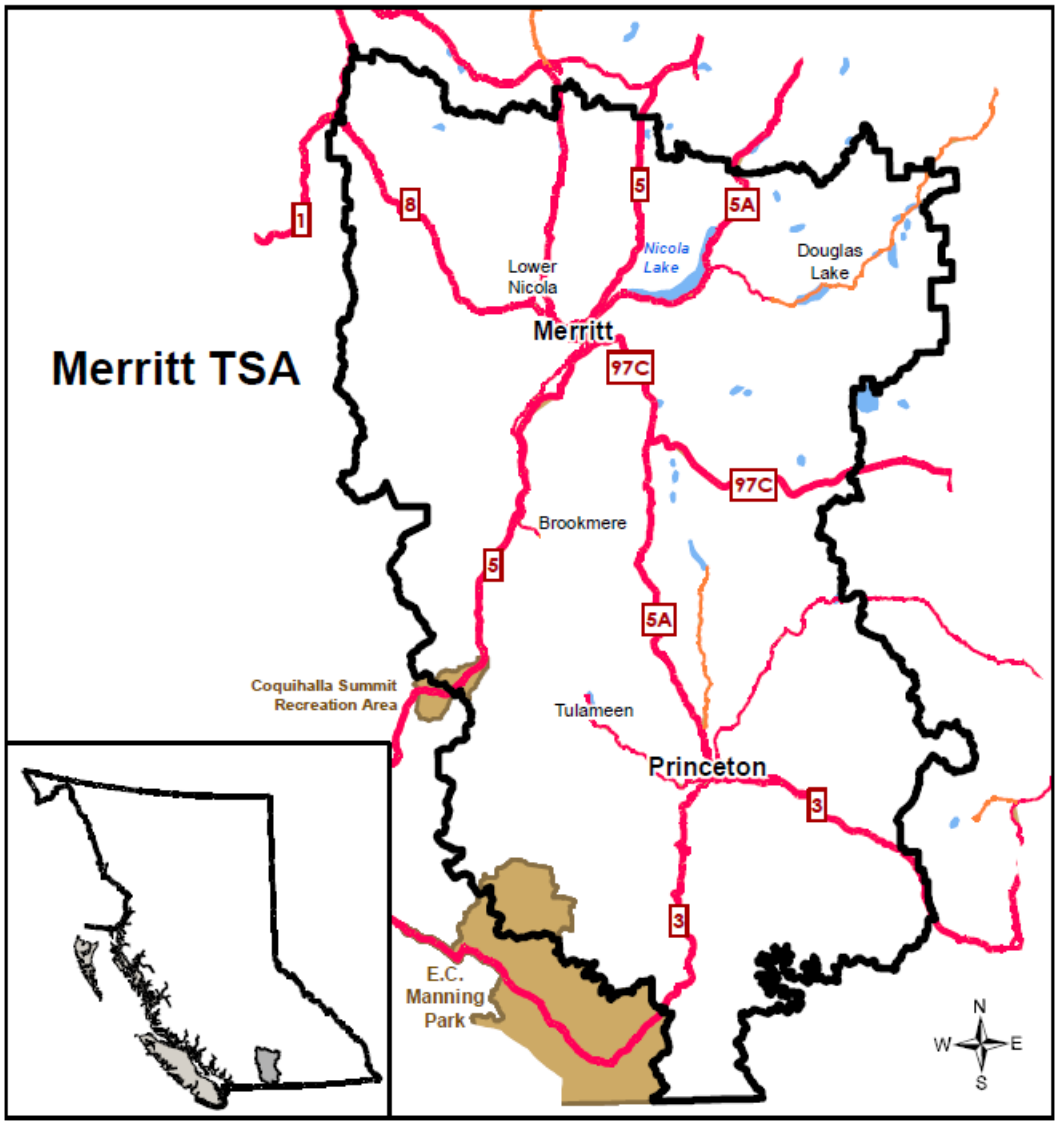


Figure 1 Overview Map of the Merritt TSA

Approximately 71 % of the TSA is forested crown land, and about 52% is considered to be the THLB. Lodgepole pine comprises approximately half of the forested land base, with Douglas Fir, spruce, ponderosa pine, subalpine fir, and trembling aspen making up the majority of the remainder (Figure 2). There are also minor amounts of red cedar, western larch, and western hemlock.

Lodgepole pine comprises approximately two thirds of the timber available for harvest, primarily because some Douglas fir is required to provide snow interception cover for mule deer, and deciduous species are not considered commercial species within the TSA (Figure 3).

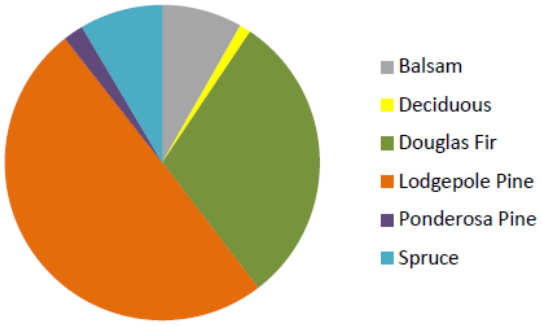


Figure 2 Species Composition of the Crown Forested Landbase

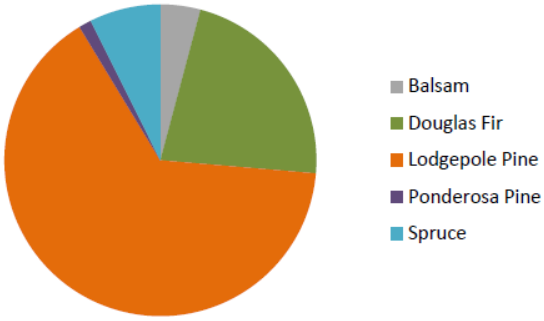


Figure 3 Species Composition of the Timber Available for Harvest

The Merritt TSA lies within the Thompson-Nicola Regional District, and about 60% of the population resides in the major centres of Merritt (population 7000) and Princeton (population 2687). Smaller communities include Brookmere, Tulameen, Missezula Lake, Douglas Lake, Lower Nicola, Osprey Lake and Allison Lake. The public sector, forestry, and tourism are the major employment sectors, with agriculture, construction and mining also contributing to the local economy. Forestry and the public sector are the largest contributors with the forest sector accounting for approximately 25 percent of the basic income in the Merritt area and the public sector accounting for about 20 percent. The forest sector supports numerous other jobs in the area through companies and employees purchasing goods and services.

2 Summary of Current Plans and Strategies

A strategic land use plan has not been completed for the Merritt TSA. Forest planning and practices are guided by other broad plans or by legislation.

2.1 Provincial Timber Management Goals and Objectives

Provincial Timber Management Goals and Objectives (FLNR 2014) set high-level provincial timber management goals, objectives and targets to provide context and guidance for planning across management units - including specific direction to ISS projects.

The 5 main timber management goals are summarized below.

2.1.1 Timber volume flow over time

Timber volume flow over time describes what has traditionally been the focus of sustainable forest management. The provincial aim is not a strict even flow regime, but rather predictable and reliable flows to support economic and social objectives. Timber flow will be managed in an integrated manner with other key forest values.

Goal	Promote resilient and diverse forest ecosystems that will provide a sustainable flow of economically valuable timber that generates public revenues, supports robust communities, healthy economies that provide an opportunity for a vigorous efficient and world competitive timber processing industry
Objectives	1) Timber is managed in an adaptive manner to address the dynamic nature of natural processes and the inherent uncertainty of managing over long time frames. 2) Attainment in the long-term of realized harvest flows that benefit from timber management activities including harvest practices and silviculture investments. 3) Data used to determine timber flows will be continuously improved, to verify assumptions and to reduce uncertainty.
Targets	1) Targets for timber flow may be refined through Merritt TSA level analysis and planning such as through Type 4 silviculture strategies (ISS in this case)

2.1.2 Timber quality

Timber quality is defined by species, log sizes and grades, end use, and economic value. In order to minimize risks and maintain future options for different products, a diverse portfolio of timber quality is desirable.

Goal	Maintain a diversity of timber-related economic opportunities through time.
Objectives	1) Proportions of high-value tree species within each management unit will be maintained at no less than pre-harvest levels. 2) Proportions of lower value species within each management unit will not be increased above pre-harvest levels. 3) To restock new forests with trees which will produce high quality fibre as the primary product objective. 4) To ensure a proportion of logs are of premium grade.
Targets	1) No reduction in the proportion of provincial forest land made up of high-value tree species. 2) To produce a minimum of 10 per cent premium grades from B.C.'s forests.

2.1.3 Tree Species Composition

Tree species influences timber values, quality, productivity, health, resilience, and non-timber values. Tree species diversity is a fundamental climate change adaptation strategy.

Goal	To maintain or enhance timber and non-timber values, forest health, and resilience, through the management of tree species composition.

Objectives	1) Where it is ecological feasible, reliable and productive, a resilient mix of species at both the stand and landscape scales will be used to reduce long-term forest risks and maintain future options. 2) Promote reforestation of species compositions that reduce vulnerability from climate change and forest health impacts on timber and other forest values. 3) Management will reduce the occurrence of species where future risks (ecological and economic) are disproportionately high compared with other species. 4) Seedlings planted are grown from source-identified and genetically-diverse tree seed that is climatically-suitable to the planting site.
Targets	1) The proportion of monoculture stands at free growing in B.C. is no greater than the proportion of monoculture stands prior to harvest. 2) Within the management unit, the total number of tree species at free growing is no less than what was present prior to harvest. 3) Within the management unit, the proportion of a specific tree species at free growing is no more than 10 per cent greater than what was present prior to harvest unless it increases the proportion of higher value species or specific species diversity targets are approved for the management unit. 4) By 2020, all tree seed used to establish a free growing stand is registered and selected in accordance with new climate-based seed transfer standards.

2.1.4 Stand productivity and growing stock

Management of stand productivity and growing stock encompasses the health, genetics, density, and stocking of various stands so that they can productively utilize site resources.

Goal	Maintain or improve stand productivity.
Objectives	1) Develop cost effective management options for the consideration of government with timely management unit analysis and planning after significant and sudden changes to growing stock from natural disturbances and salvage harvesting. 2) Management will target full site occupancy of growing space, after making effective allowances for other values and risks. 3) The proportion of high-risk species across a management unit will not be increased and, where future risks for such species are disproportionately high compared with other species, they will be gradually reduced. 4) Decisions at the stand level will not be made solely on the basis of return-on-investment data, but will consider stand level risks and management unit objectives and targets. 5) Use tree seed selected for improved growth or pest tolerance, where available.
Targets	1) Harvested areas will be reforested with tree species and stocking levels that meet or exceed growth and yield projections assumed in TSR. 2) By 2020, 75 per cent of all trees planted will be grown from selected seed with an average genetic gain of 20 per cent.

2.1.5 Inherent site capacity

Inherent site capacity is about the biophysical attributes of the land as they relate to timber productivity. Site capacity is mostly influenced by soil attributes, hydrological flows and balances, and associated processes such as decomposition and nutrient cycling.

Goal	To maintain the inherent site capacity of B.C.'s forested ecosystems.
Objectives	1) The permanent footprint of road, trails, and landings will not exceed what is necessary for logical and efficient natural resource management. 2) Access construction and maintenance will maintain natural drainage patterns and flows, and will not contribute to slope failures or chronic erosion over the long term. 3) Harvesting, silviculture and other management activities will not result in significant soil compaction and/or erosion on growing sites, temporary trails and work areas that will be reforested. 4) Harvesting, silviculture and other management activities will be conducted to provide for maintenance or recovery of proper nutrient cycling and soil nutrition.

Targets	1) The Forest Planning and Practices Regulation (FPPR), s. 35, restricts soil disturbance to a maximum percentage of site disturbance within the net area to be reforested 2) The province has incorporated explicit maximum percentage limits for site disturbance and construction of permanent access structures into the FPPR, s. 36. The ministry's target is to have the average site disturbance for the province at less than 5 per cent. 3) The province directs the maintenance of natural drainage patterns for road construction and maintenance in FPPR, s. 37-39.

2.2 Designations and objectives set by government

In June 2004 the minister approved the designation of landscape units and non-spatial old retention targets. Non-legal old growth management areas were subsequently drafted to provide operational guidance to licensees.

To conserve critical habitat, Wildlife Habitat Areas (WHA) were established for the following species:

- Coastal Tailed Frog
- Great Basin Spadefoot
- Grizzly Bear
- Lewis's Woodpecker
- Western Screech Owl
- Williamson's Sapsucker
- Data Sensitive species

Additional WHAs are proposed for Williamson's Sapsucker and a Data Sensitive species.

Government orders have also been implemented to establish general wildlife measures and Ungulate Winter Range (UWR) locations for mule deer and mountain goat.

2.3 BC Mountain Pine Beetle model (BCMPB)

The BC Mountain Pine Beetle model (BCMPB) was developed by FLNR to project the annual volume of mature pine killed by MPB. Aerial overview survey data are fundamental to calibration of BCMPB and these data are provided by a series of annual surveys. Projection reports and updates have been published annually since 2004, with the most recent update projecting infestation levels to 2015.

As illustrated by Figure 4, the level of red attack in the Merritt TSA started to increase dramatically in 2004, reaching a peak in 2007. This was followed by a sharp decline, with red attack reaching the pre-2004 levels in 2011.

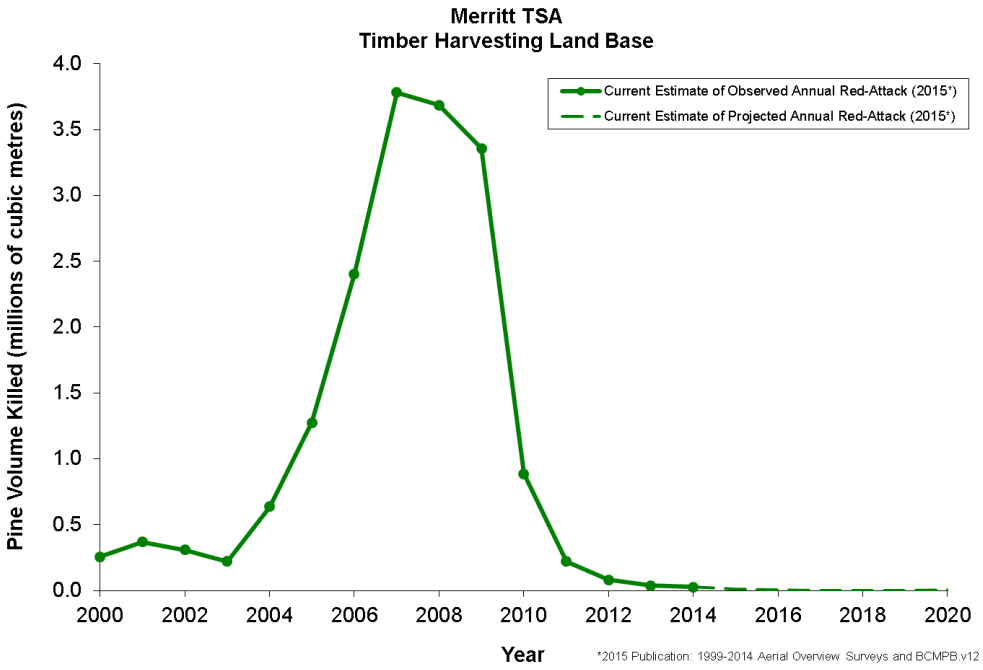


Figure 4 Annual MPB Kill Levels on the Merritt TSA THLB

Figure 5 provides the current cumulative pine volume killed by year, relative to predictions of the cumulative kill for previous versions of the model. The cumulative kill to date is significantly less than predicted in previous years.

Since the MPB infestation began in the district in 2004, harvesting has focused on salvaging dead and dying pine trees, so that pine accounts for approximately 70 percent of the total volume harvested. The 2015 Timber Supply Review public discussion paper has indicated that only about 2.5 million m^3 of dead pine remain on the THLB and that the dead pine volume is dispersed throughout stands that include significant volumes of live timber.

Using data from the provincial Vegetation Resource Inventory and applying the TSR 2015 shelf life function (see Section 5.4.1) confirms that roughly 67% of the dead pine in the Merritt TSA THLB is in stands where the dead pine component is 50% or less of the total volume of the stand (Figure 6).

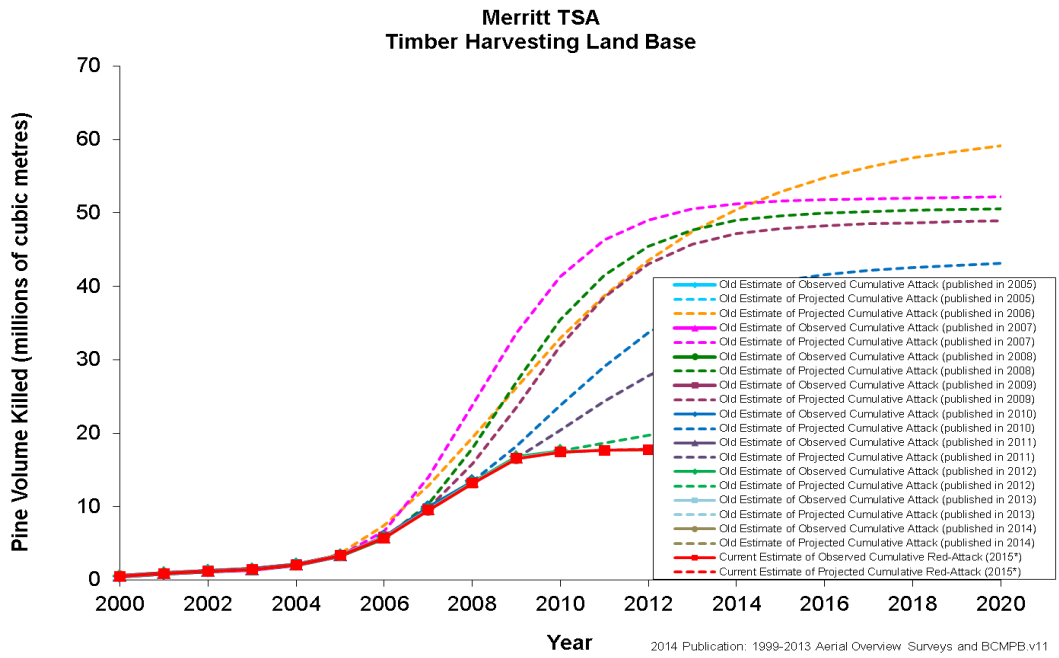


Figure 5 Cumulative MPB Kill Levels on the Merritt TSA THLB

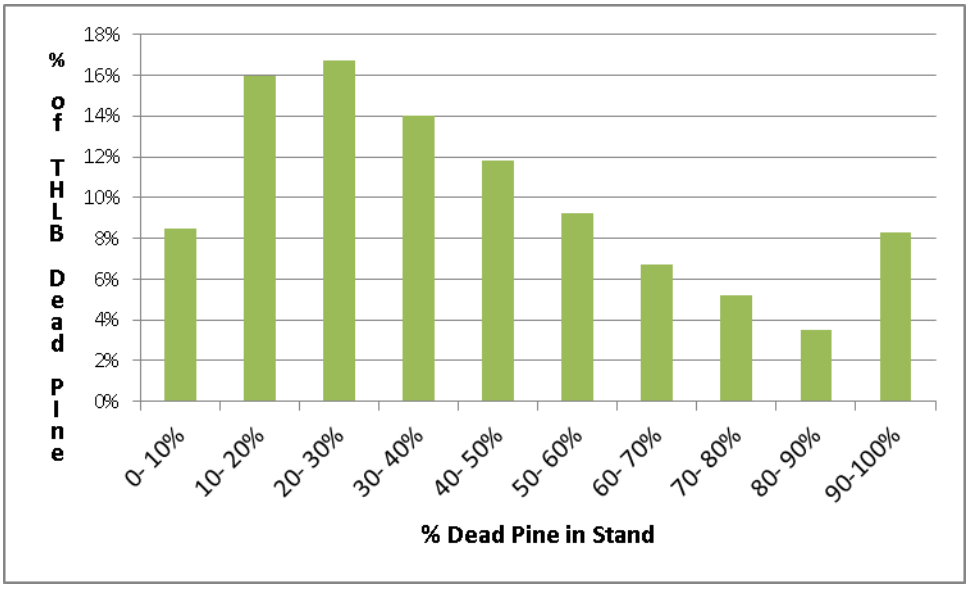


Figure 6 Distribution of THLB pine volume using forest inventory data and shelf life assumptions

2.4 Mid-Term Timber Supply Action Plan

In response to the Special Committee on Timber Supply's recommendations the FLNR released *Beyond the Beetle: A Mid-Term Timber Supply Action Plan* in October, 2012 and a backgrounder document for the Merritt TSA released in June, 2012. The backgrounder document includes maps and details on the status of land use plans, past allowable annual cuts, mid-term timber supply forecasts, silviculture investments, economic profiles, opportunities for diversification, opportunities for mitigations, and resource value implications. It provided information to inform the discussion on whether to initiate a process to review and/or amend objectives such as visual quality, old growth management, and

ungulate winter ranges to mitigate the fall-down in mid-term timber supply. No specific analysis was completed to investigate mitigation opportunities and no recommendations were made.

The backgrounder also indicated that enhanced forest management such as intensive silviculture and strategic planning of harvesting may provide some opportunities for increasing the mid-term timber supply. In particular:

- Mitigation opportunities exist through the salvage and reforestation of beetle-killed stands with low value overstory. A reforestation program funded by Forests for Tomorrow could soften the transition if supported by a salvage program, and it could mitigate the mid-term by a small amount through enabling stands to be harvested earlier.
- Spacing and fertilization of younger stands may improve the mid-term timber supply slightly by decreasing time to merchantability of these stands.
- Continued support of forest health initiatives is imperative. The protection of the remaining growing stock from pest/disease and initiation of high-priority inventory and analysis projects should be top priorities from a timber supply perspective.
- Douglas-fir selection areas are expected to contribute to the timber supply throughout the mid- and long-term. Appropriate management planning is necessary to ensure the harvest from this profile is captured and projected benefits are realized.

2.5 Multiple Resource Value Assessment

The goal of sustainable forest management is to achieve a balance between environmental, social and economic objectives. The purpose of the Multiple Resource Value Assessment (MRVA) reports is to provide resource professionals and decision makers with information about the environmental component of this 'balance' so that they can assess the consistency of actual outcomes with their expectations.

The Forest and Range Practices Act (FRPA) lists eleven resource values essential to sustainable forest management in the province; biodiversity, cultural heritage, fish/riparian and watershed, forage and associated plant communities, recreation, resource features, soils, timber, visual quality, water, and wildlife. The MRVA report is a summary of the available field-based assessments of the conditions of these values. Field assessments are generally conducted on or near recently harvested cut blocks and therefore are only evaluating the impact of industrial activity and not the condition of the value overall (i.e., they don't take into account protected areas and reserves). Most of the information is focused on the ecological state of the values and provides useful information to resource managers and professionals on the outcomes of their plans and practices. This information is also valuable for communicating resource management outcomes to stakeholders, First Nations and the public, and as a foundation for refining government's expectations for sustainable resource management in specific areas of the Province.

Source: Merritt NR District MRVA November 2013

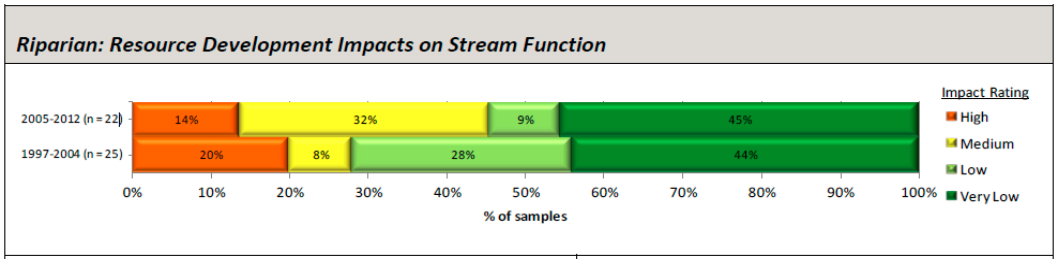
The extraction and development of natural resources, along with natural factors (e.g., insects, wind, floods) can influence and impact ecological condition. The goal of effectiveness evaluations is to assess these impacts on the state of public natural resource values (status, trends, and causal factors); such evaluations do not assess compliance with legal requirements. These evaluations help resource managers:

- Assess whether the impacts of resource development result in sustainable resource management,

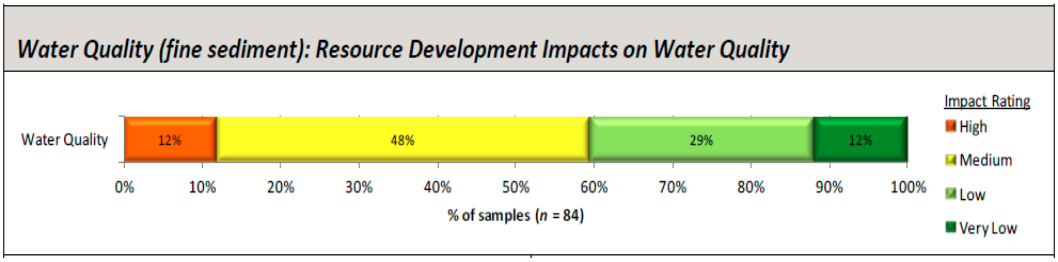
- Provide transparency and accountability for the management of public resources,
- Support the decision-making balance between environmental, social, and economic factors, and
- Inform the ongoing improvement of resource management practices, policies, and legislation.

The MRVA produced a summary of key findings, and in some cases identified performance trends, as illustrated in the graphs taken from the report (Figure 7). The MRVA provides excellent baseline data for comparing against future performance.

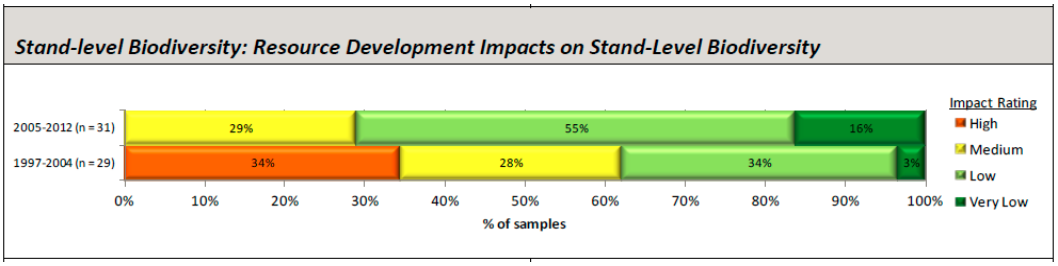
Source: Merritt MRVA Report, November 2013



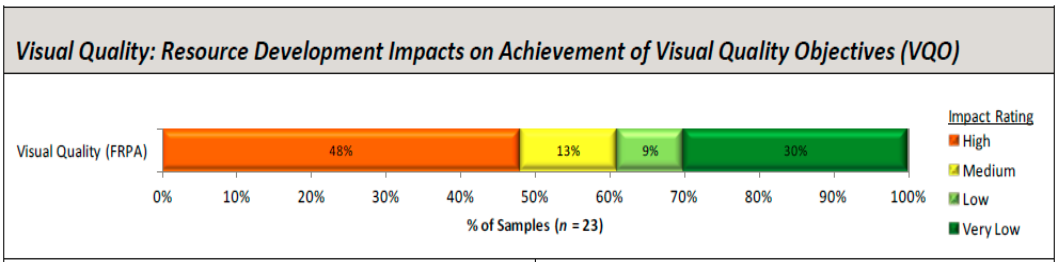
Overall Trend in Riparian Stewardship: <u>Neutral</u>



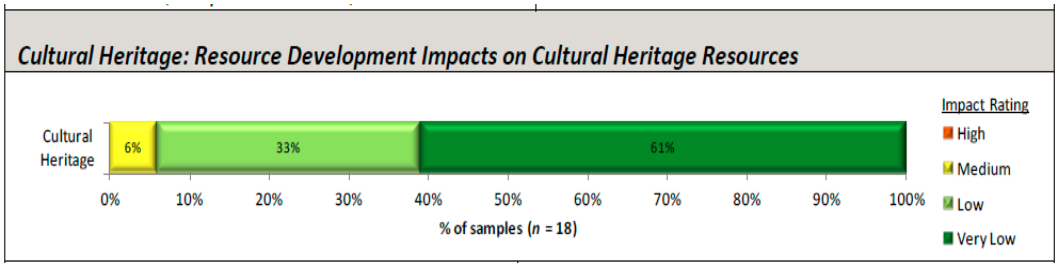
Overall Trend in Water Quality: <u>Insufficient data</u>



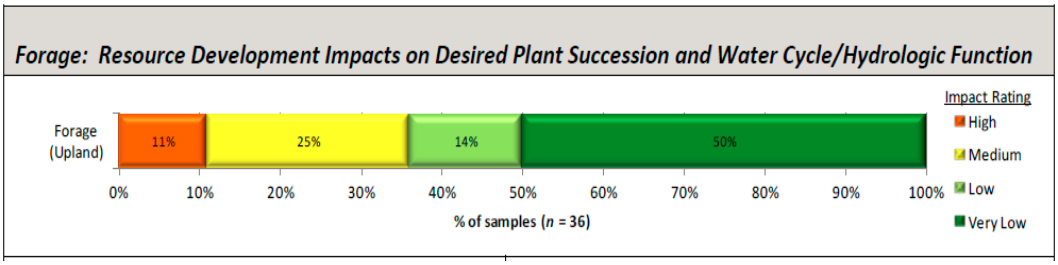
Overall trend in Stand-level Biodiversity Management: <u>Improving</u>



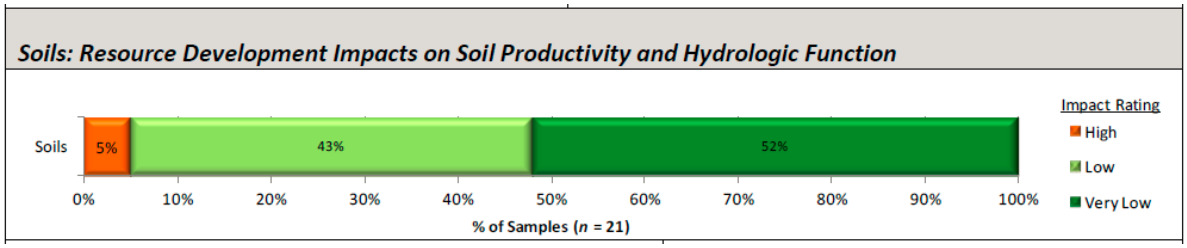
Overall trend in Visual Quality Management: <u>Insufficient data</u>



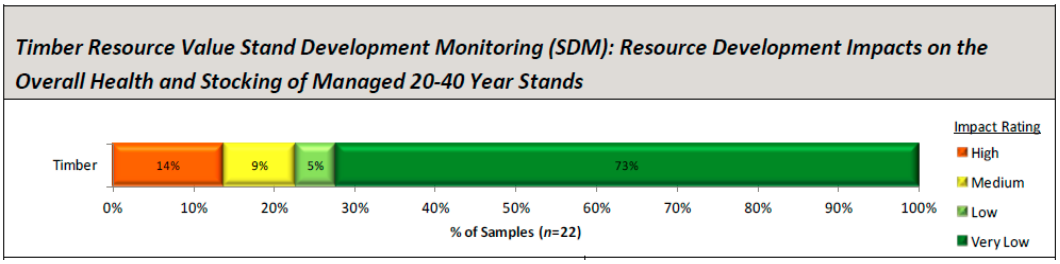
Overall trend in Cultural Heritage Management: <u>Insufficient data</u>



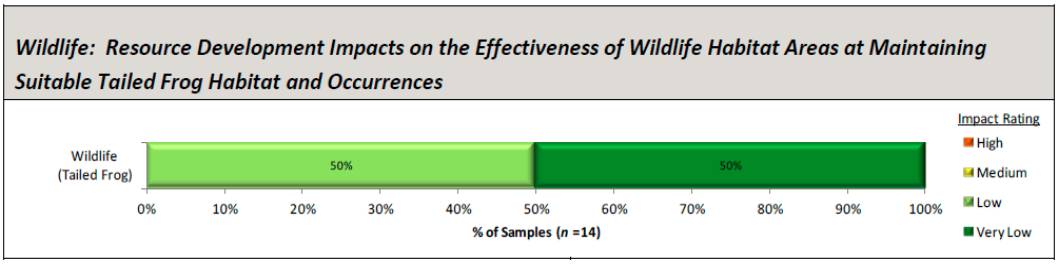
Overall trend in Resource Development Impacts: <u>Insufficient data</u>



No trend established at this time.



No trend established at this time.



Overall trend in Wildlife Management: <u>Insufficient data</u>

Figure 7 MRVA Performance and Trends - Merritt TSA

2.6 Provincial Stewardship/Timber Harvesting Land Base Stabilization

The FLNR's Forest Competitiveness Initiative has produced a set of guidelines for implementing Provincial Stewardship/THLB Stabilization Projects. The intent of these projects is to optimize the stewardship of Provincial forest and natural resources while realizing the full operational potential of the THLB. The best possible combination of overlapping the many THLB constraints, referred to as co-location, is the key objective of the process optimization, which is hoped to result in an overall increase in THLB. The projects will not change any existing land use plans or legislation.

2.7 Forest Health Strategy

The 2013 Merritt TSA Forest Health Strategy was prepared with the goal of protecting forest resources from damaging agents that threaten the resources immediate and long-term sustainability. Forest health pests were ranked following the Provincial Forest Health Strategy, based on known impacts to forest resource values, availability of operational detection and treatment methods, cost and benefits of applying detailed detection and treatment activities, overall level of knowledge of the hazards and risk and distribution and incidence levels of the pests. Table 1 summarizes the priority ranking of forest health pests in the TSA.

Table 1 Priority Ranking of Forest Health Pests in the Merritt TSA

Very High	High	Medium	Low	Very Low
Mountain Pine Beetle	Western Spruce Budworm	Cattle	Western Balsam Bark Beetle	
Spruce Bark Beetle	Lodgepole pine Dwarf Mistletoe	Tomentosus Root Rot	Vole	
Armillaria Root Disease	Hard pine stem rusts		White pine blister rust	
Phellinus Root Disease	Douglas-fir Beetle			

2.8 Silviculture Strategies

2.8.1 Type 1 Silviculture Strategy

In March 2006, Forsite Consultants Ltd., Symmetree Consulting Group, and Mike Fenger and Associates completed a Type 1 silviculture strategy for the Merritt TSA. The focus was to mitigate impacts to non-timber values brought about by the mountain pine beetle (MPB) epidemic and associated harvesting, while also looking to treat non lodgepole pine stands to improve midterm timber supply. Addressing non-timber issues was seen as the highest priority as significant indirect benefits to timber supply were evident. Limited opportunities to improve timber supply over a five year period were identified because salvage was keeping up to MPB mortality, most burned areas had been reforested, and there were limited non-pine stands outside the dry-belt (see section 5.8) to fertilize.

2.8.2 Type 2 Silviculture Strategy

A Type 2 silviculture strategy was developed in April 2007 by Timberline Forest Inventory Consultants Ltd. This project explored opportunities to substantially improve future timber supply while retaining high priority First Nations and environmental areas. The primary opportunity to improve timber supply was identified as carrying out planting on areas heavily impacted by MPB without silviculture obligations.

2.8.3 Forests For Tomorrow

The Forests for Tomorrow (FFT) program aims to improve the future timber supply and address risks to forest values through the re-establishment of young forests. It focuses on land that is primarily within the THLB but outside of forest industry obligations.

Initially, the program focused on areas impacted by forest fires since 2003. However, since 2009 over-story removal stands deemed uneconomic for management by current licensees has been conducted through BC Timber Sales' Innovative Timber Sales.

To 2013, the FFT program in the Merritt TSA has completed reforestation on over 6,250 hectares and has completed 2,094 hectares of over-story removal (Table 2).

Note 1 - Include results for 2014? – Doesn't seem to be on internet. Perhaps get from ministry.

Table 3 summarizes the forecast activities from 2014 to 2018 in the FFT 5 year plans. These projected activities are dependent on the continuation of FFT funding, the amount of eligible stands within the TSA, market conditions and the demand for low quality fibre.

Source: Merritt TSR Data Package – 2014 Factor 21 Forests for Tomorrow

Table 2 Forests For Tomorrow Activities from 2003 to 2013 in the Merritt TSA.

Year	Planting		Over-story Removal (hectares)
	Hectares	seedlings	
2003	14.7	18,000	0.0
2006	204.8	300,410	0.0
2007	510.5	692,935	0.0
2008	0.0	0	21.1
2009	842.0	1,035,145	251.5
2010	1,086.5	1,680,085	202.0
2011	1,222.3	1,849,705	548.0
2012	1,254.7	1,991,605	556.0
2013	1,122.8	1,788,045	515.0
Totals	**6,258.3**	**9,355,930**	**2,093.6**

Table 3 Forecast Forest for Tomorrow Activities from 2014 to 2018

Year	Planting (approximate)		Over-story Removal (hectares)
	Hectares	seedlings	
2014	720	1,151,500	154
2015	812	1,300,000	194
2016	206	330,000	167
2017	200	320,000	28
2018	162	260,000	0
Totals	**2100**	**3,361,500**	**543**

2.9 Grassland Conversion and Ecosystem Restoration

The vision of the Provincial ecosystem restoration program is to restore identified ecosystems to an ecologically appropriate condition creating a resilient landscape that supports the economic, social, and cultural interests of British Columbia (Neil & Anderson, 2009). Ecosystem Restoration is defined as the process of assisting with the recovery of an ecosystem that has been degraded, damaged, or destroyed by re-establishing its structural characteristics, species composition, and ecological processes.

Certain grassland ecosystems within the Merritt TSA are being encroached upon by Douglas-fir/ponderosa pine forests. TSR 2 identified approximately 1,258 THLB hectares of grassland within the IDFdk1a, IDFxh1a, IDFxh2a, and BGw1 biogeoclimatic zones. No new data has been collected since TSR 2, but district personnel believe this estimate may be too low.

Source: Merritt TSR Data Package – 2014 Factor 31 – Grassland Conversion and Ecosystem Restoration

A project recently completed for FLNR indicates that there may be significant opportunities for additional ecosystem restoration in the Cascades District, with up to 31,609 hectares identified as high priority (Forsite, 2015). Areas within the Merritt TSA and within THLB were not specifically described.

Approximately 586 hectares of forest were treated with the goal of restoring these stands to a more open forest type, and a further 1,041 hectares were treated to reduce fuel loading in community interface zones. The Cascades district currently has no further plans to conduct ecosystem restoration activities.

2.10 Cumulative Effects Framework

Source: Addressing Cumulative Effects in Natural Resource Decision Making, 2014

Cumulative effects are changes to economic, environmental, and social values caused by the combined effects (positive or negative) of present, past and reasonably foreseeable actions or events. The Province is implementing a Cumulative Effects Framework which includes policy, procedures and decision support tools designed to improve the assessment and management of cumulative effects in natural resource decision making in BC.

Key elements of the framework include:

a. Values Foundation
b. Identify a priority set of values and associated objectives
c. Confirm the methods for assessment
d. Identify and collate data
e. Confirm the appropriate geographic areas for cumulative effects assessment and reporting with each Region
f. Assessment
g. Current condition
h. Foreseeable future condition to identify emerging issues and risk
i. Longer term scenarios of resource development, natural disturbances, and other climate change-induced ecological changes may be required

Decision Support to provide easy access to:

a. Mapped location of key values being monitored and assessed
b. Current condition and trend for those values, reflected in 'risk maps' for each value and in tabular data
c. Relevant objectives, methods and assumptions
d. Monitoring

Existing monitoring programs will be leveraged to monitor compliance, implementation and effectiveness.

Work is underway to implement the framework in the Merritt TSA.

Note 2 - Need to confirm and expand the above sentence. Cannot find anything concrete on web other than a few maps of Merritt contained within generic presentations.

2.11 Nicola-Similkameen Innovative Forest Society

The Nicola-Similkameen Innovative Forest Society (NSIFS) is comprised of nine members (Ardew Forest Products Ltd., Aspen Planers Ltd., Nicola Tribal Association, BC Timber Sales, Tolko Industries Ltd., Upper Similkameen Indian Band, Weyerhaeuser Company Ltd, and Stuwix Investment). Six of the members hold an Innovative Forest Practices Agreement (IFPA) and carry out the requirements of this agreement through the consensus of the NSIFS. The six IFPA holders are committed to ensuring innovative approaches are developed for all six IFPAs to similar standards.

The vision for the society is:

1. NSIFS uses innovative forest management practices that incorporate Aboriginal knowledge and values and public involvement in order to increase the productivity of a healthy and resilient working forest. These local forests provide increased forest values, additional investment and enhanced employment opportunities while assuring environmental, economic, and social sustainability for communities in the Nicola-Similkameen region.
2. NSIFS has produced three Forestry Plans for submission to the Regional Executive Director, with the most recent one being submitted in June 2012. The main purpose of this plan is to outline the ongoing work in support of the IFPA AAC uplift request, highlight the accomplishments achieved from Forestry Plan II, and identify the program areas the NSIFS will continue to work on.

The strategic objectives for Forestry Plan III are:

a. create an innovative forest management environment;
b. support First Nation's communities;
c. increase the sustainable harvest;
d. enhance environmental values;
e. strengthen forest inventories and support tools; and
f. maintain effective community involvement.

The NSIFS has completed many projects in the areas of habitat modelling, predictive ecosystem mapping, MPB, biodiversity, hydrology, species at risk, and wildlife. Through the NSIFS, many of the First Nations have collaborated with licensees in developing tools that assist in the identification of specific cultural and wildlife values on the landscape.

2.12 Nicola Thompson Fraser Sustainable Forest Management Plan

Aspen Planers Ltd., BC Timber Sales, Canadian Forest Products Ltd., Gilbert Smith Forest Products Ltd., and Tolko Industries Ltd. are the participating entities in the Nicola Thompson Fraser Sustainable Forest Management (SFM) Plan (January 2015). This plan was developed to achieve certification to the Canadian Standards Association (CSA) Z809-08 Sustainable Forest Management Standard, and applies to defined areas within the Kamloops, Lillooet and Merritt TSAs. Within the Merritt TSA, the plan applies to the licensee operating areas for Aspen Planers, BC Timber Sales, and Tolko.

Through this plan, the participating licensees have committed to conducting business in a fashion that protects the environment while ensuring sustainable development of forests through adherence to a set of management and operational principles. The SFM plan is a "roadmap" to current and future strategies related to long-term performance, with values, objectives, indicators and targets developed in collaboration with a Public Advisory Group. The SFM plan is an evolving document that will be reviewed and revised on an annual basis with the Public Advisory Group.

Evaluation of participating licensees' performance against the indicators and targets is reported annually and is available on the Nicola Thompson Fraser certification website:
http://thompsonokanagansustainableforestry.ca

3 First Nations and Cultural Heritage

Note 3 - Check with FLNR for more robust discussion for this section

Source: Merritt Timber Supply Area Timber Supply Review Technical Report, November 2015

Approximately thirty percent of the population for the area are represented by First Nations living within or immediately adjacent to the Merritt TSA. First Nations have a strong history of traditional use on the lands within the Merritt TSA. Cultural use sites can be found throughout the TSA and include areas of spiritual importance as well as traditional use of fish, wildlife, and plants.

Local First Nations are extensively involved at the operational level of forest planning in the Merritt TSA, including the Nicola Similkameen Innovative Forestry Society (section 2.8). Through this involvement, forest licensees are able to work with First Nations to accommodate known aboriginal interests with minimal timber supply impacts.

Nlaka'pamux Nation

The Nlaka'pamux Nation represents the largest number of members (approximately 6,524 people) who reside in 15 communities located within, or immediately adjacent to, the Merritt TSA. Members residing outside of Merritt TSA live close by in the Fraser Canyon area.

All Nlaka'pamux member bands have asserted aboriginal interests to areas within the Merritt TSA and all are signatory to the 2003 Nlaka'pamux Writ of Summons claiming title to Nlaka'pamux territory. While the Nlaka'pamux have asserted aboriginal interests to the entire Merritt TSA (including areas beyond the TSA) the communities are largely located to the north and west between the Fraser/Thompson and Coldwater River systems.

The Nlaka'pamux is represented by two tribal associations: the Nicola Tribal Association (NTA) and the Nlaka'pamux Nation Tribal Council (NNTC) are responsible to varying degrees for strategic planning, economic development and coordination of information for the communities. Some of the larger communities, Lytton and Lower Nicola for example, handle most of their own affairs and handle their own referrals.

Okanagan Nation

The Okanagan Nation has the next largest representation from three communities within the east and south east portions of the TSA. Four Okanagan Nation communities outside the TSA have also asserted interests within the TSA. In total the Okanagan Nation represents approximately 5,877 people.

The Okanagan Nation has asserted aboriginal interests to a large portion of the Merritt TSA (2003 WRIT) and is represented by the Okanagan Nation Alliance (ONA).

Secwepemc Nation

The Secwepemc people are a nation of 17 bands occupying the south central part of BC. Nation has asserted interests in the north section of the Merritt TSA.

Sto:Lo Nation

The Sto:lo Nation is comprised of eleven Sto:lo communities and has a small area of asserted traditional territory in the south section of the Merritt TSA.

4 Forest Licensees

Note 4 - Let's elaborate; repeat harvest allocations? Mill capacity? Certification? Other mills without woodlands?

Within the Merritt TSA, seven licensees currently hold replaceable harvesting rights while eight licensees hold non-replaceable harvesting rights. Details of the volumes allocated to licensees are summarized in Table 7 within Section 5.3.6.

4.1 Replaceable Forest Licensees

Ardew Wood Products Ltd. is a family owned business that previously operated a sawmill located in Merritt. This mill was closed in January, 2013.

Aspen Planers Ltd. is an independent, family owned business that operates a lumber mill in Merritt, as well as, post and rail facilities in Merritt and Princeton.

Tolko Industries Ltd. is a large, family owned business that operates a dimension lumber mill in Merritt, plus additional lumber, plywood, OSB, and paper manufacturing facilities located across western Canada.

Weyerhaeuser Company Ltd. is a large, multinational corporation that operates a lumber mill in Princeton. Within Canada, Weyerhaeuser operates seven timberland operations in BC, Alberta, Saskatchewan and Ontario.

Stuwix Resources Ltd. is a fibre management and marketing company that is owned jointly by seven First Nations Bands (Coldwater Band, Nooaitch Indian Band, Siska Indian Band, Upper Similkameen Band, Cook's Ferry Band, Upper Nicola Band, and Shackan Band).

Lower Nicola Indian Band, located six kilometres west of Merritt at Shulus, holds one replaceable licence.

4.2 Non-Replaceable Forest Licensees

Eight licensees hold thirteen non-replaceable forest licences within the Merritt TSA. Five of these licensees are First Nations: Coldwater Indian Band (three licences), Siska Indian Band (one licence), Nooaitch First Nation (two licenses), and Shackan Indian Band (two licences). The other three licences are held by Ardew Wood Products Ltd., Aspen Planers Ltd., and Princeton Post and Rail Ltd.

4.3 BC Timber Sales

BC Timber Sales has a mandate to provide the cost and price benchmarks for timber harvested from public land by auctioning blocks through timber sale licenses. This semi-autonomous program within FLNR has an AAC allocation of 389,520 m^3/year in the Merritt TSA. BC Timber Sales is currently certified to the ISO 14001: 2004 Environmental Management System (EMS) Standard and, as part of the Provincial Sustainable Forestry Initiative single certificate initiative, BC Timber Sale's Kamloops Business Area is certified under the 2015 - 2019 Sustainable Forestry Initiative Standard.

4.4 Area-Based Tenures

Area-based tenures within the Merritt TSA are awarded their own AAC based on a defined area and management regimes. While these tenures are not within the scope of this project, they are affected by similar issues and regulatory regimes.

Community Forests

The Vermillion Forks Community Forest is an area-based tenure of 12,950 hectares held in partnership between the Town of Princeton, the Upper Similkameen Indian Band, and the Regional District of Okanagan Similkameen. It has an AAC of 20,000 m^3/year and is located west of Princeton.

Woodlots

There are 23 woodlots within the Merritt TSA; each managed by individual woodlot licensees. The crown land portion of these woodlot licences totals 14,738 hectares with an AAC of 71,305 m^3/year. An additional 2,803 m^3/year of AAC is attributed to the 4,294 hectares of Schedule A (private) land within these licences. Three applications totalling 2,424 hectares are currently being considered for the woodlot program.

5 Timber Supply

5.1 Resource Inventories

Table 4 lists the inventories presented in the TSR 2015 technical report. This information should provide an excellent foundation for this Merritt TSA ISS project.

Table 4 Merritt TSA Resource Inventories

Data	Source	Vintage	Update
Timber Supply Area Boundary	**British Columbia Government Warehouse (BCGW)** *(WHSE_ADMIN_BOUNDARIES.FADM_TSA)*	2003	
Ownership	**BCGW** *(WHSE_FOREST_VEGETATION.F_OWN)*	2010	
Woodlots & Community Forests	**BCGW** *(WHSE_FOREST_TENURE.FTEN_MANAGED_LICENCE_POLY_SVW)*	2008	2014
Vegetation Resource Inventory	**BCGW** *(WHSE_FOREST_VEGETATION.VEG_COMP_LYR_R1_POLY)*	1991	2013
Provincial Managed Stand Site Productivity	**FLNR Forest Analysis and Inventory Branch**	2014	
Depletion Layer	**BCGW/RESULTS and FLNR Forest Analysis and Inventory Branch**	2014	
Heritage Trails	**BCGW** (WHSE_FOREST_TENURE.FTN_RECREATION_LINES_SVW)	2014	
Existing Roads	**FLNR Thompson Okanagan Region**	2012	
Environmentally Sensitive Areas	**FLNR Cascades District** (Environmentally_Sensitive_Areas.gdb)	1994-1996	
Terrain Stability	**FLNR Cascades District** (Terrain_Stability_Mapping.gdb / TSM_Class_5_TME)	????	
Operability Lines	**FLNR Cascades District** (fopr_sir)	1990s	
Digital Elevation Model Elevation, Slope and Aspect Data	**GEOBC**	2002	
Parks and Ecological Reserves	**BCGW** (WHSE_TANTALIS.TA_PARK_ECORES_PA_SVW)	2008	2014
Stream, Lake, and Wetland Class Data	**FLNR Cascades District** (Riparian_Mgmt.gdb)	1990s	
Informal Old Growth Management Areas	**FLNR Cascades District**	2014	
Visual Quality Polygons	**BCGW** (WHSE_FOREST_VEGETATION.REC_VISUAL_LANDSCAPE_INVENTORY)	2004	2014
Ungulate Winter Range Planning Cells	**BCGW** (WHSE_WILDLIFE_MANAGEMENT.WCP_UNGULATE_WINTER_RANGE_SP)	2005	2014
Approved Wildlife Habitat Areas	**BCGW** (WHSE_WILDLIFE_MANAGMENT.WCP_WILDLIFE_HABITAT_AREA_POLY)	2005	2014
Water Intakes for Community Watersheds	**BCGW** (WHSE_WATER_MANAGEMENT.BCHA_DRNKNG_WATR_EXTR_SITES_SP)	2006	2014

5.2 Forest Inventory

Aerial photography for most of the current forest inventory was taken in 1991 (Figure 8). However, the attributes associated with this inventory has been projected to January 1, 2014. The Vegetation Resource Inventory Management System (VRIMS) is also used to update the original inventory. In this process, new harvest and free-growing data are extracted from the Reporting Silviculture Updates and Land status Tracking System (RESULTS), verified and integrated into the Vegetation Resources Inventory (VRI).

New air photos for the Merritt TSA were flown in 2015. These will be used for interpreting a new VRI Phase 1 inventory; tentatively scheduled to be completed by 2018.

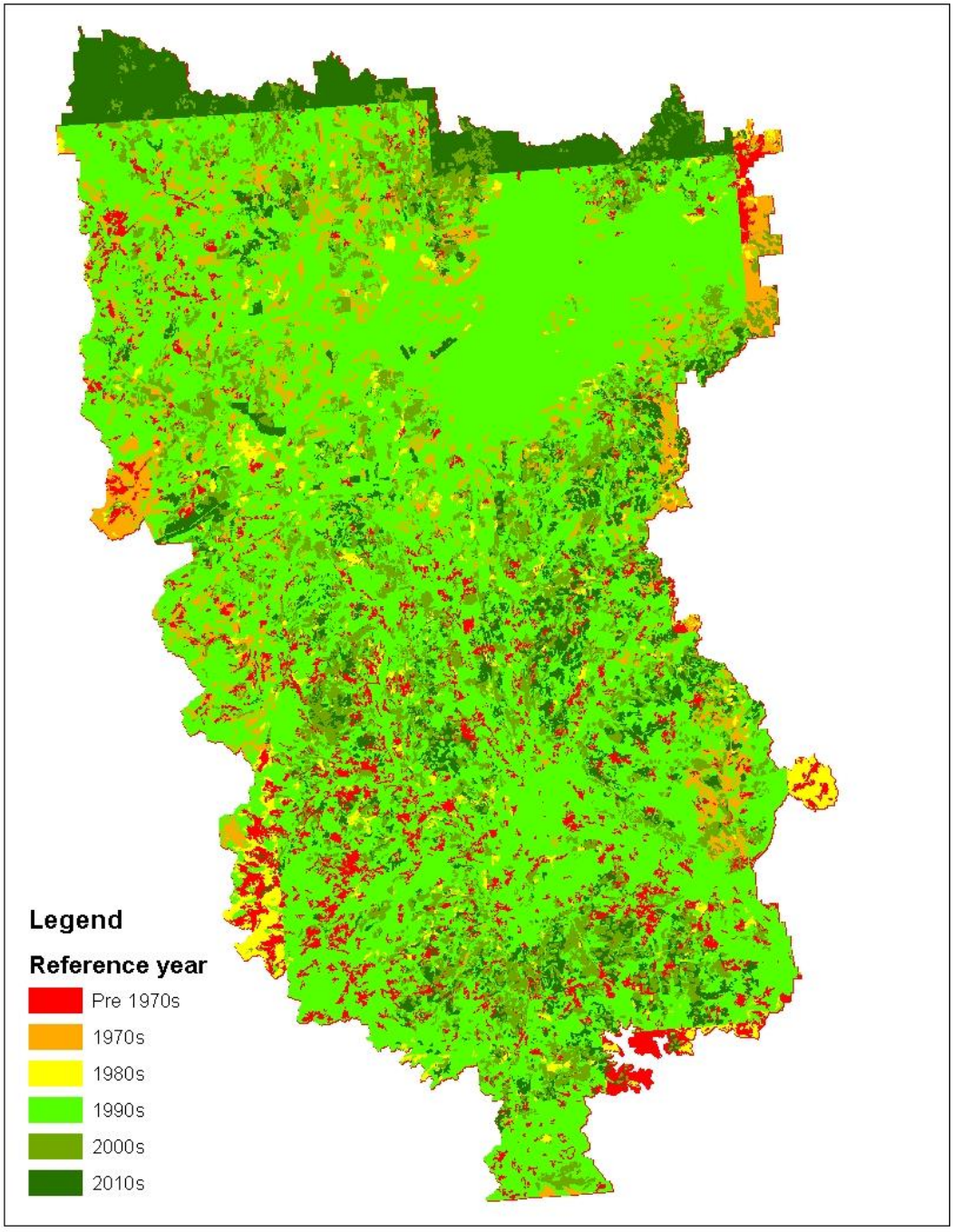


Figure 8 Inventory reference year for the Merritt Timber Supply Area

5.3 Allowable Annual Cut

5.3.1 Historic AAC

In 1996, the chief forester established an allowable annual cut (AAC) of 1,454,250 m³/year for the Merritt TSA, including a 250,000 m³/year partition attributable to small-diameter pine stands.

The AAC was later increased to 2,004,250 m³/year in 1999 to allow for the salvage of timber damaged in the 1998 Lawless Creek Wildfire and a MPB infestation. The 250,000 m³/year partition for small-diameter pine was continued.

By 2002, most of the economically-viable damaged timber had been salvaged and the AAC was reduced to 1,508,050 m³/year. At this time, the small-diameter pine partition was increased to 312,500 m³/year.

In 2004, work undertaken through the IFPA supported an AAC increase of 330,700 m³/year to 1,838,750 m³/year. The 312,500 m³/year small-diameter pine partition was continued.

The AAC was increased again to 2,814,171 m³/year in 2005 to address the MPB epidemic underway in the TSA. The small-diameter pine partition was maintained at 312,500 m³/year.

5.3.2 Current AAC

By 2010, the MPB epidemic in the Merritt TSA had peaked and the volume of beetle-killed pine was decreasing. As a result, the chief forester decreased the AAC to 2,400,000 m³/year. This AAC included a partition that limited the harvest of non-pine species volume to a maximum of 720,000 m³/year (30%). Within partition, the chief forester expected that about two-thirds would be incidental non-pine harvest resulting from the salvage of MPB stands. The remaining third was expected to come from stands damaged by spruce beetle. The partition was intended to conserve non-pine species volume, while providing licensees with an opportunity to salvage the remaining dead pine. At this time the small-diameter pine partition was discontinued.

In 2013, the Regional Executive Director for the Thompson Okanagan Region determined an IFPA AAC of 373,000 cubic metres for three years. This AAC was considered to be within the Merritt TSA AAC of 2,4M m³/year determined by the chief forester.

Table 5 provides the current AAC apportionment.

Table 5 AAC apportionment as of September, 2012

Forest License Type	Total AAC (m³/year)	%	Conventional AAC (m³/year)	%	Non-Pine Species AAC (m³/year)	%
Forest Licensees – Replaceable	920,605	38.36	644,425	38.36	276,180	38.36
Forest Licensees – Non-Replaceable	974,486	40.60	682,140	40.60	292,346	40.60
BC Timber Sale – Licence	389,520	16.23	272,664	16.23	116,856	16.23
Community Forest Agreement	20,000	0.83			20,000	2.78
Forest Service Reserve	95,389	3.97	80,771	4.81	14,618	2.03
Total	**2,400,000**	**100**	**1,680,000**	**100**	**720,000**	**100**

Source: Merritt TSA apportionment and commitments report of 2015/06/03

5.3.3 AAC Determinations of Innovative Forest Practices Agreement

As mentioned in section 2.8, six forest licensees with IFPAs work collaboratively through the NSIFS to develop and implement a consistent forestry plan to support AAC increase applications. Since 2004, the NSIFS has submitted three AAC increase applications that required determination by the Regional Executive Director.

In 2004, an IFPA uplift of 330,700 m³/year was awarded for the period January 1, 2004 to December 31, 2007. This uplift was in recognition of a wide scope of innovative projects ranging from updating inventory and growth and yield information to mapping wildlife capability and First Nations' values.

On March 30, 2005 NSIFS made application for a further 500,000 m³/year increase, based on innovative forestry practices that enhanced efforts to suppress the MPB infestation. The determination (July 13,

2005 to December 31, 2007) confirmed the 330,700 m³/year previously awarded plus an increase of 500,000 m³/year to salvage MPB.

In 2013, the Regional Executive Director made another determination to extend the IFPA and award 373,000 m³/year to the IFPA holders for the period January 1st, 2013 to December 31st, 2015. This volume was considered to be within the existing AAC of 2,400,000 m³/year determined by the Chief Forester.

Source: Public Discussion Paper, Merritt Timber Supply Review, 2015

5.3.4 Current Timber Supply Review and Future AAC

Under current legislation, the AAC for the Merritt TSA is not due until December 2, 2020. However, licensees are focused salvaging dead pine from pine-leading stands and only about 2.5M m³ of dead pine is estimated to remain on the THLB; dispersed throughout stands that include significant volumes of live timber. Consequently, the chief forester has concluded that there is an urgent need to re-examine the timber supply of the Merritt TSA.

The *Merritt Timber Supply Area Timber Supply Analysis Discussion Paper* was released in July 2015, and comments will be accepted until September 23, 2015. The discussion paper includes a base case harvest scenario and two alternate harvest scenarios. The base case uses the maximum initial harvest level that can be sustained without decreasing anytime in the future. Under this base case, the harvest level for the first 50 years is 1.16M m³/year (48.3% of current AAC), increasing to 1.34M m³/year for another 30 years, and then stabilizing at 1.50M m³/year (Figure 9).

In the first alternative forecast (Figure 10), the initial harvest level was set at 2.0M m³/year for five years. After five years the harvest level decreases to 1.08M m³/year, a level that is about seven percent lower than in the base case. This level is maintained for 45 years before the harvest level begins to increase to the same long-term level as in the base case (1.50M m³/year).

In the second alternative forecast (Figure 11), the initial harvest level is set at 1.50M m³/year - approximately the same level as in 2002. After five years the harvest level decreases to 1.13M m³/year, about three percent lower than in the base case. This level is maintained for 45 years before the harvest level begins to increase to the same long-term level as the base case.

The next AAC determination is expected prior to March 31, 2016. While the Chief Forester has not yet made a determination, it is likely - based on the harvest flows below - that this will result in a significant decrease in AAC over the next five to ten years.

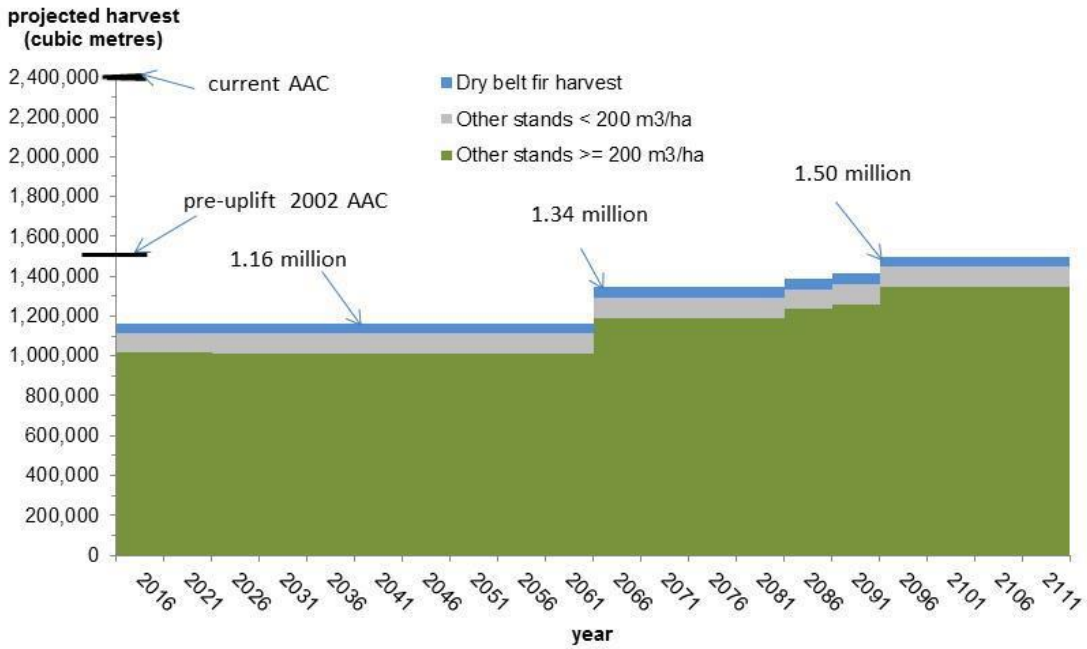


Figure 9 Base case forecast for the Merritt TSA 2015 Timber Supply Review

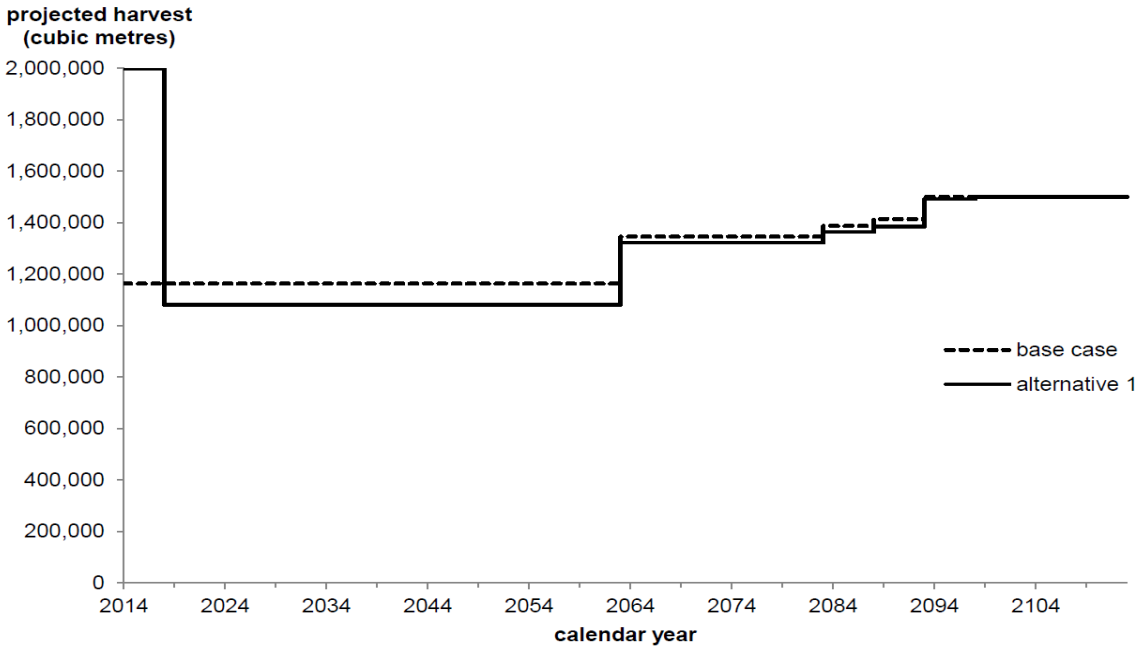


Figure 10 First Alternative harvest forecast – initial harvest level 2.0M m³/year for five years.

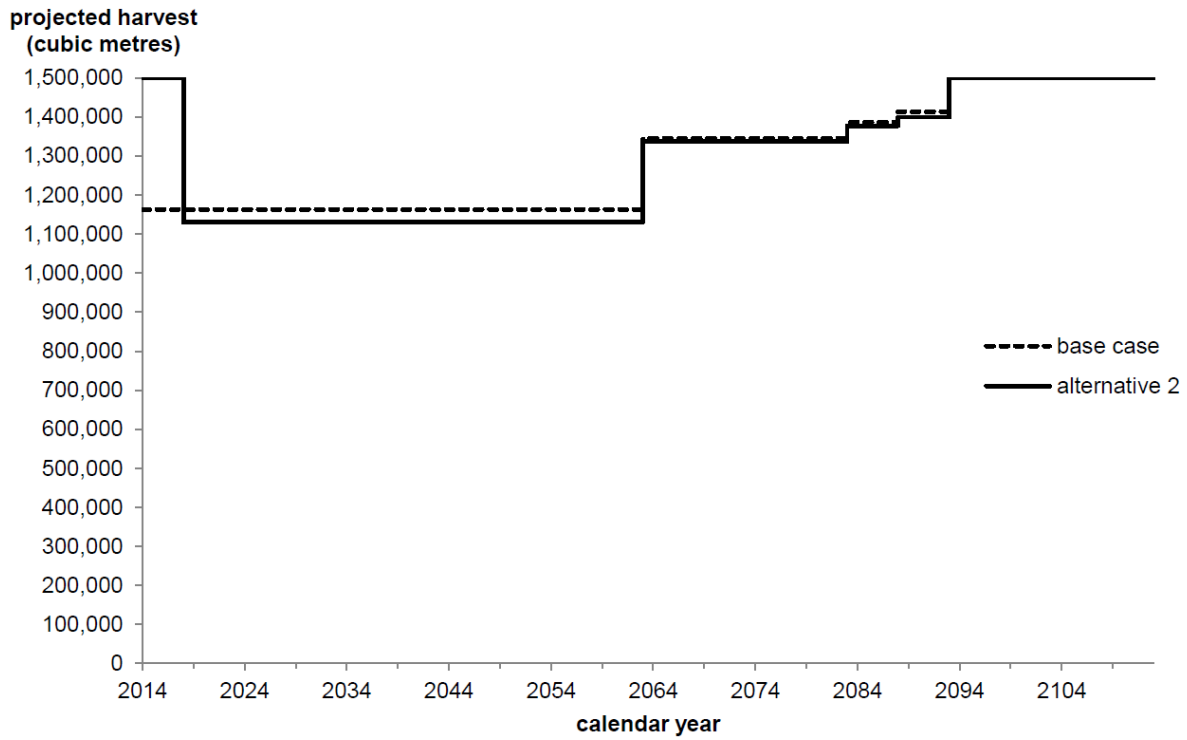


Figure 11 Second alternative harvest forecast – initial harvest level 1.5M m³/year for five years

5.3.5 Harvest Performance

Unlike some other areas in the province, the Merritt TSA fully harvested the allowable annual cut during the period from 2007 to 2009 when the sudden crash of the US housing market drastically reduced the demand for wood products. During this three year period, approximately 9.06 million m^3 was harvested, compared to the allowable annual cut of approximately 8.44 million m^3.

Data from the FLNR's Harvest Billing System (Table 6) shows that approximately 16.1M m³ of timber was harvested between January 1, 2010 to August 31, and the 70% target for lodgepole pine was achieved. The allowable annual cut during this period was approximately 14.0 million m^3, which indicates there are no issues with harvesting performance in the TSA. It is also apparent that the annual harvest has been decreasing with approximately 2.2M m³ harvested in 2014.

Table 6 Conifer Harvest Volume and percent harvest by species

	2010	2011	2012	2013	2014	2015 to August 31	Total
AAC	2,814,171	2,400,000	2,400,000	2,400,00	2,400,000	1,600,000	14,014,171
Harvest Volume	3,664,777	3,231,429	2,749,882	2,493,548	2,221,530	1,735,984	16,097,152
Lodgepole Pine (%)	74.6%	72.2%	72.1%	69.4%	71.2%	61.8%	71.0%
Spruce (%)	15.6%	17.2%	16.6%	18.2%	17.6%	19.8%	17.2%
Balsam (%)	5.0%	6.4%	6.8%	8.6%	7.4%	8.4%	6.8%
Fir (%)	3.5%	2.5%	4.0%	3.4%	3.7%	9.3%	4.0%
Other Conifer (%)	1.3%	1.8%	0.4%	0.5%	0.1%	0.6%	0.9%

Source: Harvest Billing System

5.3.6 Existing License Commitments

Compared to the AAC apportioned (Table 5), 68% of the AAC is currently committed (Table 7) to volume-based tenure holders within the Merritt TSA. Four of the six replaceable forest licences (Ardew Wood

Products Ltd., Aspen Planers Ltd., Tolko Industries Ltd., Weyerhaeuser Company Ltd.) operate processing facilities, while other two (Stuwix Resources Ltd. and Lower Nicola Indian Band) primarily sell the timber they harvest.

Source: Merritt TSA apportionment and commitments report of 2015/06/03

Table 7 Annual license commitments in the Merritt TSA

			Total m^3	Conventional Volume m^3	Non AAC Lump Sum Volume m^3
Replaceable Forest Licences	A18039	Ardew Wood Products	50,020	50,020	
	A18695	Aspen Planers	158,854	158,854	
	A18696	Tolko	165,475	165,475	
	A18697	Tolko	103,730	103,730	
	A18698	Weyerhaeuser	519,871	519,871	
	A65006	Stuwix Resources	206,100	206,100	
	A74911	Tolko	125,000	125,000	
	A88928	Lower Nicola	51,246	51,246	
		Total	**1,380,296**	**1,380,296**	
Non-Replaceable Forest Licences	A82441	Siska			9,800
	A84349	Coldwater			24,084
	A84350	Nooaitch First Nation			10,069
	A84497	Upper Nicola	25,000	25,000	
	A84498	Princeton Post and Rail	35,000	35,000	
	A84499	Ardew Wood Products	25,000	25,000	
	A84506	Aspen Planers	25,000	25,000	
	A85191	Coldwater			17,226
	A85451	Shackan	15,000	15,000	
	A85452	Siska	24,000	24,000	
	A86066	Nooaitch First Nation	84,000	84,000	
	A86085	Coldwater	20,000	20,000	
	A87237	Shackan	6,063	6,063	
		Total	**259,063**	**259,063**	**61,179**
		Total Annual Commitments	**1,639,359**	**1,639,359**	**61,179**

While operating areas are not legally defined, a well-respected informal agreement exists to identify specific geographical areas where each licensee operates (Figure 12). Licensees have already indicated a desire to renegotiate these operating areas shortly after the TSR 2015 is determined.

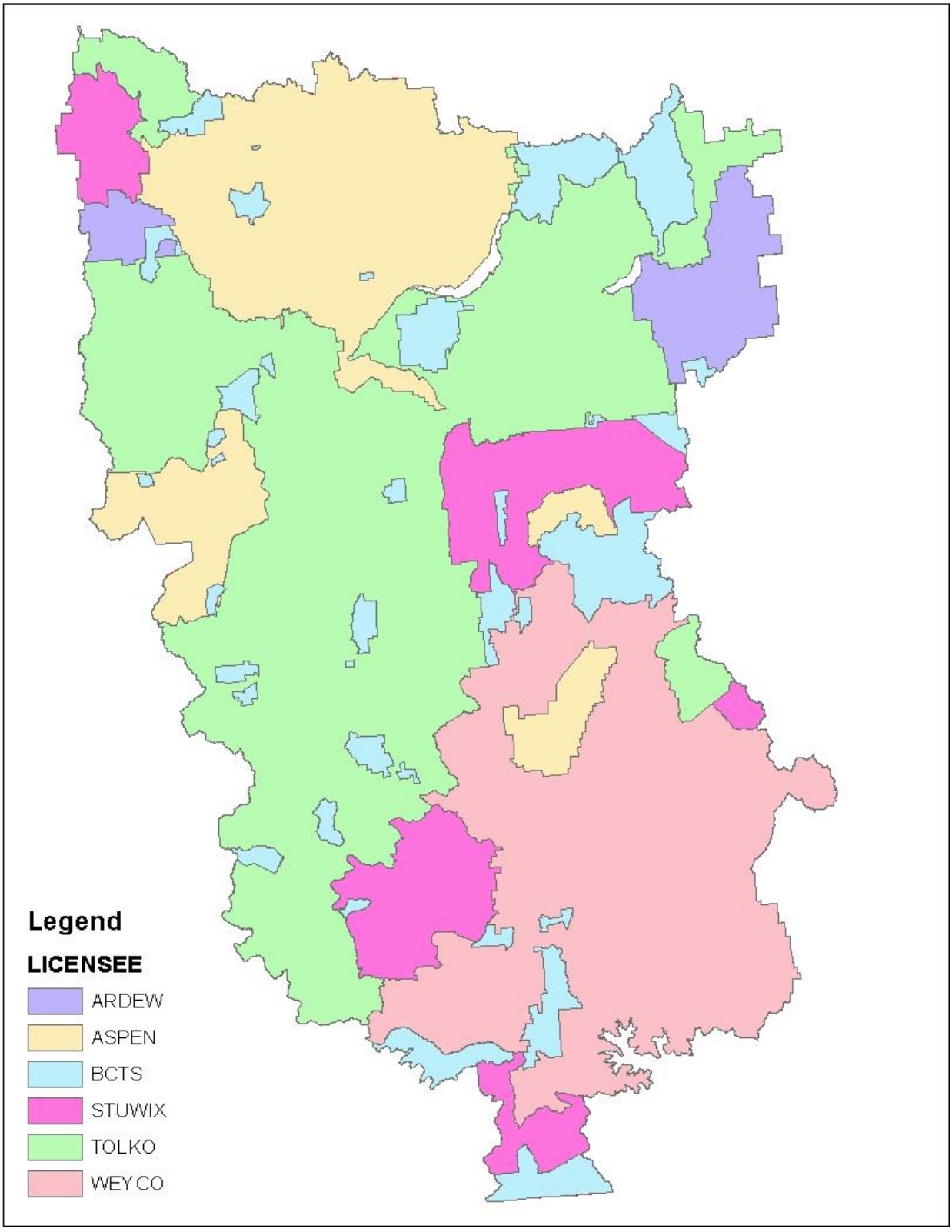


Figure 12 Licensee Operating Areas for the Merritt Timber Supply Area

5.4 MPB Impacts

The MPB infestation in the Merritt TSA increased dramatically in 2004, reached a peak in 2007, and then declined sharply until 2011 (section 2.3). The 2015 Timber Supply Review public discussion paper has indicated that only about 2.5M m³/year of dead pine remain on the THLB; dispersed throughout stands that include significant volumes of live timber.

5.4.1 Beetle Killed Pine and "Shelf Life"

A mill's ability to utilize MPB-killed logs is determined by the loss of volume attributed to dead trees and decay beyond merchantability (shelf life). This volume loss is considered defect or cull volume that is not included in the appraisal and is not accounted for cut control purposes. Following MPB attack, the wood fibre of the dead trees continually gets drier, more brittle and begins to rot at the base of the tree. This has a negative impact on both costs and revenues where:

1. "non-sawlog" timber must be left in the woods and merchantable stands are located farther away from the mills;
2. lumber recoveries drop with increasing wastage due to rot and checks;
3. milling becomes more difficult (e.g., more saw changes, clog-ups, breakage and wood dust); and
4. lumber grade yields decline.

In the last TSR 4, an "age since death" function was developed by the NSIFS licensee group to predict merchantable net pine volume over a period of 32 years, after which the volume would be zero (Figure 13).

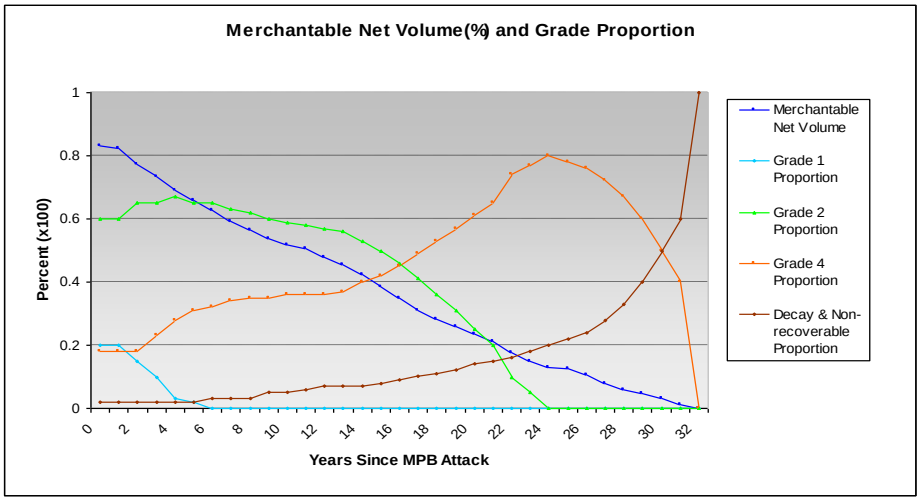


Figure 13 Shelf-life by grade proportion and merchantable net volume

Source: Merritt TSA Timber Supply Review #4 Timber Supply Analysis Report, April 28, 2010

To model the shelf life of the dead pine component, the TSR 2015 used the same merchantable net volume line developed for TSR 4 but applied the following shelf life function to reduce volumes at various ages beyond the year of attack (i.e., dead volume is reduced according to this shelf life function; a mathematical representation of the merchantable net volume line portrayed in Figure 13):

(equation 1) $useable\_dead\_conifer\_vph = initial\ dead\_vph * useable\_dead\_pct$

where

(equation 2) $useable\_dead\_pct = 0.9 – (0.0281 * yrs\_since\_death)$

Applying this shelf life function to the VRI results in a 37% overall reduction to the dead pine volume reported for the TSR 4 (i.e., THLB stands with at least 150 m³/hectare). The resulting dead pine volume is 5.6M m³/year using this approach, indicating that there is some uncertainty in the actual volume of dead pine in the TSA.

Source: TSR 2015 Technical Report

5.4.2 MPB Attack in Young Stands

In the years following TSR 4, the amount of MPB infestation within young stands was dramatically less than originally projected at the time of TSR 4. An analysis of young pine impacts using provincial aerial overview survey data indicates that 588.5 hectares of the 39,464 hectares (1.5%) of pine leading age class 2 and 3 stands within the THLB had severe and very severe impact levels, and are therefore assumed to be dead.

Source: Merritt TSR Data Package Draft Factor 46 – Young Pine Stands and MPB, 2014

A summary of the young stand monitoring completed for the TSA (FLNR 2015) found that 12.4% of the lodgepole pine trees/hectare and 12.8% of the lodgepole pine basal area was affected by insect attack. There was also significant damage from other forest health agents. This report recommends that forest health specialists and growth and yield specialists should review and analyze the severity data to determine potential impacts.

The TSR 2015 technical report (FLNR 2015) indicates that growth and yield impacts of MPB were not modelled for managed stands (i.e. less than 30 years).

Source: Merritt TSA Ground Sample Data Analysis Young Stand Analysis, March 2015

5.4.3 Regeneration in Unsalvaged MPB-attacked stands

While harvested MPB-attacked stands will be regenerated, there will be some impacted areas that will not be developed and replanted prior to the stand exceeding its shelf life. It is important to verify the degree of natural regeneration expected to occur within these stands to determine the effect this will have on mid-term timber supply and on the recovery of non-timber values, such as watershed health. Most mature pine stands will have some degree of advanced regeneration as an understory and some pine will regenerate from seeding, but it will be necessary to assess these stands from an inventory standpoint. For example, the species composition of unsalvaged stands may change significantly as the existing understory may be dominated by shade-tolerant species (e.g., spruce and balsam), which will then become the dominant species. Depending on the condition of these stands, one potential strategy to mitigate timber supply may be to rehabilitate and reforest these stands.

5.4.4 Future Dependency on Non-pine Leading Stands

Expected losses within MPB-attacked stands and the current concentration of harvest in pine stands will focus harvesting of stands with non-pine leading species throughout the mid-term period. These ‘green’ stands will be subject to significant pressures as providing both timber and non-timber values. Many MPB-attacked stands remaining will lose key attributes for wildlife habitat (e.g., closed-canopy

sheltering) that will result in wildlife dependence on the same (non-pine leading) stands targeted for the mid-term timber supply.

Other implications to the forest product sector will include a distinct switch in species in final products. Markets currently used to a high % of pine in lumber marketed as "SPF" lumber will assume a much higher proportion of spruce and fir in the future. There will also be an increase in the processing of non-SPF species such as Douglas-fir. Overall grade recovery and productivity should increase as less old and degraded pine enters the mills. The change in species composition will also affect pulp products as much of the pine harvested at the end of the salvage period will be considerably downgraded in fibre quality. Switching to non-pine leading stands will produce a significant increase in chip quality; more gradually than the change in lumber as the dead pine may remain suitable for pulping longer than for lumber.

5.4.5 MPB Effect on Age Class Distribution

Elevated harvest levels since 2004 have resulted in a shift from a predominantly old forest to a predominantly young forest. Figure 14 shows a significant amount of forest less than 29 years of age which will become available for harvest again over a common period. It will be necessary to explore ways to break up this age class group (e.g., extended rotations for a portion of these stands) to reduce the risk of future MPB outbreaks.

The distribution of these young stands across a full range of sites will lead to some degree of variation in their natural rotation age, or culmination. Surveys of the regenerating stands will be required to determine the future pattern of maturing stands.

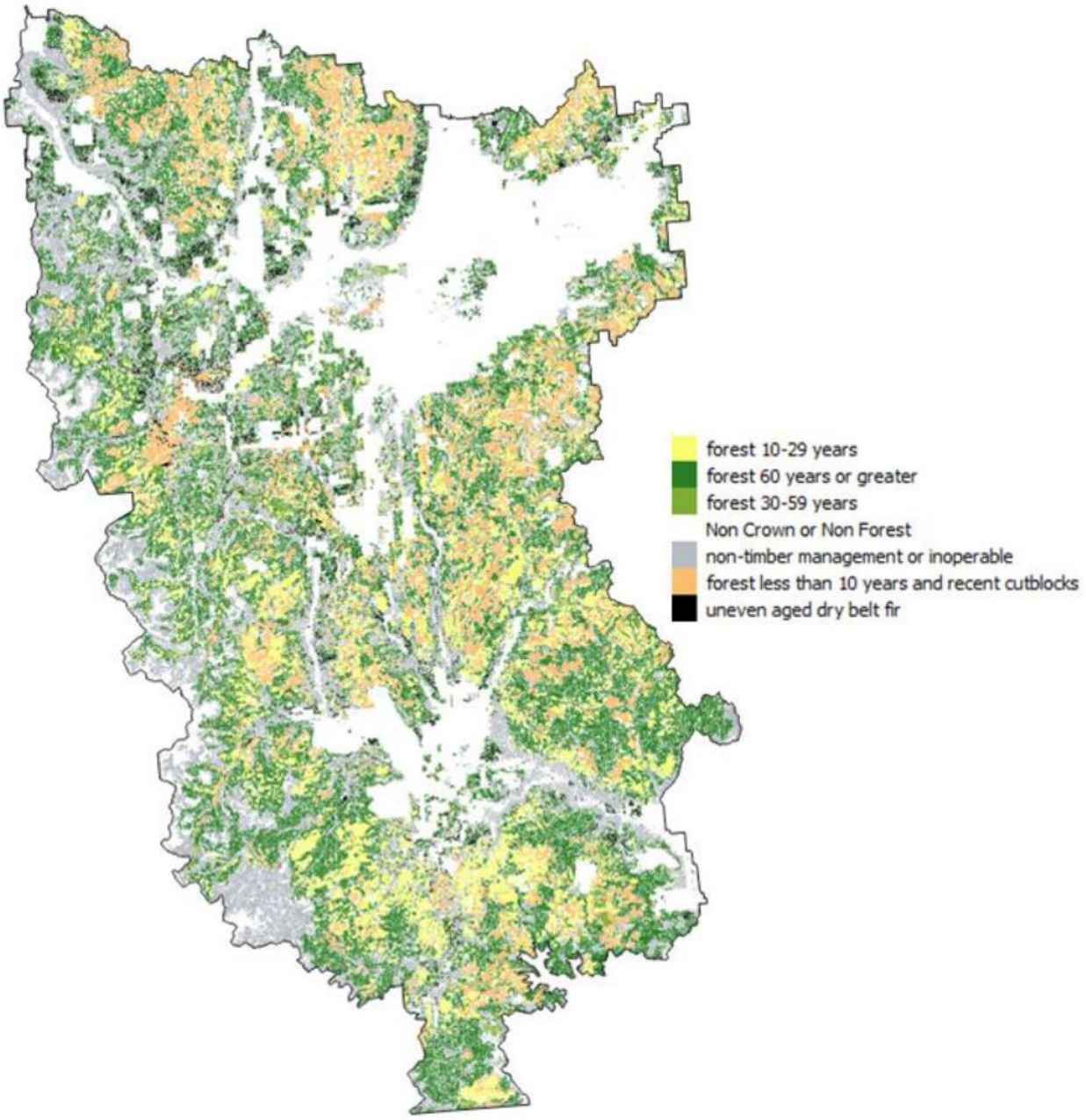


Figure 14 Age Class of the Merritt TSA in 2014

Source: Merritt TSR Technical Report 2015

5.5 Non-MPB Forest Health Factors

The main non-MPB forest health factors affecting the Merritt TSA are spruce bark beetle (SBB), western spruce budworm (WSBW), balsam bark beetle (BBB), and fire. Other forest health factors such as Douglas-fir bark beetle are present but generally have minimal impacts and insignificant management applied. Table 8 provides a summary of impacted hectares identified on the provincial aerial overview surveys from 2004 to 2013.

Table 8 Impacted Hectares from Provincial Aerial Overview Survey (PAOS) in the Merritt TSA

Factor	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
WSBW	52,014	61,934	170,339	125,043	84,504	135,395	112,703	34,982	91,795	1,678
SBB	9	179	26	259	200	1,560	263	418	871	866
BBB	2,835	8,564	9,957	13,902	6,931	5,574	2,901	3,614	9,217	10,351
Fire	200	150	5,516	352	193	885	147	180	591	181
DFBB	35	0	11	0	0	91	38	49	70	65

Source: Merritt TSR Data Package – 2014 Factor 42 – Forest Health Management – Non-MPB

5.5.1 Spruce Bark Beetle

A landscape level outbreak of spruce bark beetle was recognized as a concern by the Chief Forester in his 2010 TSR 4 AAC determination through the expectation that approximately 240,000 m³/year would be directed to spruce bark beetle salvage.

The 2014 *TSR Data Package* indicates that this infestation has subsided and that licensees have harvested or addressed all of the significantly impacted polygons greater than 15 hectares. Licensees reported that between 2011 and 2013, 376,599 m³ of harvested volume was directed at spruce bark beetle. Remaining spruce-leading polygons less than 15 hectares will be addressed as broader areas are prioritized for pine harvest. Dead spruce trees within these polygons will likely be unrecoverable at the time of harvest so these spruce volumes were accounted for through non-recoverable losses.

5.5.2 Balsam Bark Beetle

In BC, western balsam bark beetle (Dryocoetes confusus) is the most significant damaging agent of its primary host, mature sub-alpine fir. This bark beetle and an associated pathogenic fungus is responsible for significant tree mortality in high elevation ecosystems. More commonly, less than 5% of a stand is killed in one year.

While Table 8 indicates a significant area of infestation, it is consistently weighted heavily to the trace and light infestation levels. Since the harvest through the mid-term will depend increasingly on balsam stands, it may be necessary to further evaluate the impact of balsam bark beetle.

5.5.3 Western Spruce Budworm

Western spruce budworm (Choristoneura occidentalis) is the primary defoliator of concern for interior Douglas-fir in the Merritt TSA (FLNR 2013). Outbreaks of this budworm cause significant damage through larval feeding on the foliage, resulting in damaged cones and reduced seed production, growth loss, top kill, formation of stem deformities and even mortality, particularly in the understory. The IDF biogeoclimatic zone, which covers nearly half of the TSA, is a high hazard zone for western spruce budworm in Douglas-fir stands where high infestation levels have already occurred (Table 8).

Approximately eight outbreaks of western spruce budworm have been recorded in the southern interior of BC since 1916 with over 1.6 million hectares defoliated. In 2012, portions of an outbreak were treated with Bacillus thuringiensis var. kurstaki (B.t.k.) - the preferred insecticide treatment for budworm in BC.

5.5.4 Fire

Past fires are accounted for through depletion updates to the forest inventory. The impact of future fires on timber supply is accounted for through the allowance for non-recoverable losses.

In 2012, FLNR's Wildfire Management Branch prepared a Discussion Paper on Proactive Wildfire Threat Reduction. This discussion paper indicated that there will be more wildfire potential over time resulting

from MPB killed stands and rapidly increasing effect of climate change. Based on an increase of 4^{o} C by 2080, severe future wildfire conditions are predicted for the southern interior of BC, including:

- increased fire size, doubling from an average of 7,961 hectares to 19,076 hectares;
- increased fire severity by 40% in spring, 95% in summer, and 30% in fall;
- increase fire season length and fire frequency by 30%;
- increase in crown fire ignition and severe fire behaviour by 4 to 7%; and
- a decrease in extent of fire free areas by 39%.

The discussion paper referenced landscape fire planning and management as a way of mitigating impacts of extreme wildfire events and associated losses of communities, critical infrastructure and natural resource values. The objective of landscape fuel and fire management is to stop the development of extreme "mega" fires by creating landscape level fuel breaks. This can be accomplished by modelling wildfire risk and threat; analysing land management options; and, creating landscape level fuel breaks through targeted harvesting, establishing linear fuel breaks, and, utilizing alternative silviculture practices. Often, even simple management actions such as widening road right-of-ways or realigning cut block patterns can have significant beneficial effects of mitigating extreme wildfire behaviour. These activities can also support local employment creation, provide harvest opportunities, protect mid-term timber supply, and support other key programs such as ecological restoration and the emerging biofuel economy in BC.

A Fire Management Plan for the Merritt TSA was recently completed; consisting of two main sections.

The first section, *Integrating Resource Management into Fire Response,* provides concise information needed for wildfire response and is intended primarily for use by those involved in wildfire response. It includes an overview of land management direction, overview of the four fire management value themes, and fire suppression response zones and recommendations.

The second section, *Integrating Wildfire into Resource Management – Landscape FMP* contains information that will be relevant for this IIS project including:

- A brief overview of the plan area in terms of geographic extent, climate, and fire history.
- Fire Hazard and Risk Analysis.
- Fire Management Unit Objectives.
- Fuel Management and treatment recommendations.

Of particular interest, draft landscape fuel breaks have been mapped for the Merritt TSA, but desired fuel conditions have not yet been achieved. The plan recommends reducing the amount of coarse woody debris on harvested areas within these firebreaks through site preparation treatments such as broadcast burning or pile and burning. It also recommends that where industrial roads have been identified for the fuel breaks, a 10 metre fuel free zone and additional 30 metre zone with minimal surface fuels and modified stocking standards be established within both sides of the running surface.

The Fire Management Plan also reference areas within the Wildland Urban Interface (WUI) that should be considered for fuel management treatments, as identified within Community Wildfire Protection Plans (CWPP) that have been completed to date.

5.6 Protecting Secondary Structure

Section 43.1 of the Forest and Range Practices Act, Forest Planning and Practices Regulation, *Secondary structure retention in MPB affected stands,* requires forest licensees to protect secondary structure (understory advanced regeneration and non-pine canopy trees) in MPB affected areas.

Considerable variation in secondary stand structure exists among different lodgepole pine stands. In their recent study to determine the proportion of Biogeoclimatic Ecosystem Classification (BEC) units considered to be in poor condition and hence likely to recover slowly from a timber supply perspective, Coates and Sachs (2012) reached the following conclusions for pine leading stands:

1. Generalizations about secondary structure abundance based solely on pre-beetle dominance are too crude since understory, sub-canopy and canopy secondary structure post-beetle can vary widely at any level of pine dominance.
2. ESSF and ICH zones pose few problems for recovery while MPB-impacted stands in the SBS zone pose the greatest risk.

Based on 3,823 plots examined, Coates and Sachs (2012) further predicted the natural recovery of pine leading stands, as shown in Table 9.

Table 9 Predicted Natural Recovery of Pine-Leading Stands by BEC

BEC Unit	Suggested % range of predicted natural recovery (1)
SBS	58-68
MS	76-86
SBPS	78-88
IDF	75-85
ESSF	92-100
ICH	90-100
BWBS	80-100
Total	70-80

+/- 5% tolerance used around calculated means except for ICH and BWBS where +/-10% used given low # of plots

It will be important to get a clear understanding of the regeneration that exists within unharvested stands to predict their eventual contribution to timber supply. Stands with good stocking of advance regeneration may be available to contribute to later in the mid-term. Generating new inventory information for these stands is a considerable challenge.

5.7 Minimum Harvestable Volume

TSR 2015 used minimum harvestable volume criteria as outlined in Table 10. The minimum harvest volume of 150 m^3 /hectare was derived by considering the historical harvest data provided by BC Timber Sales, Weyerhaeuser, and Tolko. The minimum volume per tree criteria did not limit projected timber supply since stands reached 0.2 m^3/tree by the time they reached 150 m^3/hectare.

While reducing the minimum harvest volume may increase the mid-term AAC, it must be supported by a demonstrated change in licensee behaviour.

Table 10 Minimum Harvest Criteria

Stand type	minimum merchantable volume (m^3/ha)	minimum volume per tree (m^3)	minimum age (years)
Even-aged Natural	150	0.2	N/A
Even-aged Managed	150	0.2	60
Uneven-aged dry belt fir	120*	0.2	N/A

* although the minimum is 120 m3/ha only half is removed upon entry.

Source: TSR 2015 Technical Report

5.8 Dry Belt Fir

For purposes of TSR 2015, dry belt fir was defined as all Douglas-fir leading, south facing polygons within the IDF and PP biogeoclimatic zones, with the exception of stands above 1200 metres in the IDFdk subzone. Dry belt fir stands are a source of uncertainty since, a result of harvesting being directed towards the salvage of pine, there has not been any significant harvesting within these stands for a number of years.

It is not known how successfully these stands can be managed using clearcut silviculture systems. In the TSR, 20% of the harvest was modelled as a traditional clearcut with reserve silviculture system, while the other 80% was modelled as a single tree selection silviculture system. For the selection system, it was assumed that 50% of the basal area would be removed. The stand would then be left to regenerate naturally and the next entry occurring sometime after the volume recovers to a minimum harvestable level (i.e., 120 m^3/hectare).

Source: TSR 2015 Technical Report

5.9 Harvest Capacity

There are no issues identified with respect to having capacity to harvest the AAC in the short term. AACs in the Merritt TSA and adjacent TSAs have been fully harvested in recent years, and the projected future harvest is expected to decline in Merritt and adjacent southern interior TSAs.

5.10 Haul Distances

Unlike some larger TSAs, haul distances in the Merritt TSA are not a dominant factor in determining a stand's economic operability over a business cycle. However, fluctuations in market conditions will affect economic operability of certain stands at a given point in time.

6 Timber Quality

Timber quality in the TSA is variable, and includes significant volumes of small diameter pine and pine degraded as a result of the MPB infestation.

Silviculture strategies completed to date for the Merritt TSA (section 2.8) have focused on achieving timber quantity objectives and have not substantially addressed timber quality. Consequently, timber quality objectives have not been identified as a priority for the TSA within the *2015/16 to 2017/18 Land Based Investment Strategy*. Opportunities exist to explore product flow objectives to address log quality from future stands.

6.1 Small Diameter Pine

As mentioned in section 5.3.1, a small diameter pine partition of 250,000 m³/year was established in 1996, increased to 312,500 m³/year in 2002, and then dropped altogether in 2010.

Table 11 provides a summary of the small wood volume harvested between 2005 and 2013. It is estimated that approximately 7.2M m³ (64,200 hectares) of small wood is currently available within the Merritt TSA.

Table 11 Volume of small wood harvested between 2005 and 2013

Year	Volume of Smallwood (m³)	Year	Volume of Smallwood (m³)
2005	276,869	2010	529,917
2006	192,622	2011	313,475
2007	292,956	2012	298,363
2008	389,987	2013	397,130
2009	189,295		

Source: Merritt TSR Data Package – 2014 Factor 06 Smallwood

6.2 Grade 4 (Lumber Reject)

Section 17 (6) of the Cut Control Regulation allows licensees to reduce the volume attributed to a licence for 100% of the Grade 4 (i.e. Lumber reject) if the timber is sold or delivered to an appropriate facility. One indication of timber quality in the Merritt TSA is the amount of Grade 4 credit removed from cut control (Table 12).

Table 12 Historic amounts of Grade 4 credit against cut control

Year	Grade 4 Volume Harvested (m³)	Year	Grade 4 Volume Harvested (m³)
2007	27,278	2010	267,952
2008	107,606	2011	266,352
2009	126,2014	2012	292,075

While some of the volume increase between 2007 and 2012 is likely due to improved economic conditions, these numbers provide an indication of the quality degradation resulting from the significant harvest of MPB infested timber. Grade 4 volume harvested is expected to decrease as harvest transitions into non-pine stands.

Source: Merritt TSR Data Package – 2014 Factor 97 Grade 4 Credit

7 Species Habitat

7.1 Species At Risk

In considering habitat supply, it is important to identify the environmental values potentially at risk from MPB, wildfires and/or harvesting. Table 13 to Table 16 show the *species at risk* and red and blue listed species for the Merritt TSA. These tables were generated from data exported from the Ministry of Environment BC Species and Ecosystems Explorer. As this data cannot be queried directly for the Merritt TSA, it was assumed that species that were found in both the Cascades Forest District (i.e. Merritt and Lillooet TSAs) and either of the Okanagan-Similkameen or Thompson-Nicola Regional Districts would represent Merritt TSA species by eliminating any species specific to the Lillooet TSA.

To be included in the tables, the species need to meet at least one of the following criteria:

- BC Status is either *"Red"* or *"Blue"*
- COSEWIC status is *Endangered (E), Threatened* (*T), or Special Concern (SC)*
- SARA status is *Endangered (E), Threatened* (*T), or Special Concern (SC)*
- Migratory Bird Convention Act (MBCA) applies is *Yes (Y)*

Species that have been identified under the BC Identified Wildlife Management Strategy (IWMS) are also indicated in these tables. The IWMS includes the "*Alkali Saltgrass Herbaceous Vegetation*" plant community. Note that additional SARA / COSEWIC status codes in the table include *Not at Risk (NAR)* and *Data Deficient (DD).* Although these codes do not meet the SARA / COSEWIC criteria for inclusion, they are in the table because the species meets one of the other inclusion criteria.

Table 13 Species at risk for the Merritt Forest District: Vertebrate Animals

Scientific Name	English Name	Ident. Wildlife	BC List	COSEWIC	SARA	MBCA
Acrocheilus alutaceus	Chisel Mouth		Blue	NAR		
Aeronautes saxatalis	White-throated Swift		Blue			Y
Anaxyrus boreas	Western Toad		Blue	SC	SC	
Ardea herodias Herodias	Great Blue Heron, *herodias* subspecies	Y	Blue			
Ascaphus truei	Coastal Tailed Frog	Y	Blue	SC	SC	
Asio flammeus	Short-eared Owl	Y	Blue	SC	SC	
Athene cunicularia	Burrowing Owl	Y	Red	E	E	
Botaurus lentiginosus	American Bittern		Blue			Y
Buteo swainsoni	Swainson's Hawk		Red			
Catostomus platyrhynchus	Mountain Sucker		Blue	SC		
Chordeiles minor	Common Nighthawk		Yellow	T	T	Y
Coluber constrictor	North American Racer	Y	Blue	SC	SC	
Contopus cooperi	Olive-sided Flycatcher		Blue	T	T	Y
Corynorhinus townsendii	Townsend's Big-eared Bat		Blue			
Cottus hubbsi	Columbia Sculpin		Blue	SC	SC	
Crotalus oreganus	Western Rattlesnake	Y	Blue	T	T	
Cypseloides niger	Black Swift		Blue	E		Y
Dolichonyx oryzivorus	Bobolink		Blue	T		Y
Eremophila alpestris merrilli	Horned Lark, merrilli subspecies		Blue			
Euderma maculatum	Spotted Bat	Y	Blue	SC	SC	
Euphagus carolinus	Rusty Blackbird		Blue	SC	SC	
Falco mexicanus	Prairie Falcon		Red	NAR		

Falco peregrinus anatum	Peregrine Falcon, anatum subspecies		Red	SC		
Grus Canadensis	Sandhill Crane	Y	Yellow	NAR		Y
Gulo gulo luscus	Wolverine, luscus subspecies	Y	Blue	SC		
Hirundo rustica	Barn Swallow		Blue	T		Y
Icteria virens	Yellow-breasted Chat		Red	E	E	Y
Lepus townsendii	White-tailed Jackrabbit		Red			
Megascops kennicottii macfarlanei	Western Screech-Owl, macfarlanei subspecies	Y	Red	T	E	
Melanerpes lewis	Lewis's Woodpecker	Y	Blue	T	T	Y
Myotis ciliolabrum	Western Small-footed Myotis		Yellow			
Myotis thysanodes	Fringed Myotis	Y	Blue	DD		
Numenius americanus	Long-billed Curlew	Y	Blue	SC	SC	Y
Oncorhynchus kisutch	Coho Salmon		Yellow	E		
Oreamnos americanus	Mountain Goat		Blue			
Oreoscoptes montanus	Sage Thrasher		Red	E	E	Y
Ovis Canadensis	Bighorn Sheep	Y	Blue			
Patagioenas fasciata	Band-tailed Pigeon		Blue	SC	SC	Y
Pekania pennant	Fisher	Y	Blue			
Perognathus parvus	Columbia Plateau Pocket Mouse		Blue			
Picoides albolarvatus	White-headed Woodpecker		Red	E	E	Y
Pituophis catenifer deserticola	Gopher Snake, deserticola subspecies	Y	Blue	T	T	
Plestiodon skiltonianus	Western Skink		Blue	SC	SC	
Podiceps nigricollis	Eared Grebe		Blue			Y
Psiloscops flammeolus	Flammulated Owl	Y	Blue	SC	SC	
Recurvirostra Americana	American Avocet		Blue			Y
Rhinichthys Umatilla	Umatilla Dace		Red	T		
Salvelinus confluentus	Bull Trout	Y	Blue	SC		
Sorex preblei	Preble's Shrew		Red			
Spea intermontana	Great Basin Spadefoot	Y	Blue	T	T	
Sphyrapicus thyroideus	Williamson's Sapsucker	Y	Blue	E	E	Y
Sphyrapicus thyroideus thyroideus	Williamson's Sapsucker, thyroideus subspecies	Y		E	E	
Strix occidentalis	Spotted Owl		Red	E	E	
Synaptomys borealis artemisiae	Northern Bog Lemming, artemisiae subspecies		Blue			
Taxidea taxus	American Badger	Y	Red	E	E	
Tympanuchus phasianellus columbianus	Sharp-tailed Grouse, columbianus subspecies	Y	Blue			
Ursus arctos	Grizzly Bear	Y	Blue	SC		

Table 14 Species at risk for the Merritt TSA: Invertebrate Animals

Scientific Name	English Name	Ident. Wildlife	BC List	COSEWIC	SARA
Apodemia mormo	Mormon Metalmark		Red	E	
Argia emma	Emma's Dancer		Blue		
Argia vivida	Vivid Dancer		Blue	SC	
Callophrys affinis	Immaculate Green Hairstreak		Blue		
Chlosyne hoffmanni	Hoffman's Checkerspot		Red		
Cicindela decemnotata	Badlands Tiger Beetle		Red		
Cicindela hirticollis	Hairy-necked Tiger Beetle		Blue		
Cicindela pugetana	Sagebrush Tiger Beetle		Blue		
Danaus plexippus	Monarch		Blue	SC	SC
Enallagma clausum	Alkali Bluet		Blue		
Euphyes vestris	Dun Skipper		Red	T	T

Galba bulimoides	Prairie Fossaria		Blue		
Galba dalli	Dusky Fossaria		Blue		
Gyraulus crista	Star Gyro		Blue		
Hemphillia camelus	Pale Jumping-slug		Blue		
Hesperia Nevada	Nevada Skipper		Blue		
Limenitis archippus	Viceroy		Red		
Oeneis jutta chermocki	Jutta Arctic, chermocki subspecies		Blue		
Ophiogomphus occidentis	Sinuous Snaketail		Blue		
Parnassius clodius pseudogallatinus	Clodius Parnassian, pseudogallatinus supspecies		Blue		
Pholisora Catullus	Common Sootywing		Blue		
Physella virginea	Sunset Physa		Blue		
Polites Sonora	Sonora Skipper	Y	Red	SC	SC
Pristiloma arcticum	Northern Tightcoil		Blue		
Satyrium californica	California Hairstreak		Blue		
Satyrium semilunar	Half-moon Hairstreak		Red	E	E
Sphaerium occidentale	Herrington Fingernailclam		Blue		
Sphaerium striatinum	Striated Fingernailclam		Blue		
Stagnicola traski	Widelip Pondsnail		Blue		
Vallonia cyclophorella	Silky Vallonia		Blue		

Table 15 Species at risk for the Merritt TSA: Vascular Plants

Scientific Name	English Name	BC List	COSEWIC	SARA
Allium geyeri var. tenerum	Geyer's Onion	Blue		
Alopecurus carolinianus	Carolina meadow-foxtail	Red		
Anemone drummondii var. drummondii	alpine anemone	Blue		
Antennaria flagellaris	stoloniferous pussytoes	Red	E	E
Atriplex argentea ssp. Argentea	silvery orache	Red		
Boechera cascadensis	littleleaf rockcress	Red		
Brickellia oblongifolia ssp. Oblongifolia	narrow-leaved brickellia	Blue		
Callitriche heterophylla var. heterophylla	two-edged water-starwort	Blue		
Carex bicolor	two-coloured sedge	Blue		
Carex hystericina	porcupine sedge	Red		
Carex incurviformis var. incurviformis	curved-spiked sedge	Blue		
Carex rupestris ssp. Drummondiana	curly sedge	Blue		
Carex scopulorum var. bracteosa	Holm's Rocky Mountain sedge	Blue		
Carex vallicola var. vallicola	valley sedge	Red		
Castilleja cusickii	Cusick's paintbrush	Red		
Chenopodium atrovirens	dark lamb's-quarters	Blue		
Cistanthe umbellate	Mount Hood pussypaws	Blue		
Collomia tenella	slender collomia	Red	E	E
Crepis modocensis ssp. rostrata	western low hawksbeard	Red		
Crepis occidentalis ssp. conjuncta	western hawksbeard	Red		
Crepis occidentalis ssp. pumila	gray hawk's-beard	Red		
Cryptantha ambigua	obscure cryptantha	Blue		
Delphinium bicolor ssp. bicolor	Montana larkspur	Blue		
Descurainia sophioides	northern tansymustard	Blue		
Epilobium halleanum	Hall's willowherb	BLue		
Epilobium pygmaeum	smooth spike-primrose	Red		
Erythranthe breviflora	short-flowered monkey-flower	Blue		

Erythranthe suksdorfii	Suksdorf's monkey-flower	Red		
Gayophytum humile	dwarf groundsmoke	Blue		
Hackelia diffusa var. diffusa	spreading stickseed	Red		
Hornungia procumbens	ovalpurse	Blue		
Iva axillaris	poverty-weed	Blue		
Juncus confuses	Colorado rush	Blue		
Leptosiphon septentrionalis	northern linanthus	Blue		
Lewisia columbiana var. columbiana	Columbia lewisia	Blue		
Lewisia triphylla	three-leaved lewisia	Blue		
Lomatium brandegeei	Brandegee's lomatium	Blue		
Lomatium triternatum ssp. Platycarpum	nine-leaved desert-parsley	Red		
Lupinus bingenensis var. subsaccatus	Suksdorf's lupine	Red		
Lupinus sulphurous	sulphur lupine	Red		
Marsilea vestita	hairy water-clover	Red		
Melica bulbosa	oniongrass	Blue		
Melica spectabilis	purple oniongrass	Blue		
Muhlenbergia racemosa	satin grass	Red		
Nicotiana attenuate	wild tobacco	Red		
Orobanche corymbosa ssp. Mutabilis	flat-topped broomrape	Blue		
Pectocarya penicillata	winged combseed	Red		
Pinus albicaulis	whitebark pine	Blue	E	E
Plagiobothrys leptocladus	finebranched popcornflower	Blue		
Poa abbreviata ssp. pattersonii	abbreviated bluegrass	Blue		
Poa fendleriana ssp. Fendleriana	mutton grass	Red		
Polemonium elegans	elegant Jacob's-ladder	Blue		
Polygonum polygaloides ssp. Confertiflorum	close-flowered knotweed	Red		
Polygonum polygaloides ssp. Kelloggii	Kellogg's knotweed	Blue		
Polystichum kruckebergii	Kruckeberg's holly fern	Blue		
Polystichum scopulinum	mountain holly fern	Red	T	T
Potentilla diversifolia var. perdissecta	diverse-leaved cinquefoil	Blue		
Potentilla nivea var. pentaphylla	five-leaved cinquefoil	Blue		
Potentilla paradoxa	bushy cinquefoil	Blue		
Psilocarphus brevissimus var. brevissimus	dwarf woolly-heads	Red	E	E
Pyrola elliptica	shinleaf wintergreen	Blue		
Ranunculus pedatifidus ssp. affinis	birdfoot buttercup	Blue		
Salix boothii	Booth's willow	Blue		
Senecio integerrimus var. ochroleucus	white western groundsel	Red		
Sparganium fluctuans	water bur-reed	Blue		
Sporobolus compositus var. compositus	rough dropseed	Blue		
Stuckenia vaginata	sheathing pondweed	Blue		
Thelypodium laciniatum var. laciniatum	thick-leaved thelypody	Blue		

Table 16 Species at risk for the Merritt TSA: Non-Vascular Plants and Lichens

Scientific Name	English Name	BC List	COSEWIC	SARA
Brachythecium holzingeri		Blue		

Bryoerythrophyllum columbianum	Columbia carpet moss	Blue	SC	SC
Bryum gemmiparum		Blue		
Campylium radicale		Blue		
Crossidium seriatum	tiny tassel	Blue	SC	
Encalypta intermedia		Blue		
Encalypta spathulata		Blue		
Entosthodon rubiginosus	rusty cord-moss	Blue	E	E
Funaria muhlenbergii		Blue		
Physcomitrium pyriforme		Blue		
Plagiobryum demissum		Red		
Platyhypnidium riparioides		Blue		
Pterygoneurum kozlovii	alkaline wing-nerved moss	Blue	T	T
Schistidium heterophyllum		Blue		
Ulota curvifolia		Blue		
Weissia brachycarpa		Blue		

Source: Exported from the Ministry of Environment BC Species and Ecosystems Explorer at: http://a100.gov.bc.ca/pub/eswp/

Specific strategies, including silviculture practices, can be employed to reduce risks to biodiversity, water, fish, wildlife and habitat (Manning et. al., 2006). These strategies focus on enhancing special habitat like riparian areas and maintaining landscape level biodiversity elements and ecological values. Managing forest health and salvaging MPB increases road densities across the landscape, which can cause disproportionate impacts to species at risk. Given the vulnerability of forest-dependent species and large areas of MPB impacted timber, increased emphasis on managing these road impacts is warranted. Spatial and temporal modelling will be an important tool to ensure the opportunities can be realized without impacts to wildlife populations.

7.2 Ungulate Winter Range

An Ungulate Winter Range (UWR) for mule deer, bighorn sheep, elk, and white-tailed deer, was established under the Government Action Regulation (GAR) Order # 3-003 (January 21, 2008 - Figure 15). This includes over 1,100 individual UWR planning cells within the Merritt TSA; each with its own target percentage of mature seral forest (age of 121 yrs+) based on the snow zone(s) for that planning cell. These planning cells are currently under review but it is not clear if, or when, any changes might be contemplated.

A UWR for mountain goat was established under GAR Order #3-006 (February 7, 2011 - Figure 15).

Moose habitat requirements are addressed through a notice given under Section 7(2) of the Forest Planning and Practices Regulation and Section 9(3) of the Woodlot License Planning and Practices Regulation.

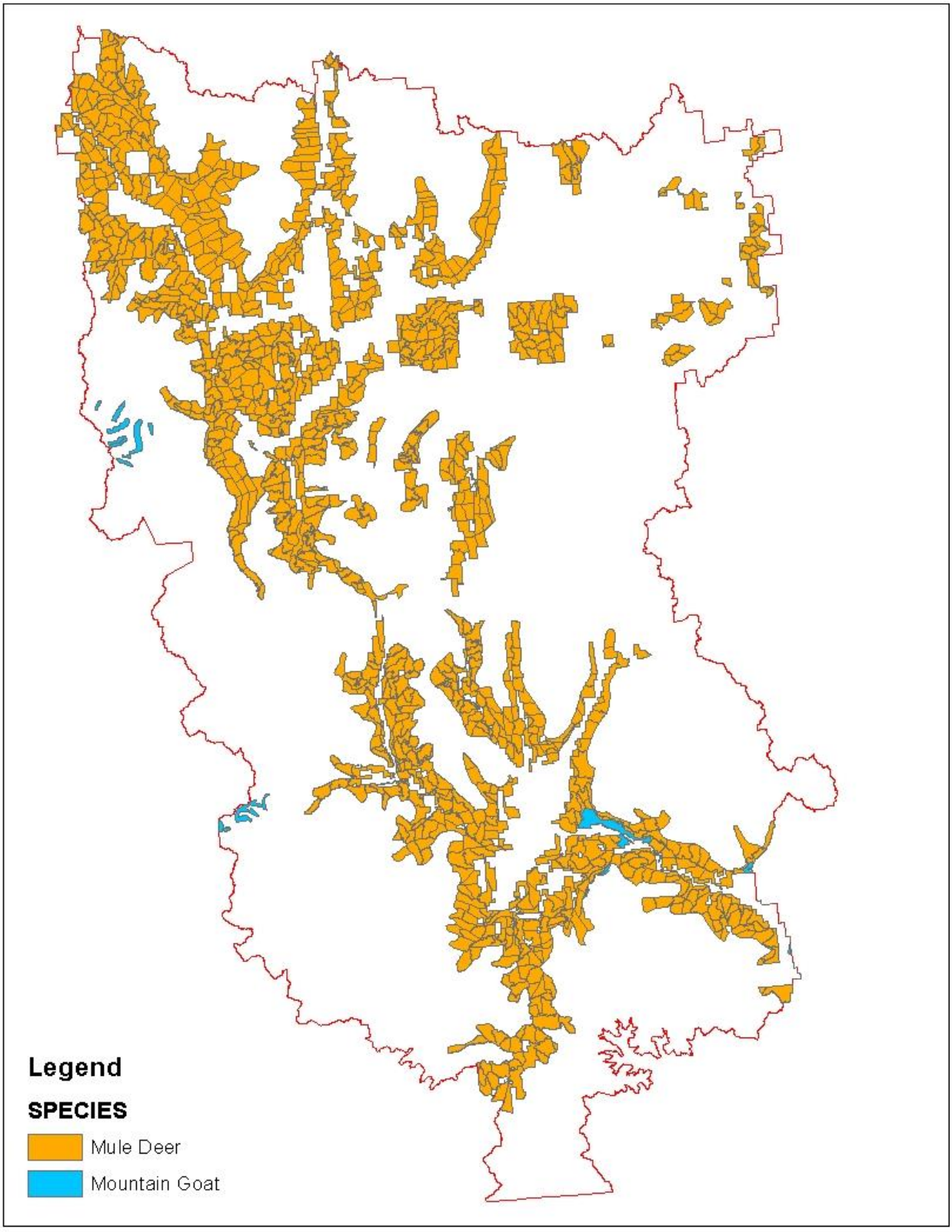


Figure 15 Ungulate Winter Ranges by Species in the Merritt TSA

7.3 Wildlife Habitat Areas

Table 17 summarizes the Wildlife Habit Areas (WHA) established within the Merritt TSA. In addition to these approved WHAs, there are 40 proposed WHAs for Williamson's Sapsucker (1,539 hectares), and one proposed WHA for a data sensitive species (135 hectares).

Table 17 Wildlife Habitat Areas in the Merritt TSA

Species	Number	No Harvest Area (ha)	Conditional Harvest Area (ha)	Total Area (ha)
Coastal Tailed Frog	17	204.4	166.3	370.7
Great Basin Spadefoot	1	45.1		45.1
Grizzly Bear	10	4503.6		4503.6
Lewis's Woodpecker	4	38.9	37.8	76.7
Western Screech Owl	3	113.3	71.8	185.1
Williamson's Sapsucker	21	826.9		826.9
Data Sensitive (snakes)	7	1145.9	134.5	1280.4
Total	**63**	**6878.1**	**410.4**	**7288.5**

7.4 Identified Wildlife Notices

Notices of objectives species at risk have been given under Section 7(2) of the Forest Planning and Practices Regulation (B.C. Reg. 14/04) for the following species:

1. Coastal Tailed Frog – 2,793 hectares not exceeding a mature THLB impact of 1,187 hectares
2. Great Basin Gopher Snake – 4,000 hectares not exceeding a mature THLB impact of 0 hectares
3. Flammulated Owl – 4,050 hectares not exceeding a mature THLB impact of 3,150 hectares
4. Interior Western Screech Owl – 44 hectares not exceeding a mature THLB impact of 22 hectares
5. Spotted Bat – 16 hectares not exceeding a mature THLB impact of 4 hectares
6. Grizzly Bear – 5,211 hectares within the Merritt TSA not exceeding a mature THLB impact of 521 hectares

8 Biodiversity

The magnitude of the MPB epidemic poses significant impacts to timber supply, with corresponding impacts to biodiversity and habitat supply. Retention strategies have been implemented at both the landscape level and the stand level to address biodiversity.

There may be opportunities to improve biodiversity in the mid- to long-term through treatments such as planting, thinning, road rehabilitation, and ecosystem restoration.

8.1 Landscape-level Retention

This section refers to general biodiversity and habitat management provisions not dealt with through higher level processes such as parks, ecological reserves, and specific wildlife habitat designations and their associated management zones. Landscape-level retention requirements in the Merritt TSA have been addressed through the Order Establishing Provincial Non-Spatial Old Growth Objectives that took effect in June 30, 2004. This order identifies the amount of old forest that will be maintained to address biodiversity values across the province by assigning biodiversity emphasis to landscape units and old forest targets for biogeoclimatic variants within each landscape unit. This assists in clarifying the amount of area available for timber harvesting.

A total of 114,467 hectares are specifically identified as non-legal Old Growth Management Areas (OGMAs) in the Merritt TSA, resulting in a net reduction to the THLB of 56,758 hectares. Through approved Forest Stewardship Plans (FSPs), licensees have committed to retain specific mapped polygons with provisions that allow, in some cases, for the replacement of identified polygons. Because multiple licensees can operate across the same land base, it is important to track, manage, and communicate these ongoing changes. As a result, the Cascades District has developed guidelines for managing a consolidated OGMA spatial database.

Source: Merritt TSR Data Package – 2014

8.2 Stand-Level Retention

MPB impacts are not limited to areas available for timber harvest. Timber reserved to protect sensitive species, riparian areas, wildlife tree patches, and OGMAs are also affected. Direct effects (increased mortality of pine, roads) and indirect effects (water quality/quantity and equivalent clear cut area), can impact these reserved areas. Landscape units with low biodiversity emphasis pose higher risks of loss for species diversity due to their reduced reserve areas. Species that are sensitive to changes in pine forest, or indirect impacts, will also be at higher risk - particularly from salvage operations within reserves designed to protect those species.

The management of stand level biodiversity improved in the Merritt TSA between 2005 and 2012. A major driver for this improvement was an increase in the amount and quality of coarse woody debris left on harvested areas. Opportunities for improvement include:

1. continue retaining large snags, large diameter trees and the full range of tree species in densities similar or better than pre-harvest conditions;
2. look for opportunities to leave large patches of 2 hectares or greater; and
3. retain higher densities of big, coarse woody debris pieces (>= 10 metres long and 20 cm diameter) in harvest areas.

Source: FLNR 2013, FREP MVRA report

Stand level biodiversity values are addressed in licensee FSPs through minimum wildlife tree retention levels for each biogeoclimatic zone where harvesting occurs. Licensees have committed to an overall retention level of 4% across the landbase, distributed across the biogeoclimatic zones (Table 18). These percentages are typically applied at the cutting permit level, with levels varying for individual cutblocks.

Table 18 Minimum wildlife tree retention percentages

Biogeoclimatic Zone	Percent of Forested Land Base
ESSF	4.5%
MS	3.0%
IDF	7.0%
PP	17.0%
CWH	12.0%

In-block retention consists both of patch retention and dispersed retention. Some of this retention is located in areas that are either inoperable or in areas already constrained for other reasons. TSR 2015 used an analysis of Forest and Range Evaluation Program (FREP) monitoring data and concluded that within harvested cutblocks an average of 14.7% of the forested land was retained with 8.1% that was not otherwise constrained. Licensees have indicated that this 8.1% retention is based on a large cut block strategy to salvage MPB-impacted stands and this likely overestimates future retention practices.

8.3 Riparian Management

Riparian areas are a significant contributor to stand- and landscape-level biodiversity. Forest harvesting, road construction, and other disturbances such as fires or insects have the potential to degrade riparian areas. The overall trend for resource development on stream function was neutral in the Merritt TSA between 2005 and 2012. Increased stream bank disturbance was observed from windthrow, cattle damage, and some beaver damage. Opportunities for improvement include:

1. enhance management of windthrow, livestock, roads and crossings to minimize sediment input and protect channel banks; and
2. maintain high levels of retention within the first 10 metres of streams, particularly on the small streams connected to fish streams or drinking water, and decrease exposed erodible ground near streams.

Source: FLNR 2013, FREP MVRA report

A comprehensive stream classification has not been completed in the Merritt TSA. In 2001, the NSIFS developed a stream classification model based on TRIM1 and Forest Practice Code riparian classifications that was shown to correctly classify streams with 68% spatial accuracy, and 97% netdown accuracy based on riparian zones for each class. This model was not accepted by the Ministry of Sustainable Resource Management for operational use, but they indicated it might be acceptable at the strategic level for timber supply review. They also indicated that the model validation process was perceived as biased given that a separate data set was not used for validation.

Most lakes in the TSA have been classified through a local planning process - the Merritt TSA Lakes Classification Process - that resulted in lakeshore management zones for classified lakes.

Through their FSPs, licensees have committed to riparian zone widths that are consistent with those in the Forest Planning and Practices Regulation.

A spatial dataset containing stream, lake and wetland class data provided by the FLNR Cascades district was used for TSR 2015.

Sources: Merritt TSR Data Package – 2014 Factor 28 – Riparian and TSR 2015 Technical Report.

8.4 Landscape Connectivity

In some areas, stand structures that serve to connect habitats across a landscape have been adversely affected by salvaging infested pine from mixed stands, extensive clearcuts in pine-dominated watersheds, limited retention and large scale fires. The loss of this aspect of biodiversity can cause disproportionate impacts to species at risk confined to isolated pockets of suitable habitat. Connectivity is provided in the Merritt TSA through various mechanisms including strategies that prescribe retention for specific resource management zones, old growth management areas, and provisions for riparian management.

Monitoring the impact to stand structure in these areas may be needed to ensure they provide required stand structure over time. Prescribing foresters can help enhance connectivity by increasing retention levels in large cutblocks and focusing some retention strategies in riparian areas, gullies, and other connectivity corridors for wildlife habitat features.

8.5 Management for Coarse Woody Debris

At a stand level, coarse woody debris is managed through provisions in FSPs, the Chief Forester's guidance, licensee discretion, and stewardship principles. While the beetle infestation has enhanced the supply of coarse woody debris in the short- and medium-terms, activities such as salvage, road building, and safety-hazard abatement for roads, replanting and stand tending, can significantly reduce the supply of coarse woody debris over time. Coarse woody debris is also vulnerable to intensive fires promoted by large supplies of MPB-killed pine. Strategies to retain coarse woody debris through time are an essential component for developing silviculture strategies.

9 Climate Change Adaptation

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. Table 19 provides an estimate of the predicted change by 2050.

Table 19 Summary of Climate Change for Thompson/Okanagan Region in the 2050s (Pacific Climate Impacts Consortium – Plan2Adapt)

Summary of Climate Change for Thompson / Okanagan in the 2050s

Climate Variable	Season	Projected Change from 1961-1990 Baseline	
		Ensemble Median	Range (10th to 90th percentile)
Mean Temperature (°C)	Annual	+1.8 °C	+1.1 °C to +2.7 °C
Precipitation (%)	Annual	+6%	-1% to +11%
	Summer	-9%	-19% to +1%
	Winter	+7%	-4% to +15%
Snowfall* (%)	Winter	-11%	-20% to -0%
	Spring	-55%	-75% to -12%
Growing Degree Days* (degree days)	Annual	+319 degree days	+183 to +482 degree days
Heating Degree Days* (degree days)	Annual	-654 degree days	-962 to -403 degree days
Frost-Free Days* (days)	Annual	+24 days	+14 to +35 days

Projected changes in average (mean) temperature, precipitation and several derived climate variables from the baseline historical period (1961-1990) to the 2050s for the Thompson/Okanagan region. The ensemble median is a mid-point value, chosen from a PCIC standard set of Global Climate Model (GCM) projections. The range values represent the lowest and highest results within the set.

Source: Pacific Climate Impacts Consortium, 2012. Plan2Adapt, http://www.plan2adapt.ca/tools/planners?pr=47&ts=8&toy=16

As outlined on the FLNR Competitiveness and Innovation Branch website page *Adapting BC's Natural Resource Management to Climate Change,* BC's overarching Climate Change Adaptation Strategy envisions that "British Columbia is prepared for and resilient to the impacts of climate change." Adapting forest to climate change is an important part of the adaptation work being undertaken in BC.

The FLNR Competitiveness and Innovation Branch released a Climate Change Strategy (2013-2018) in September, 2013. The three goals included in the strategy are:

1. climate change is integrated in ministry core business;
2. climate-relevant science, data and knowledge guide and inform the identification of the ministry's environmental, social, and economic risks, opportunities, and priorities for climate change action; and
3. climate change action is undertaken through collaboration, partnerships, communication and outreach with BC's First Nations, communities and natural resource sector.

A number of tools have been developed to assist foresters with understanding changes underway in their area and to adapt forest management so that BC forests remain resilient to climate change,

variability and other stressors. Examples include regional climate summaries, western larch seed planning zone updates, and stand establishment aids. The full list of tools and website links can be found at: https://www.for.gov.bc.ca/het/climate/knowledge/tools.htm.

This ISS project aims to consider the effects of climate change and develop clear objectives and strategies for appropriate tree species to be planted at the landscape and forest level.

10 Other Development

10.1 Mines

The Copper Mountain mine, located 20 kilometres south of Princeton, is the third largest copper mine in Canada, covering roughly 7,300 hectares. It began production in 2011 and has an expected mine life of 17 years.

10.2 Pipelines

A Kinder Morgan pipeline capable of transporting both crude oil and refined products passes through the Merritt TSA from Kamloops to the lower mainland. As well, Spectra Energy owns a natural gas pipeline that follows a similar route, while FortisBC operates several natural gas pipelines within the TSA.

10.3 Hydro-Electric Power

While there are no hydro-electric power stations, several major transmission lines traverse the Merritt TSA.

10.4 Wind Power

While one 391 hectare area is being developed for wind power, there are 26 other licence and permit areas, totalling 90,084 hectares, in the investigative and monitoring phase. Another 8 areas, totalling 25,885 hectares, are currently under application for the investigative and monitoring phase.

10.5 Communication Sites

There are numerous communication sites within the Merritt TSA.

11 Other Key Values and Issues

11.1 Parks, Protected Areas and Ecological Reserves

Harvesting is not permitted from the nine parks and two ecological reserves located within the Merritt TSA:

- Kentucky-Alleyne Park
- Allison Lake Park
- Bromley Rock Park
- Coldwater River Park
- E.C. Manning Park
- Monck Park
- Otter Lake Park
- Pennask Creek Park
- Stemwinder Park
- Soap Lake Ecological Reserve
- Whipsaw Creek Ecological Reserve

In TSR 2015, the Coquihalla Summit Recreation Area was also considered to be protected, while the Brent Mountain Protected Area and Otter Lake Protected Area would be available for harvest.

Source: TSR 2015 Technical Report

Two areas of interest have also been identified as potential future parks:

- Kentucky-Alleyne ASA (1,052 hectares of THLB)
- Paradise Lake ASA (84 hectares of THLB)

Source: Merritt TSR Data Package - 2014 Factor 04 – Protected Areas

11.2 Watershed Health

Large scale MPB infestations affect watershed hydrological processes such as canopy interception, transpiration, soil moisture storage, groundwater levels and recharge, snowfall, snow melt, rain-on-snow effects, runoff and peak flow timing and duration, flood events, stream and stream bank stability, erosion, and sedimentation. Changes in these hydrologic factors can increase the risk on a number of watershed values including aquatic ecosystems, species, and supply of domestic water use. In some cases the potential for hydrologic changes may be, to some degree, estimated by equivalent clear cut areas within specific drainages.

The accelerated rate of harvesting and associated road development poses an increased risk to water quality, as does the increased amount of road that is active throughout the salvage period. Significant increases in road density and numbers of stream crossings can increase peak flows, sedimentation, and changes in channel morphology. This can be reduced by accelerating hydrological green-up with an emphasis on maintaining vegetation within riparian ecosystems. This is especially important along fish-bearing streams and wetlands, as well as, within fishery-sensitive watersheds and community watersheds. Landscape level effects of MPB salvage harvest within watersheds that contain bull trout is a management concern.

The MRVA completed in 2013 (Section 2.5) assessed: a) water quality as affected by road construction and ongoing maintenance, and b) well riparian management as affected by forest harvesting activities, including blowdown. Together these assessments provide an indication of how well watersheds are

faring today compared to past practices and also provide an excellent baseline for comparing ongoing and future operations and the impacts of the accelerated salvage harvesting.

Approximately 270 assessment watersheds are located within the Merritt TSA.

11.2.1 Community Watersheds

There are nine designated community watersheds located within the TSA, totalling 11,351 hectares (Table 20). Interior Watershed Assessment Procedures and Overview Hydrologic Assessments have been completed for most of these watersheds. Only one watershed has an assessment that contains recommended maximum equivalent clearcut area (ECA) levels. Licensees' FSPs generally require an assessment to be completed when ECAs reach 25 to 30 percent.

Table 20 Community Watersheds in the Merritt TSA

Community Watershed Name	Total Area (hectares)	THLB Area (hectares)
Anderson	275	206
Bell	344	171
Brook	3,009	2,392
Dillard	3,872	3,182
Hackett	164	140
Kwinshatin	2,726	1,907
Lee	465	314
Skuagam	452	376
Thomas	44	0

Source: Merritt TSR Data Package – 2014 Factor 30 Community Watersheds

11.2.2 Fisheries Sensitive Watersheds

Eight Fisheries Sensitive Watersheds (FSW) or basins have been proposed within the Merritt TSA (Table 21). Default draft objectives that might accompany each FSW through an Order include:

The objectives for these FSWs are to:

- retain and protect mature timber and/or other natural vegetation on all active fluvial units with fish-bearing channels, and those that are direct tributary to fish bearing waters, to maintain stability and riparian function;
- minimize adverse sediment related effects on fish and fish habitat by maintaining a low likelihood of sediment delivery from un-natural sources to fish streams or direct tributaries to fish streams; and
- maintain an equivalent clearcut area of less than 20% in fisheries sensitive watersheds as set out in the areas identified in Table 1.

Despite objective c, an equivalent clearcut area of more than 20% may be maintained after:

- an assessment of watershed sensitivity to forest development disturbance is completed by a qualified professional;
- Maintaining an amount type and distribution of forest cover that is sufficient to sustain natural hydrological and fluvial processes, based on the assessment in subsection (i); and,
- To the extent practicable, an adaptive management plan is developed and implemented.

Table 21 Proposed Fisheries Sensitive Watershed in the Merritt TSA

Watershed/Basin	THLB Area (hectares)
Spius	24,506
Prospect (basin)	8,392
Maka (basin)	7,832
Upper Spius (basin)	2,754
Coldwater	32,519
Juliet (basin)	2,169
Upper Coldwater (basin)	14,561
Nuaitch	2,270

Merritt TSR Data Package – 2014 Factor 99 – Fisheries Sensitive Watersheds

Note 5 - Need to find a spatial layer so we can get the total area and provide a map.

11.2.3 Temperature Sensitive Streams

Under the *Wildlife Act,* the Minister of Environment may designate a portion of a fish stream as temperature sensitive if trees are required adjacent to the stream to manage the temperature of the designated portion for the protection of fish, and management of the temperature of the designated portion is not otherwise provided.

No temperature sensitive streams are currently designated within the Merritt TSA but they are being considered for fish bearing streams (S1-S4) and direct tributaries (S5-S6) within the Nicola watershed boundary. Such designations would require additional tree retention within the riparian management zones for S4 streams and S5/S6 direct tributaries greater than 100 metres in length. Figure 16 illustrates how this would be applied.

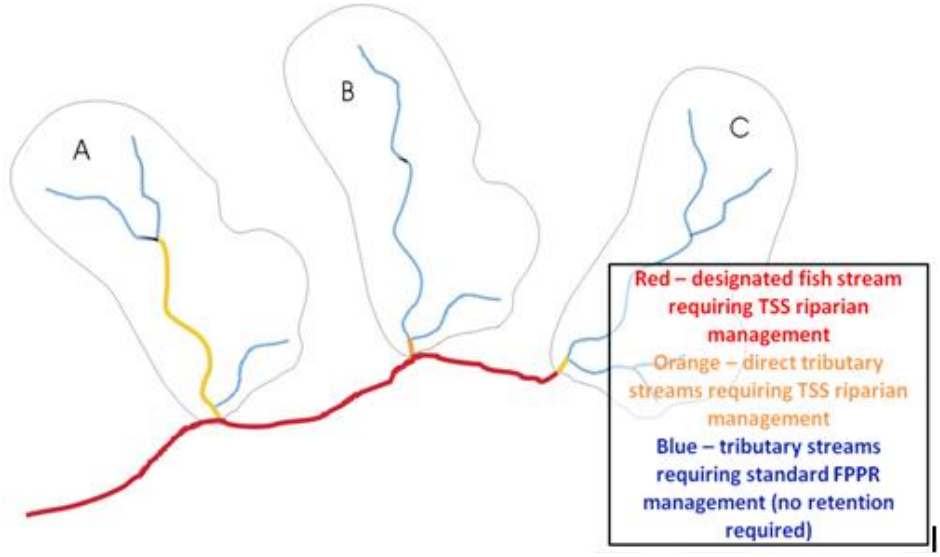


Figure 16 Application of GAR s.15 and the FPPR s.53 to three different stream networks in three similar sized watersheds (From Reese-Hanson et al 2012)

Merritt TSR Data Package – 2014 Factor 98 – Temperature Sensitive Streams

11.3 Archaeological Resources, First Nations Cultural Use and Sensitive Sites

Various archaeological inventory studies (including archaeological impact assessments) have been undertaken in the Merritt TSA. For TSR 2015, the archaeological sites resulted in a reduction to the total landbase and THLB of 2,159 hectares and 558 hectares, respectively. Additional sites identified by First Nations and forest licensees during the planning process are usually protected by establishing wildlife tree patches**.**

Source: Ministry of Tourism, Culture and the Arts', Remote Access to Archaeological Data (RAAD) website

First Nations have also identified two sites that are spiritually important:

1. Stoyoma Mountain - the current practice is to actively and deeply engage First Nations in planning and harvesting monitoring. Licensees are also encouraged to communicate any plans to harvest on Stoyome Mountain with the District Manager so that the district may proactively work with the licensees and First Nations on the planning phases.
2. The Missezula Lake area - also known as Xe Xe - is approximately 619 hectares in size. Timber harvesting is excluded and this area is viewed as a long-term reduction to timber supply.

There are a number of other spiritual or cultural sensitive sites that also exist within the Merritt TSA. Maps of these areas have not yet been made available but these areas are estimated to total over 300,000 hectares.

Sources: Merritt TSR 2015 Technical Report & Merritt TSR Data Package – 2014 Factor 33 Archaeological and FN Cultural Use.

11.4 Visual Quality Objectives

An inventory of visually sensitive areas has been in place for the Merritt TSA since the early 1990s; covering major highways, communities, lakes, and some trails. Visual quality is managed through the application of design guidelines cooperatively between District staff and forest licensees.

A lakeshore classification project completed in 1998 supported the establishment of Visual Quality Objectives for all Class A, B, and C lakes on July 2, 1999. The visual landscape inventory was updated for major travel corridors in 2002 and Visual Quality Objectives were subsequently established on September 30, 2003.

Table 22 provides a summary of the total and THLB areas by visual quality objective. Approximately 17% of the total area and 14% of the THLB area falls within the more restrictive visual quality objectives (i.e., Preservation, Retention, and Partial Retention). Figure 17 shows the locations of the VQO polygons within the TSA.

Table 22 Visual Quality Objective Summary for the Merritt TSA

Visual Quality Objective	Total Area (ha)	THLB Area (ha)
Preservation	1,954	654
Retention	49,538	13,217
Partial Retention	142,109	68,144
Modification	45,725	20,744

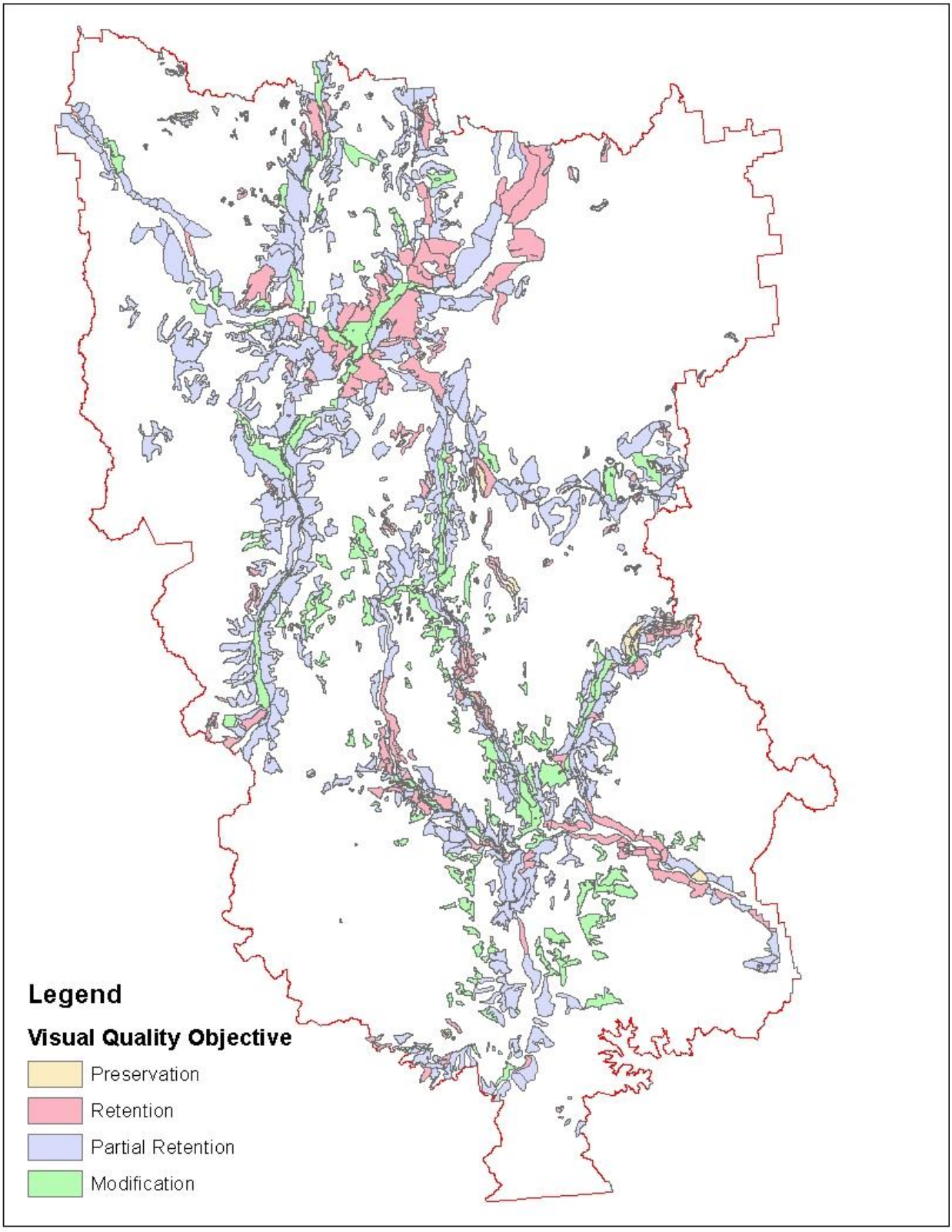


Figure 17 VQO polygons established in the Merritt TSA

11.5 Recreation

Recreation objectives were established for 145 recreations sites, trails, and interpretive sites in January, 2000. These objectives are considered higher level plans and only apply to the areas for which they were established. These were not considered to have any timber supply impacts for purposes of TSR 2015.

Portions of four trails declared under the Heritage Conservation Act are located within the Merritt TSA:

- The Hope Pass trail section (2.75 km)
- The Dewdney trail section (3.7 km)
- The Whatcom trail section (4.02 km)
- The Hudson's Bay Company trail (23.23 km)

These trails have a 200 metre right-of-way that requires a permit for any alterations. Since the area adjacent to these trails must meet a Retention visual quality objective, much of the trail is considered to be non-THLB. Locations of the recreation sites and trails are best viewed on the project website: http://services.forsite.ca/merrit_tsa

Source: Merritt TSR Data Package – 2014 Factor 34 – Recreation

11.6 Guide Outfitters and Trappers

In BC, all non-residents are required to be accompanied by a licenced guide while hunting big game (i.e., deer, mountain sheep, mountain goat, moose, caribou, elk, cougar, wolf, grizzly bear, black bear, lynx, bobcat, and wolverine). There are five guide-outfitter certificates designated within the Merritt (Figure 18). Two of these are located mainly in adjacent TSAs with small areas overlapping the Merritt TSA (approximately 1,890 and 4,130 hectares respectively).

In 1926, to protect species from over harvesting, the Province was divided into registered trapline areas sold to a trapper so that he/she is the only person with the right to trap furbearing animals inside this area. There are 39 trapline licenses distributed throughout the Merritt TSA (Figure 18).

Both trappers and guide outfitters rely on the maintenance of wilderness, wildlife and fisheries values. Concerns have been expressed that salvage operations may adversely impact wildlife populations, and in the case of guide outfitters, their clients' experience.

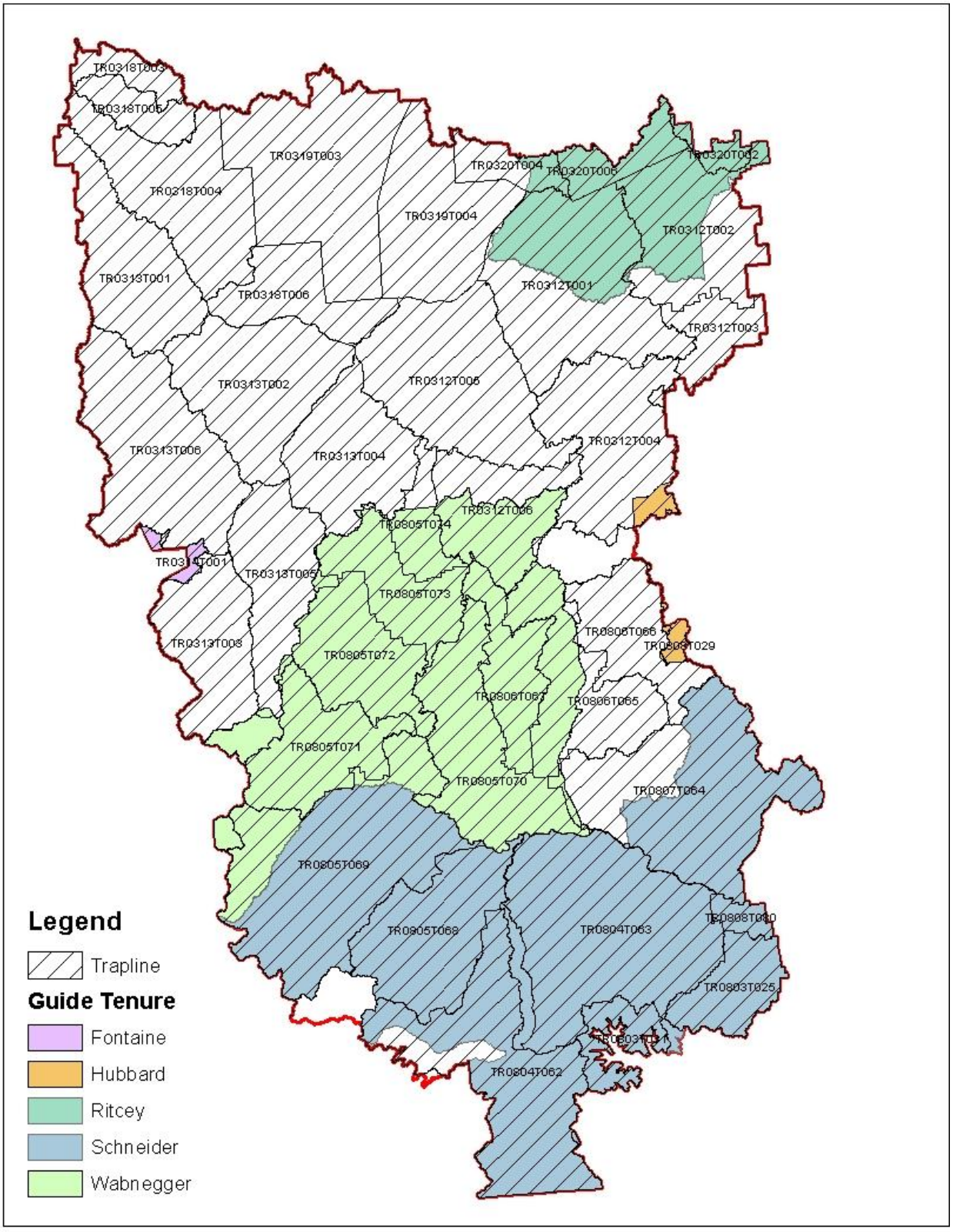


Figure 18 Traplines and Guide Outfitters in the Merritt TSA

11.7 Ranching

Ranching is a significant industry in the Merritt TSA; with over 70 active range tenures covering approximately 81% of the total TSA area (Figure 19). Activities of both range tenure holders and forest licensees can affect each other to a great degree; requiring both stakeholders to communicate and work together to resolve conflicts, such as the few examples described below.

Harvesting and silviculture activities can create forage opportunities within a grazing tenure but these activities can make it difficult for cattle to access cutblocks if there is excessive coarse woody debris left on-site, or de-stumping to address root disease. The opportunity to create forage through grass seeding can also be reduced if the harvesting and site preparation does not result in exposed mineral soil.

Harvesting can also make it easier for cattle to access riparian areas, which can then impact water quality. Harvesting can also breach natural range barriers that must then be mitigated by fencing.

Regeneration of cutblocks can be impacted by trampling, browsing, and competition from grass. This makes it more difficult and costly for forest licensees to meet their legal reforestation obligations, while reduced stocking can affect future timber supply.

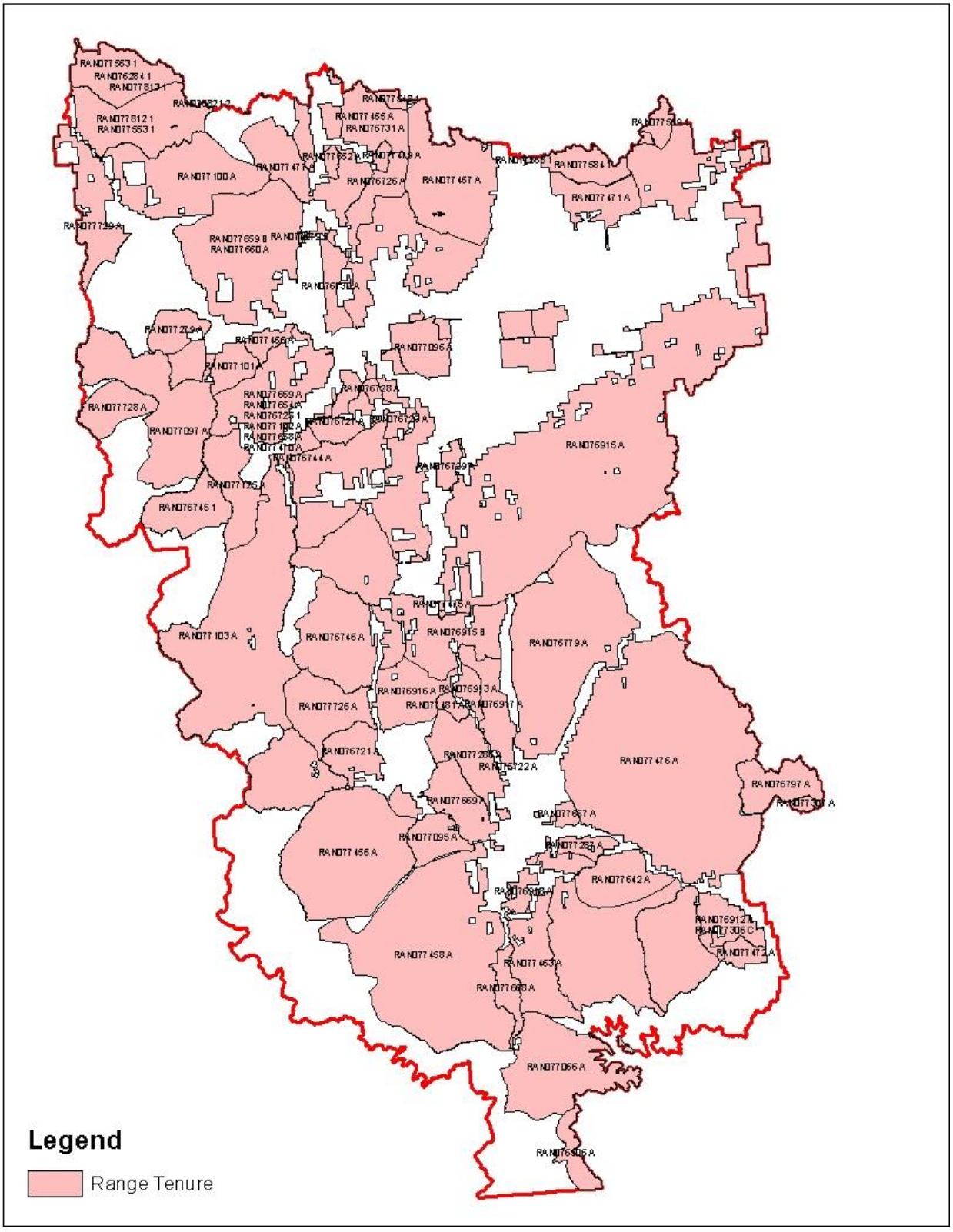


Figure 19 Range Tenures in the Merritt TSA

11.8 Road Density and Access

Roads, transmission lines, pipelines, and seismic lines can impact biodiversity by fragmenting habitat, impeding the movement of native species, facilitating the invasion of alien species, disrupting surface and subsurface waterflow, altering predator-prey relationships, and causing direct mortality through collisions with vehicles (Gayton, 2007). For example, roads are known to have a negative effect on Grizzly bears at densities over 0.4 kilometres of road per square kilometre.

The Merritt TSA is considered to be relatively well-roaded; with over 20,000 kilometres of road included in TSR 2015.

11.9 Herbicide Use

Pesticides may be used by licensees to control brush species to meet free growing requirements. The most common pesticides used are glyphosate and triclopyr; applied to reduce the competition of aspen, birch and cottonwood. Licensees utilize pesticides in accordance with a registered and publically reviewed Integrated Pest Management Plan (IPMP) which is required by the Integrated Pest Management Act.

Despite their proper and appropriate use, there is additional risk to biodiversity values such as non-target species that could be affected by overspray and loss of habitat/food species. Riparian areas and grassland/forest borders are of particular concern.

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