TYPE 4 SILVICULTURE STRATEGY IN THE KAMLOOPS TSA

SILVICULTURE STRATEGY REPORT

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March 2016

Contract number: 1070-20/FS15HQ090

STRATEGY AT A GLANCE

Strategy at a Glance		
Historical Context		The annual allowable cut (AAC) in the Kamloops TSA has been set at 4 million m^3/year in the 2008 TSR 4 and partitioned by species groups: pine, non-pine, cedar and hemlock, and deciduous. Prior to the MPB epidemic the AAC was 2.6 million m^3/year, which was increased to a high of 4.3 million m^3/year in 2004. Harvesting in the TSA from 2009 to 2013 billed against the AAC has averaged around 2.7 million m^3/year. The 2016 AAC Rationale has determined an AAC of 2.3 million m^3/year using TSR 5 and this Type 4 Silviculture Strategy as supporting documents.
Objective		To use forest management and enhanced silviculture to mitigate the mid-term timber supply impacts of mountain pine beetle (MPB) and wildfires while considering a wide range of resource values.
General Strategy		Direct current harvesting into areas of high wildfire hazard and apply a variety of silviculture activities to mitigate mid-term timber supply and achieve the working targets below.
Working Targets	**Timber Supply:**	**Short-term** (1-10yrs): Utilize remaining MPB affected pine through salvage and the ITSL program. Direct both partial-cut and clear-cut preferentially into areas of high wildfire hazard. **Mid-term** (11 - 70yrs): Maintain a maximized mid-term harvest level of 2.1 million m^3/year with the implementation of a diverse silviculture program.
	Habitat Supply:	Minimize the risk to a wide range of non-timber forest resources throughout the planning horizon (wildlife, water, forage, etc.). Risk categories are in relation to defined targets based on legal objectives and expert interpretation.
	Range Supply:	Consider range values so that we can make resource management decisions that consider range values along with other forest values. At minimum reach the currently allotted AUM targets by pasture.
Major Silviculture Strategies	**Timber Supply:**	The location of the silviculture activities modelled can be seen spatially in treatment maps. Main trends in areas treated are: **<u>Fertilization</u>**: Fertilize Douglas-fir and spruce stands between 40 and 80 years that are predominantly in the wetter part of the TSA with minimal forest health. These stands are just below MHA currently and fertilization allows them to be harvested soon in order to fill in the early part of the mid-term. **<u>ITSL</u>**: Dry pine stands that are highly affected by MPB, less than 90 years old that do not have any other type of harvesting available. Preferentially directed into areas of high wildfire hazard. **<u>Balsam IU</u>**: Previously harvested balsam stands > 50 years that are not above MHA. Because of slow growth and low volumes, this is how to get them to become a harvestable stand and contribute to the later mid-term. **<u>Commercial thinning</u>**: Pine stands 80 - 140 years old that are predominantly in the ICHdw3, ICHmw3, MSxk3. CT is used to get into stands with and high wildfire risk and MDWR. **<u>Ecosystem restoration</u>**: Treat dry Douglas-fir stands 80 - 160 years old with low productivity (site index <= 15) where there was no other treatment option available. Concentrate in areas of high wildfire hazard and constrained MDWR. **<u>Partial harvest</u>**: Dry Douglas-fir stands > 100 years old mainly in the IDFdk and IDFxh. Preferentially in high wildfire hazard areas, constrained CWS and MDWR.
	Habitat Supply:	Consider the implications to non-timber resources and factors from all silviculture activities both short- and long-term.
	Range Supply:	The location and timing of all treatments contribute to forage supply across both the both short- and long-term.
Silviculture Program Scenarios	**Potential Program**	The following table summarizes the treatment areas and cost applied over 20 years in the 'Silviculture Scenario'. As the areas chosen were within a reasonable expenditure range, no upper limit on spending was imposed.

Treatment	Area (ha)	Average Unit Cost ($/ha)	Target Funding ($/yr for 20 yr)
Fertilization	5,622	450	126,512
ITSL	4,720	4,939	1,165,543
Balsam IU	9,083	6,456	2,931,637
Commercial thin	3,532	9,480	1,674,196
Ecosystem restoration	30,060	1,645	2,472,617

Strategy at a Glance			
Silviculture Program Outcomes	**Timber Supply:**	Volume from fertilized stands and commercial thinning is available in the first 30 years of the mid-term. Stands regenerating from ITSL and balsam IU treatment area used in the later part of the mid-term. Ecosystem restoration is used throughout the planning horizon to access low productivity dry Douglas-fir stands.	
	Habitat Supply:	Caribou and MDWR habitat indicators as modelled are adhered to. Watersheds and visuals are projected to be more limiting across the planning horizon.	
	Range Supply:	TSA-level AUM targets are able to be met in the silviculture scenario, however some individual pastures are in deficit and may require more detailed investigation.	
Related Plans and Strategies	Climate change Land Use Plans Forest Health Wildfire Management Ecosystem Restoration		Wildlife Habitat Watershed Management Range Management Tree Improvement and Seed Transfer

Recommendations

The current forest management regime in the Kamloops TSA is similar to most TSA's in the BC interior where:

- stands are clearcut;
- stand selection is done by operational foresters;
- impact on landbase values are assessed at a stand level basis as part of operational planning;
- wildfire management is putting out fires; and
- First Nations consultation is a requirement.

The vision for the Kamloops TSA is to move towards a proactive and purpose driven management regime that effectively considers the collective values of the land base. The management regime has to be financially viable for all parties including Government, forest licensees, and ranchers. The social aspects such as jobs, water, visuals and wildfire risk must be adequately considered. The risk to environmental factors such as wildlife habitat, ecosystem resilience, and hydrology must be understood.

Doing this effectively the new management regime can evolve to:

- Where, when and how to harvest are driven by strategic & tactical planning exercises that consider a wider range of values across the TSA;
- Factors such as wildfire risk become a core part of the management regime where stands are proactively treated using financially viable harvest methods that reduce wildfire risk, while maintaining other landbase values;
- Range values are understood and considered including the revenue generated to the government and the ranchers;
- Risks to other environmental factors are understood and considered in the tactical planning exercise; and
- First Nations are an integral part of the planning process and active contributors.

Moving to a proactive purpose driven approach, the tools will be in place to provide direction to navigate the ever changing reality of resource managers. However, to move to this proactive purpose driven management regime there are several barriers that need to be overcome:

1. Institutional barriers: there are many parties that have to ‘buy-in’ to the process to effectively implement the management regime. For example in Kamloops there are 2 different forest districts, the regional office and the project is driven out of Victoria. Additionally there are forest licensee, several community forest holders (overlapping landbase requirements) and no less than 7 First Nation bands. The suggestion is to have a working group with all parties represented that meet on an ongoing basis be responsible for implementing the purpose driven management regime;
2. Short term priorities: the overwhelming strength of statuesque will be difficult to overcome as the practitioners doing the forest operations will carry on accessing the easiest wood possible. There must be a plan to effectively communicate the tactical direction to the doers, and the tools and support necessary to implement the plan;
3. Financial incentive: In many cases the purpose driven management regime may involve a higher cost to one party that benefits others. There must be a mechanism for accounting for this and compensating as required. For example a licensee can tweak its harvest location and harvest system to generate range, however, the value goes to the Government via grazing fees and the rancher via cattle. Similarly the harvest system that reduces wildfire risk will have high social value, reduce the Governments firefighting costs, but will increase the harvest costs to the licensee.

Figure 1 shows how a move to proactive purpose driven management regime can utilize harvesting and silviculture activity to stabilize the flow of timber while considering a suite of other values. The treatment activities of fertilization, salvaging balsam IU stands, commercial thinning and harvesting/replanting marginal MPB affected stands are strategically selected to ‘fill the gaps’ in the mid-term timber supply. This benefit in addition to reduced wildfire risk, increased range and improvement of many other values are very achievable under a proactive purpose driven management regime.

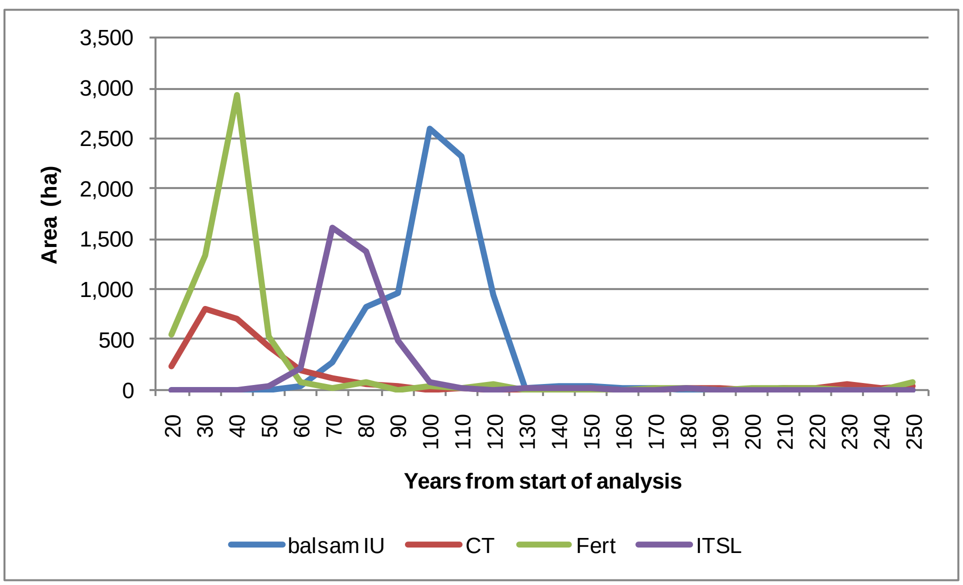

Figure 1: Utilization of Treated Stands

ACKNOWLEDGEMENTS

The authors would like to thank the following people for their participation and input into this process:

- Paul Rehsler, Silviculture Reporting & Strategic Planning Officer, MFLNRO
- Al Neal, Senior Ecosystem Restoration Specialist, MFLNRO
- Bernie Peschke, Silviculture Practices Specialist, MFLNRO
- Brent Olsen, Range Agrologist – Kamloops, MFLNRO
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- Bryce Bancroft, Symmetree
- Chuck Bulmer, Soil Restoration Ecologist, MFLNRO
- Craig Shook, Stewardship Technician – Clearwater, MFLNRO
- David Rusch, Regional Forest Pathologist – Caribou Williams Lake, MFLNRO
- Don Brown, Logan Lake Community Forest
- Ed Korpela, Fire Management Specialist, MFLNRO
- George Brcko, Wells Gray Community Forest
- Grant Glessing, Regional Silviculture Forester, Tolko
- Harold Hetherington, Range Agrologist, MFLNRO
- Heather MacLennan, Forest Health Technician – Clearwater, MFLNRO
- Jack Woods, Program Manager, Forest Genetics Council of BC
- Jeff Mycock, Professional Forester, 100 Mile Lumber Co Ltd.
- Jeff Stone, Timber Supply/ Geomatics Forester, MFLNRO
- John Hanemaayer, Stewardship Technician – Kamloops, MFLNRO
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- Mike Madill, Stewardship Team Leader, MFLNRO
- Michael Ryan, Research Ecologist, MFLNRO
- Murray Wilson, Woodlands Manager, Tolko
- Rachael Pollard, Resource Manager, MFLNRO
- Reg Newman, Research Range, MFLNRO
- Rick Sommer, District Manager – Kamloops, MFLNRO
- Ron Van der Zwan, Stewardship Officer – Kamloops and Clearwater, MFLNRO
- Stefan Albrecher, Tolko
- Ted McRae, Stewardship Officer, MFLNRO
- Tongli Wong, Associate Director, Centre for Forest Conservation Genetics, UBC
- Tyson Luedtke, Practices Forester – Clearwater, MFLNRO
- Walt Klenner, Wildlife Habitat Ecologist, MFLNRO
- Zorica Boskovic, Timber Tenures Forester, MFLNRO

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1.0 INTRODUCTION

In 2014, the Ministry of Forests, Lands and Natural Resource Operations (MFLNRO) initiated a Type 4 Silviculture Strategy for the Kamloops Timber Supply Area (TSA). The main goal was to provide tactical level direction for steering silviculture investment to help direct resource management decisions and silviculture investment to mitigate mid-term timber supply.

1.1 Project Objectives

In support of government objectives to mitigate impacts from the mountain pine beetle (MPB) infestation on mid-term timber supply, the project aims to:

1. Provide a realistic, forward-looking assessment of timber and habitat supply under a range of scenarios that will produce a preferred silviculture strategy;
2. Provide products that will support operational implementation of the strategy (e.g., a tactical plan);
3. Inform licensees and government on the alternative outcomes that could be achieved through different approaches to basic (mandatory) silviculture;
4. Provide context information or indicators that would be useful to support future management decisions in the TSA; and
5. Where appropriate, illustrate how the recommended treatments link with other landscape-level strategies while considering treatment risk.

1.2 Context

This document is the final of four documents that make up the Type 4 Silviculture Strategy for the Kamloops TSA:

1. **Situational analysis:** describing the general situation for the TSA;
2. **Information Package:** describing the input data, information and assumptions;
3. **Modelling Analysis Report:** describing the modelling output and rationale; and
4. **Silviculture Strategy:** provides direction for a TSA-level silviculture strategy considering input from stakeholders, various experts, and the forest estate modelling to identify treatment options, targets and benefits.

1.3 2016 Update

In 2016 as part of the continual update, feedback and improvement process, the analysis was updated to:

- Align the netdown with the recently published Kamloops TSR data package (September 2015). Changes were made to the definition of the following netdown items: problem forest type (PFT), operability, non-forest/non-productive, terrain stability and environmentally sensitive areas (ESAs), archaeological sites, permanent sample plots (PSPs) and research installations. This resulted in an increase in assumed THLB from 878,165 ha in 2014 to 953,450 ha in 2016. This is closely aligned with the THLB reported in the September 2015 data package of

931,373 ha. New netdown assumptions are documented in the updated information package.
- Model an additional silviculture treatment 'commercial thinning' consistent with the recent silviculture strategy addendum in the Okanagan TSA. Modelling of commercial thinning is described in the updated information package.
- Update estimates of cost and value for forage supply to be more consistent with the recent silviculture strategy addendum in the Okanagan TSA and the way that forestry costs and value are estimated. Assumptions are documented in the updated information package
- Model the harvest from offsite species on high risk ecosystems for climate change as described in the updated information package.
- The potential boundaries of 5 potential FNWL within the current Kamloops TSA are included and the AAC coming from each is modelled.

This report will include the results from the updated 2016 analysis. The initial results and summaries from the 2014/15 analysis are documented in the modelling and analysis report.

1.4 Land Base Summaries

This section summarizes information from the situational analysis, information package and the modelling and analysis report. Further details can be found in these companion documents.

The Kamloops TSA, located in southern interior BC, covers an area of 2.77 million ha, of which 953,450 ha is classified as timber harvesting land base (THLB). Areas set aside as protected areas, old growth management areas, Caribou no-harvest areas, and other resource management zones considered unavailable for harvesting account for roughly 760,000 ha. The allowable annual cut (AAC) of 4 million m^3 was set in 2008 and was partitioned by species groups: pine, non-pine, cedar and hemlock, and deciduous. Harvesting in the TSA from 2009 to 2013 billed against the AAC has averaged around 2.7 million m^3/ year.

Table 1.1 shows the land base classification including the area classified as productive forest and THLB. For further details, see the data package.

Table 1.1: Land Base Area Summary Table

Land Classification	Area (ha)
Total Area	**2,771,185**
Non-Crown	412,975
Non-Forest	620,362
Roads	23,846
Transmission Lines	741
Non-productive reductions	**1,057,924**
Crown Forest Landbase	**1,713,261**
Parks	299,823
Trails	420
Inoperable	144,198
Low Site	23,038
Problem Forest	14,915
Deciduous	26,493
OGMA	111,693
WHA	294
WMA	138
Caribou	42,651
ESA	34,959
Terrain Stability	15,696
Archaeological Sites	651
PSP & Research Installations	3,917
Riparian	22,155
WTP	18,770
Productive reductions	**759,811**
Total THLB	**953,450**

Figure 1.1 summarizes the THLB, non-THLB and non-productive land base. In this analysis, the Kamloops TSA has a gross area of 2.77 million ha of which 34% is classified as THLB.

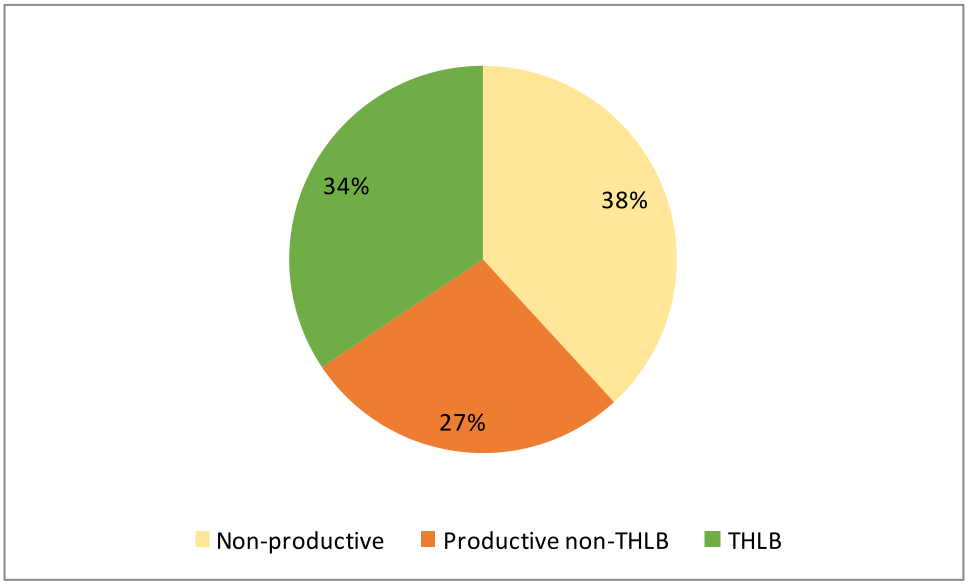

Figure 1.1: Area by Classification

Figure 1.2 shows the initial age class distribution on the THLB and non-THLB productive land base.

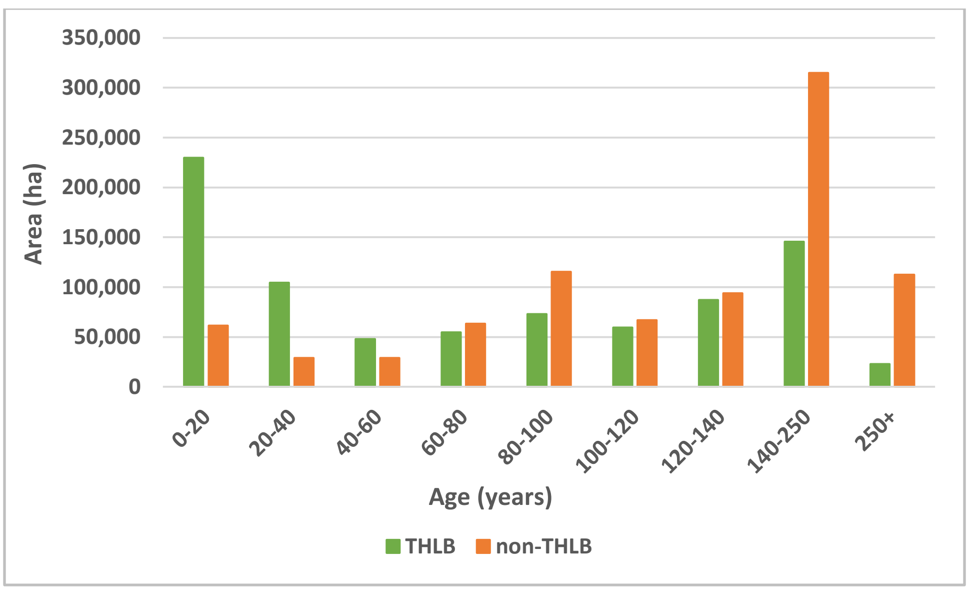

Figure 1.2: Initial Age Class Summary

Figure 1.3 shows the area by leading species on the productive land base. The TSA is 37% Douglas-fir leading and 25% Spruce leading.

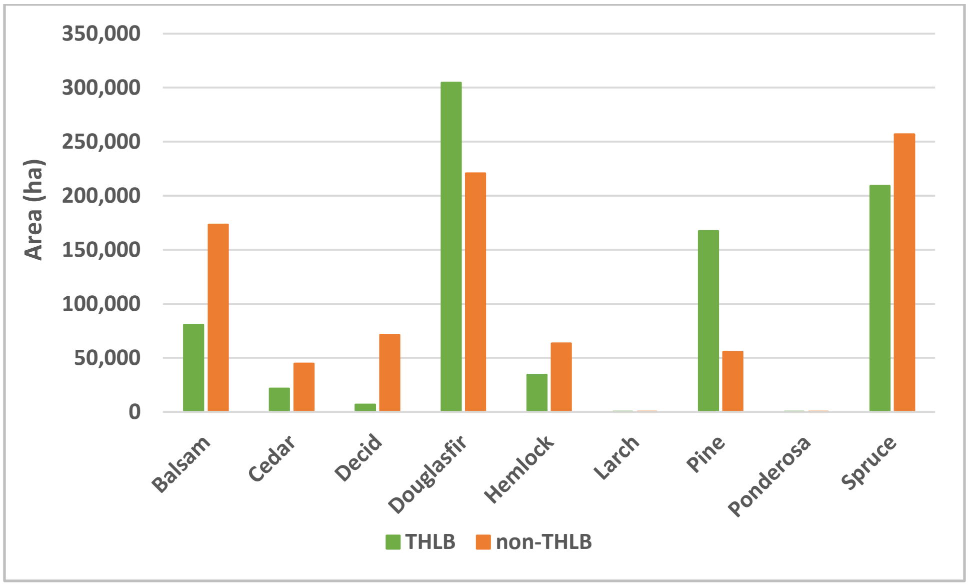

Figure 1.3: Initial Leading Species Summary

Figure 1.4 shows the THLB area by site index (height at age 50) for inventory site index. The area-weighted average THLB site index is 16m.

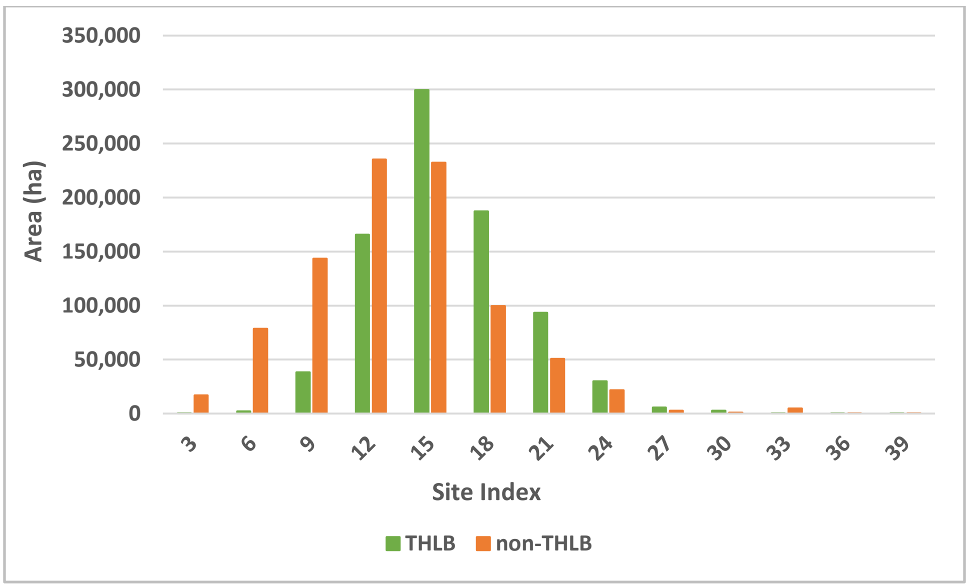

Figure 1.4: Initial Site Index Summary

2.0 KEY ISSUES AND CONSIDERATIONS

This section summarizes material from the situational analysis for this project. Further details can be found in this companion document.

2.1 Harvest Levels

The annual allowable cut (AAC) has been regulated in the Kamloops TSA since 1981. The AAC ranged from 2.35 million m^3/year to a high of 4.35 million m^3/year from 2004 - 2008 to address the current MPB epidemic and 2003 wildfire season. In June 2008, the AAC was set at 4 million m^3/year including a 1.994 million m^3/year partition for pine stands.

2.2 Forest Inventory

The new vegetation resource inventory (VRI) in the Kamloops TSA was completed in 2014 and published in January 2015. It was carried out between 2010 and 2014 with the majority of the classification completed using 2010 and 2011 photography. The VRI includes stand level descriptions for natural forested stands that include tree species, age, height, crown closure and basal area. These attributes are used to group the stands into analysis units as well as provide inputs for the natural stand growth and yield program VDYP. The VRI has been projected to the January 2015 and updated to account for disturbances from wildfire, harvesting, and MPB up to January 2015.

The VRI is the best available information; however there is still considerable uncertainty around the accuracy, especially at the stand-level when used for tactical and operational planning. The VRI is not designed for tactical or operational planning, but instead to get a reasonable volume estimate for the TSA as a whole. The planning needs, tools, and technology have advanced considerably over the past decade, however the VRI has largely remained a strategic volume based inventory.

2.3 Timber Supply

Post MPB, the timber supply is expected to drop for the next 80 - 100 years - a period that is termed the 'mid-term'. Mid-term timber supply forecasts in recent analyses vary between 1.8 and 2.2 million m^3/year.

2.4 Timber Quality

The overarching timber quality target is for at least 10% premium logs, however through this process, more importance has been placed on fibre supply and the uncertain and adaptive nature of industry to meet future supply and demand constraints.

2.5 Habitat Supply

Traditionally modelled non-timber resources are in this analysis, including community watersheds, deer winter range, mountain caribou approved ungulate winter ranges, old growth management areas, visually sensitive areas and wildlife habitat areas. Additional non-timber resources such as hydrologic modelling over an extended area, forage supply, forest health hazard for selected factors, high risk ecosystem and species combinations for climate change and wildfire hazard were also included in the analysis for consideration.

3.0 Treatments and Indicators

3.1 Additional Resource Values Modelled

Traditionally timber supply analyses that support a TSR or a silviculture strategy have managed primarily for timber volume, which is one of many important values to consider when investing silviculture funds into the land base. In the Kamloops Type 4 there has been a concerted effort to capture many additional values in the decision support tool used to assess opportunities for investing in the land base. Some of the key additions that are included in this analysis are:

1. **Wildfire hazard:** wildfire layers were provided that include spatial delineation for fire threat in order to target areas of higher threat and within the urban-wildland interface to be prioritized for treatment. Harvesting and partial cutting in high hazard areas are effective treatments to reduce wildfire risk;

2. **Net-Revenue:** effort has been made to assign a monetary value and cost to all the activities being modelled, timber harvested and range supply. This enables the model to consider net-revenue in the decision process, which has proven to significantly affect the management regime;

3. **Range:** grazing agreements have been issued throughout the TSA, which are affected significantly by harvest activity. This analysis includes range targets and shows the impact the silviculture strategy and management regime have on forage supply. Additionally it shows how the regime could be modified to enable the committed animal unit months (AUMs) to be available;

4. **Forest health:** the MPB epidemic has made it very clear that forest health hazard should be an essential consideration in our management strategy. This analysis dynamically assesses forest health hazard for 3 important insects, enabling the management regime to consider forest health hazard in the planning process;

5. **Hydrology:** a concerted effort has been made to capture the hydrological impacts of harvesting, silviculture and MPB affected stands. This enables the model to identify watersheds approaching their limits and provide direction where MPB affected stands should be left for their hydrological value;

6. **Climate Change:** the global changing climate affects BC's forests and other natural resources. Climate change presents not only risks but also opportunities to adapt if we base forest management decisions today on information of our potential future climates. Considerable work has been done on climate change, potential risk and mitigation strategies in the TSA and harvesting from offsite species on high risk ecosystems for climate change will be integrated into this analysis.

Each of these values has been captured in the model through close collaboration with one or more subject matter experts. These values are all in addition to the traditional

TSR and silviculture strategies that consider factors such as visuals, wildlife, old growth, etc.

3.2 Activities

The key output of the forest estate modelling is the schedule of activities. In the silviculture scenario, the activities being considered include:

- clear-cut and partial-cut harvesting,
- fertilization,
- ecosystem restoration (grass, open range and open forest)
- planting (innovative timber sale license (ITSL) and balsam intermediate utilization (IU) stands); and
- commercial thinning.

The main decisions being considered are around activities on MPB affected stands – How much to harvest? Where to harvest? What stands to leave? Which un-salvaged stands should be re-planted? Should we fertilize, and if so where? How much non-MPB affected timber should be harvested? What silviculture treatments can help fill in the projected mid-term timber supply downfall?

In the modelling environment, potential treatment pathways are defined (Figure 3.1 shows an example for a MPB affected stand). Each activity has different effects on the modelled indicators.

The schedule of these activities is a key component of the output as it provides direction to help resource managers implement a management regime and silviculture strategy that considers the wide range of values being captured. Although the data and modelling solution does not exist to provide a perfect answer, there are very real opportunities to improve our management decisions and silviculture investment.

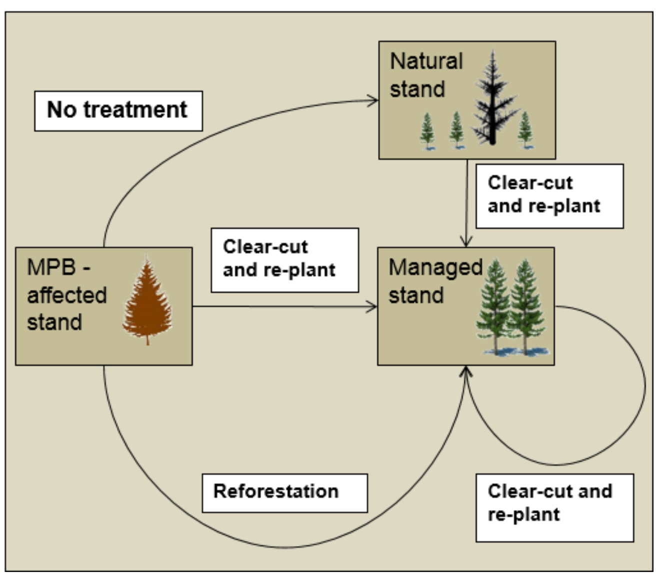

Figure 3.1: Activities Considered for MPB-Affected Stands

4.0 Silviculture Strategy

4.1 Working Targets

Provincial timber management goals and objectives provide the context and direction for the Kamloops TSA. Local timber goals and objectives rationalize the provincial priorities and goals in the context of local conditions, needs and values. The silviculture scenario attempts to balance all land base objectives. In addition to capturing the multiple values listed above, the scenario allows for silviculture activity to be implemented, helping to achieve the stated objectives.

Working targets were created and used to influence modelling decisions and outcomes from modelling scenarios in this project. Table 4.1 shows the targets and weightings for important indicators in the silviculture scenario.

Table 4.1: Indicators, Targets and Weightings for the Silviculture Scenario

Indicator	Target	Weighting
Harvest volume	TSR	Moderate
MPB volume	Maximize mid-term	Moderate
Cedar/ hemlock partition	Yes	Moderate
Non-declining THLB growing stock	Yes	Moderate
TSR RMZs	Yes	High
Silviculture activities	$10 million limit	Moderate
Net-revenue (value – cost)	Maximum positive – set at $10 per m^3 harvested	Moderate
Wildfire	Minimize hazard	Low
Hydrology - EDA	30% above/ below H50 limit	Moderate
Range	AUM targets	Low
Forest health	Minimize hazard	Low
High risk IDF Pl	Yes	Tracked
Shorter rotation	Yes	Tracked

4.2 Preferred Silviculture Strategy

The preferred silviculture strategy is intended to provide the necessary direction to translate provincial strategic objectives into tactical plans. It is not appropriate to simply apply the modelling outputs as the preferred strategy without interpretation of the results and an understanding of the modelling assumptions and limitations.

While the preferred strategy aims to achieve the working targets, the primary goal is to deliver more timber volume to mitigate the mid-term timber supply. A variety of activities are recommended to reduce financial risk and uncertainty while still providing means to address multiple values.

Figure 4.1 shows the harvest forecast of the Type 4 Silviculture Strategy and TSR 5. The silviculture scenario can achieve 2.2 million m^3/year. The base case analysis supporting TSR 5 starts at 2.5 million m^3/year dropping to 1.78 million m^3/year before increasing to 2.1 million m3/year in the long term.

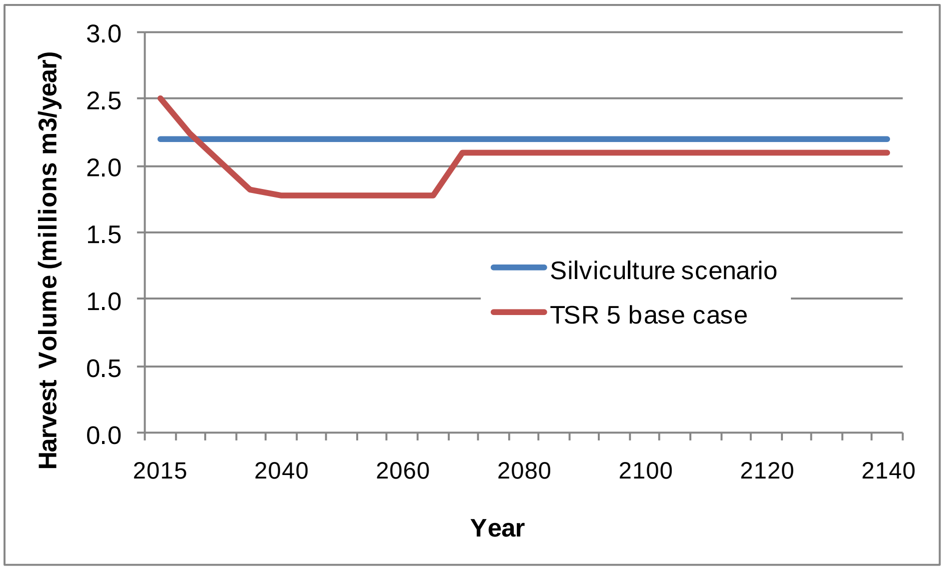

Figure 4.1: Harvest Volume: TSR 5 and Silviculture Scenario

4.2.1 Treatment Regime

Table 4.2 shows the proposed 20-year silviculture treatment regime that includes fertilization, planting (balsam intermediate utilization stands and ITSL), commercial thinning and ecosystem restoration treatments. The strategy proposes spending an average of $8.37 million per year for 20 years, equating to an estimated additional 795 jobs per year for 20 years. The strategy proposes to:

- Strategically fertilize Douglas-fir and spruce stands between 40 and 80 years that are just below MHA currently in order to increase the volume available in the next 30 years;
- Use ITSLs to access dry pine stands that are highly affected by MPB, less than 90 years old that do not have any other type of harvesting available;
- Rehabilitation balsam IU stands in order to get them to become a harvestable stand and contribute to the later mid-term;
- Commercial thin pine stands 80 - 140 years old in areas of high wildfire risk and MDWR;
- Treat dry Douglas-fir stands 80 - 160 years old with low productivity (site index <= 15) under ecosystem restoration to access volume, reduce wildfire hazard and reduce stocking.

Table 4.2: Treatment Regime Table[1]

Treatment	Area (ha)	Average Unit Cost ($/ha)	Target Funding ($M/year)
Fertilization	5,622	450	126,512
ITSL	4,720	4,939	1,165,543
Balsam IU	9,083	6,456	2,931,637
Commercial thin	3,532	9,480	1,674,196
Ecosystem restoration	30,060	1,645	2,472,617
Total	53,016		8,370,505

Table 4.3 shows the area of candidates for treatment compared to the actual area treated in the analysis by silviculture activity. High proportions of available area were chosen for treatment - for example, 59% of commercial thinning candidates were chosen for treatment.

Table 4.3: Candidate vs Treated Silviculture Activities

Treatment	Candidate area (ha)	Treated area (ha)	% treated
Fertilization	13,841	5,622	41%
ITSL	21,600	4,720	22%
Balsam IU	21,968	9,083	41%
Commercial thin	5,959	3,532	59%
Ecosystem restoration	108,804	30,060	28%

Figure 4.2 shows the area harvested through the mid-term for the stands treated in the silviculture program. The fertilization and commercial thinning program make additional volume available for the first 50 years of the mid-term, whereas stands treated as ITSLs and balsam IU stands are utilized in the later part of the mid-term. Ensuring that these stands are available for harvest at these points is necessary to realize the increased mid-term timber supply.

[1]Note: this table does not reflect all the activities carried out in the Kamloops TSA by the MFLNRO, only those modelled in this analysis.

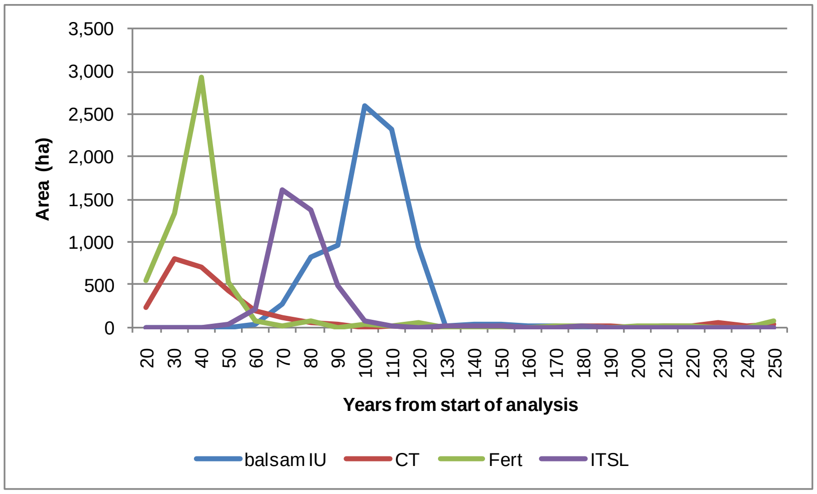

Figure 4.2: Utilization of Previously Treated Stands

5.0 TACTICAL PLAN

The tactical plan connects strategic objectives and targets for management with the required polygon level treatment schedule that must be implemented for these objectives and target to be achieved. The tactical plan for this project consists of a detailed, site-specific treatment schedule that specifies the treatment type, polygon(s) to be treated and the treatment schedule required to carry out the preferred silviculture strategy.

5.1 Target Treatment Areas

The spatial location of both eligible and treated stands is a key component of the tactical plan. These location maps and the spatial data behind them are provided to the MFLNRO as part of this project. In general:

- **Fertilization**: Fertilize Douglas-fir and spruce stands between 40 and 80 years that are predominantly in the wetter part of the TSA with minimal forest health. These stands are just below MHA currently and fertilization allows them to be harvested soon in order to fill in the early part of the mid-term.
- **ITSL**: Dry pine stands that are highly affected by MPB, less than 90 years old that do not have any other type of harvesting available. Preferentially directed into areas of high wildfire hazard.
- **Balsam IU**: Previously harvested balsam stands > 50 years that are not above MHA. Because of slow growth and low volumes, this is how to get them to become a harvestable stand and contribute to the later mid-term.
- **Commercial thinning**: Pine stands 80 - 140 years old that are predominantly in the ICHdw3, ICHmw3, MSxk3. CT is used to get into stands with and high wildfire risk and MDWR.
- **Ecosystem restoration**: Treat dry Douglas-fir stands 80 - 160 years old with low productivity (site index <= 15) where there was no other treatment option available. Concentrate in areas of high wildfire hazard and constrained MDWR.
- **Partial harvest**: Dry Douglas-fir stands > 100 years old mainly in the IDFdk and IDFxh. Preferentially in high wildfire hazard areas, constrained CWS and MDWR.

5.2 Applying the Tactical Plan

The direction provided in the previous sections form the basis of tactical plan development in this project. The following chapters identify some additional considerations when translating this into an operational plan.

5.2.1 Treatment Risk

Consider the risk that the financial gain from the treatment will not be realized due to natural disturbance factors. This may include:

- Forest health hazard;
- Wildfire hazard; and
- Risk of harvesting for regeneration treatments in areas where salvaging is still viable.

Fertilization

There is a risk to a fertilization investment if stands are harvested too soon. Currently there is no mechanism to prevent licencees from harvesting fertilized stands too early. Also, these stands are at risk of wildfire before they have been harvested. These risks have been identified by the Ministry. To address this, younger stands would be a priority for fertilization treatment to decrease the risks associated with harvesting however, this means that it will take longer to realize the return on that investment and the investment is at risk of wildfire loss for a longer period of time.

Discussion around multiple-fertilization treatments began in the kick-off meeting, however this option was not included in the analysis due to complexities and risks associated with fertilization and multiple licensees operating in the area. While there may be opportunities for multiple-fertilization treatments in some stands, risk of investment loss is increased as costs are carried longer.

5.2.2 Consider Related Plans and Strategies

Check how each treatment aligns with related plans and strategies especially including:

- Climate change,
- Forest health,
- Wildfire management;
- Ecosystem restoration; and
- Hydrological/ watershed values.

5.2.3 Data Limitations

The accuracy of the information associated with key input data layers is variable and may change over time. For example ownership and OGMAs may change over time. Field verification of inventory attributes (e.g. species, age, site productivity) prior to treatment is a critical component of the planning and implementation process. The VRI that was used as the foundation for this project was designed to provide a reasonable average volume for the TSA and may not be accurate at the stand level.

5.2.4 Utilizing the Tactical Plan

Treatment schedule maps are used to identify candidate and priority stands scheduled for treatment. These stands should then be assessed in the field to verify data, treatment risk, relation to other plans/ strategies and operational limitations that exist (e.g. road access). Areas have been constrained to be of reasonable size for operational treatment, however access and operational feasibility of the areas will need to be assessed. A stand-level return on investment (ROI) analysis on silviculture investment can be utilized as part of stand-level treatment plans.

6.0 Related Plans and Strategies

When implementing the silviculture strategy, it is important to consider the multitude of other related plans and strategies that apply. While some of these factors were incorporated into the analysis and were considered when locating priority stands for treatment in the silviculture strategy, it is important to list and formalize the factors to consider.

6.1 Climate Change

Forest management opportunities currently exist that consider climate change. Sources of information pertaining to climate change in BC are outlined in Table 6.1.

Table 6.1: Climate Change Information Sources

Source	Link
Kamloops Future Forest Strategy II	https://k2project.wordpress.com/
Overview of Guidance to Adapt Forest Management for Climate Change in the Kamloops TSA	http://www2.gov.bc.ca/assets/gov/farming-natural-resources-and-industry/forestry/land-based-investment/forests-for-tomorrow/nelsonrevisedk2adaptationguidanceoverview120607.pdf
MFLNRO's page on adapting to climate change	http://www.for.gov.bc.ca/het/climate/index.htm

6.2 Land Use Plans

The Kamloops Land and Resource Management Plan (KLRMP), Forest and Range Practices Act (FRPA) objectives, approved ungulate winter ranges (UWR) and associated orders and wildlife habitat areas (WHA) and associated general wildlife measures (GWM) form the framework for forest management and land use in the Kamloops TSA.

Many of these values are directly affected by MPB mortality and associated salvage harvesting, but have not been updated to specifically incorporate these affects. Table 6.2 lists sources of information regarding land use plans in the Kamloops TSA.

Table 6.2: Land Use Plan Information Sources

Source	Link
KLRMP	https://www.for.gov.bc.ca/tasb/slrp/lrmp/kamloops/kamloops/plan/files/klrmp_full.pdf
FRPA	http://www.for.gov.bc.ca/code/ http://www.for.gov.bc.ca/tasb/legsregs/frpa/frparegs/
Approved UWR	http://www.env.gov.bc.ca/wld/frpa/uwr/index.html
WHA	http://www.env.gov.bc.ca/wld/frpa/iwms/wha.html

6.3 Forest Health

The 2009 Kamloops TSA forest health strategy outlines emerging and important forest health issues in the TSA and strategies to minimize losses. This document identifies

Douglas-fir beetle, spruce beetle, western spruce budworm and western balsam bark beetle as emerging forest health issues. In this analysis, forest health hazard for MPB, Douglas-fir beetle and spruce bark beetle was modelled at the landscape level. Table 6.3 lists sources of information regarding forest health strategies.

Table 6.3: Forest Health Information Sources

Source	Link
Kamloops Forest Health Strategy 2009/ 2014	http://www.for.gov.bc.ca/ftp/HFP/external/!publish/Forest_Health/TSA_FH_Strategies/2014_%20Kamloops_%20TSA_%20Forest_%20Health_%20Strategy%20Final%202.pdf http://www.for.gov.bc.ca/dka/forest_health/doc/2009kamloopstsa_fhstrategyfinalmay4.pdf
MFLNRO Forest Health Website	http://www.for.gov.bc.ca/hfp/health/index.htm

6.4 Wildfire Management

The BC Wildfire Management Strategy aims to encourage healthier ecosystems, reduce the risk of loss to communities, recognize and plan for climate change, and enable more cost-effective wildfire response. The five strategies that aim to achieve these goals are to:

- Reduce the hazards and risks associated with wildfire in and around communities and other high-value areas.
- Plan and implement careful use of controlled burning in appropriate ecosystems under suitable conditions to reduce hazards and risks and achieve healthy forests and grasslands.
- Allow wildfires to burn in areas where there is minimal risk to identified values. Monitor these wildfires and intervene only when necessary to reduce unwanted losses.
- Implement land, natural resource and community planning that incorporates management of wildland fire at all appropriate scales.
- Develop a high level of public awareness and understanding about wildfire and its management.

6.4.1 Planning Silviculture Activities to Address Wildfire

Silviculture activities should be planned to recognize and protect values that are at risk from wildfire. Ideally, projects should be located within areas of reduced wildfire risk and aligned in larger, more cohesive units that can be easily identified as a priority value for suppression. The process below describes the silviculture activities that can be deployed to address different wildfire risks and management objectives.

There are two key components to evaluating silviculture treatments from a wildfire management perspective:

1. Design treatments that reduce wildfire risk and consequences to life, property and other values, and
2. Locate treatments to minimize the likelihood of loss of the investment from wildfire.

At this time, it is recommended that the burn probability map (Burn-P3) be used in conjunction with local input on values and risk, to identify and prioritize candidate treatment areas based on wildfire hazard. As Fire Management Plans evolve they will include landscape level wildfire management objectives and strategies based on local input. Proposed treatments should be consistent with Fire Management Plan objectives and strategies (when they are available) and contribute to the development of a fire resilient landscape. Communities that have been identified as the highest risk should be targeted for amelioration treatments first. Other communities with lower risk, and other values outside of the wildland urban interface (WUI) (e.g., critical infrastructure, critical habitat, community watersheds) at high risk from wildfire, should be considered a high priority for amelioration treatments.

Table 6.4 illustrates the relationship between forest management activities and fire management. It is intended to assist prescribing foresters to consider wildfire risk when planning silviculture treatments. For example, a lower priority is assigned to proposed treatment areas where silviculture activities are likely to contribute to the fire hazard, or where there is a high probability of long term silviculture investments being lost to wildfire or fuel reduction treatments in the interface. Alternatively, a higher priority is assigned to proposed treatment areas where activities will likely mitigate the risk of losses from wildfires and have a higher likelihood of growing to a commercial harvest age. It is generally preferable to locate silviculture investments in low or moderate fire risk areas, however, under some circumstances, silviculture investments can be made in areas of higher fire risk, provided appropriate hazard mitigation is part of the investment and the resulting treated stand does not increase the hazard to communities and other values over time.

Table 6.4 Forest Management Priorities for Wildfire Management

Treatments		Treatment outcome (Fire perspective)	Lower priority where…	Higher priority where…
Harvesting	Clear-cut	Reduce fuel loading and eliminate crown fire risk (short term)		High values and high hazards exist; create fuel breaks
	Partial cut	Reduce crown bulk density which reduce crown fire risk (1). May increase surface fuel loading (2)		High risk interface area (3) identifies a need to treat fuels; mitigate risk
Silviculture	Enhanced Reforestation	May have surface fire potential. This is dependent on residual slash load and grass/ herbaceous fuel loading.	Burn probability is highest; avoid losing silviculture investments	
	Alternate Reforestation (4)	May have surface fire potential. This is dependent on residual slash load and grass/ herbaceous fuel loading.		Burn probability is highest; mitigate losses and protect values
	Prescribed Burn / Ecosystem Restoration	Maintains a natural fire return interval		High values exist with high hazard and risk; treat fuels and improve forest health/habitat
	Spacing to normal stocking levels	Reduce fuel loading – lower intensity fires. May increase surface fuel loading	Burn probability is highest; avoid losing silviculture investments	
	Spacing to lower densities combined with/Fuel Reduction	Reduce fuel loading – lower intensity fires(5)		High values exist to protect community and Infrastructure High risk interface area (3) identifies a need to treat fuels; mitigate risk Burn probability and fire intensity criteria are the highest; mitigate fuel loading
	Fertilization	May increase crown bulk density and higher surface fuel loading	Burn probability is highest - avoid losing silviculture investments Burn probability is highest within interface; Areas in the interface have a high priority for	Outside of interface areas, in areas of low to moderate burn probability.

Treatments		Treatment outcome (Fire perspective)	Lower priority where…	Higher priority where…
			treatment and silviculture investments may be lost.	
	Pruning	Increase crown base height but will increase surface fuel loading.		High risk interface areas – increase height to live crown.
Rehabilitate	Knockdown and site preparation	Reduce fuel loading and eliminate crown fire risk (short term)		High risk interface area (3) identifies a need to treat fuels; mitigate risk
	Plant and brush	May have surface fire potential. This is dependent on residual slash load	Burn probability is highest; avoid losing silviculture investments	

(1) This treatment may also increase crown fire potential in certain areas due to increased air flow through the stand. Care needed with surface fuel load and crown base height

(2) Higher surface fuel loading can result in more intense surface fires. Higher intensity surface fires have the potential to increase crown fire potential.

(3) Identified through a Community Wildfire Protection Plan (CWPP) or Provincial Strategic Threat Analysis (PSTA) or Burn P3

(4) Encourage deciduous or other fire resistant species

(5) Intensity (I) is a function of the combustion (H), weight of fuel (W) and rate of spread of a fire (R) I=HWR

It is important to recognize that most of the treatments discussed in Table 6.4 have a limited amount of time where they will be effective from a fire management perspective. As trees and other vegetation grow, ingress may occur and fuels accumulate, the wildfire hazard will increase. It is important to design treatments to be effective over the long term, or plan for follow-up treatments to maintain effectiveness.

Although Table 6.4 does not specifically discuss prescribed burning, it can be an effective tool to reduce fuel loading and accomplish other objectives. Consideration should be given to how the planned treatment fits in with adjacent areas, and how it contributes to the creation of effective landscape level fuel breaks and a fire resilient landscape. Table 6.5 lists selected sources of information for wildfire management.

Table 6.5: Wildfire Management Information Sources

Source	Link
BC Wildland Fire Management Strategy	bcwildfire.ca/prevention/PrescribedFire/
Provincial Strategic Threat Analysis Wildfire Management Branch	No link available – contact Daniel.Perrakis@gov.bc.ca
Regional District Community Wildfire Protection Plans – Kamloops Fire Center	No link available – contact Gord.Pratt@gov.bc.ca
Municipal Community Wildfire Protection Plans – Kamloops Fire Center	No link available – contact Gord.Pratt@gov.bc.ca
Burn-P3 Modelling Wildfire Management Branch Fire Management Specialist – South Area	cfs.nrcan.gc.ca/pubwarehouse/pdfs/25627.pdf Contact – Mike.Black@gov.bc.ca
Forest health and climate change: A BC perspective	bcwildfire.ca/ftp/HFP/external/!publish/ClimateChange/FRPA/Workshop/Forest_Health_CC.pdf
Silvicultural Regimes for Fuel Management in the Wildland Urban Interface or Adjacent to High Landscape Values	www.for.gov.bc.ca/ftp/HFP/external/!publish/LBIS_web/Guidance/FFT%20guidance%20-Silvicultural%20Regimes%20for%20Fuel%20Management%20in%20the%20WildLand%20Urban%20Interface_V2.3.pdf

6.5 Ecosystem Restoration

Decades of fire suppression in the wildfire-maintained ecosystems have resulted in encroachment and ecosystem degradation. In the Kamloops TSA, these dry-belt IDF ecosystems are located in the valley bottoms that are also heavily used for range and recreation and are in close proximity to major population centres. The province's ecosystem restoration plan provides strategic direction to restore these areas to an ecologically appropriate and resilient condition.

Much of the treatment areas are outside of the THLB, but there may be an important indirect implication of reducing overall wildfire hazard through ecosystem restoration that will increase mid-term timber supply. Table 6.6 shows selected sources of information for ecosystem restoration.

Table 6.6: Ecosystem Restoration Information Sources

Source	Link
MFLNRO Ecosystem Restoration website	https://www.for.gov.bc.ca/hra/Restoration/index.htm
Provincial strategic plan	https://www.for.gov.bc.ca/hra/Restoration/Draft%20-%20Ecosystem%20Restoration%20Prov%20Strategic%20Plan.pdf
Rocky Mountain Trench blueprint for action	http://www.trenchsociety.com/setup/content/Blueprint_for_Action_2006.pdf

6.6 Watershed Management

The large areas of MPB mortality, as well as the increased road densities and clear-cutting associated with accelerated salvage harvests affects watershed risk to peak flow events. In this analysis, the hydrological indicators EDA (equivalent disturbance area) above and below the H50[2] elevation were modelled to mimic hydrological operational considerations.

Harvest, salvage and silviculture activities need to be spatially located keeping these indicators in mind. Accelerated green-up will result from rehabilitating a MPB killed stand rather than letting it regenerate through natural regeneration. Watersheds that have high EDA values in the short term were identified in this analysis. Table 6.7 list selected sources of information for watershed management.

Table 6.7: Watershed Management Information Sources

Source	Link
Kamloops TSA Watershed Risk Analysis	No link available
IWAP	https://www.for.gov.bc.ca/tasb/legsregs/fpc/fpcguide/iwap/iwap-toc.htm
FREP Water	https://www.for.gov.bc.ca/hfp/frep/values/water.htm
BC water sustainability act	https://engage.gov.bc.ca/watersustainabilityact/

6.7 Wildlife Habitat

The Kamloops TSA is home to many key wildlife species and non-timber values. This analysis considers TSR, GAR and KLRMP requirements including caribou, mule deer, moose, community watersheds, lakeshore management zones, and visually sensitive areas. When implementing the silviculture activities in this strategy, consider their impact on wider wildlife habitat objectives. Table 6.8 list selected sources of information for wildlife habitat.

Table 6.8: Wildlife Habitat Information Sources

Source	Link
KLRMP	https://www.for.gov.bc.ca/tasb/slrp/lrmp/kamloops/kamloops/plan/files/klrmp_full.pdf
Approved UWR	http://www.env.gov.bc.ca/wld/frpa/uwr/index.html
WHAs	http://www.env.gov.bc.ca/wld/frpa/iwms/wha.html
Fisheries sensitive watersheds	http://www.env.gov.bc.ca/wld/frpa/fsw/index.html

6.8 Range Management

The BC range program allocates and supports grazing and hay-cutting agreements on crown land through licenses, permits and leases. Range agreements are broken down into pastures (areas for use during a particular season) that have a target forage requirement. Forage requirements are measured in animal unit months (AUMs) which is the amount of forage necessary for the sustenance of one cow or its equivalent for 1 month (450kg/AUM).

In the analysis, forage production was modelled and tracked throughout and analysis scenarios specific to range values were run. The instrument through which changes in forage supply are assumed to be influenced is through selection of different harvesting

[2] H50 refers to the elevation that 50% of the area is above (for a given watershed).

systems, including clear-cut, partial cut, patch cut and strip cut. These harvesting systems represent changes in silviculture practices at time of harvest and result in different levels of forage productions (grass growth).

These analyses indicated that while under current silviculture practices and management, existing forage allocations are not likely to be met, relatively small amounts of change in management is necessary to fulfill the forage targets, as seen in several scenarios. All silviculture activities should consider how they might affect or be affected by range activities. Table 6.9 list selected sources of information for range management.

Table 6.9: Range Management Information Sources

Source	Link
BC Range program website	http://www.for.gov.bc.ca/hra/index.htm
BC Range factsheets and publications	http://www.agf.gov.bc.ca/range/factsheets.htm

7.0 Recommendations

Throughout this process, it was recognized that this planning process is meant to be iterative and continually improved upon. This section highlights possible process and data improvements that will enhance similar projects in the future.

7.1 Implementation of Strategies

The current forest management regime in the Kamloops TSA is similar to most TSA's in the BC interior where:

- Stands are clearcut;
- Stand selection is done by operational foresters;
- Impact on landbase values are assessed at a stand level basis as part of operational planning;
- Wildfire management is putting out fires; and
- First Nations consultation is a requirement.

The vision for the Kamloops TSA is to move towards a proactive and purpose driven management regime that effectively considers the collective values of the land base. The management regime has to be financially viable for all parties including Government, forest licensees, and ranchers. The social aspects such as jobs, water, visuals and wildfire risk must be adequately considered. The risk to environmental factors such as wildlife habitat, ecosystem resilience, and hydrology must be understood.

Doing this effectively the new management regime can evolve to:

- Where, when and how to harvest are driven by strategic & tactical planning exercises that consider a wider range of values across the TSA;
- Factors such as wildfire risk become a core part of the management regime where stands are proactively treated using financially viable harvest methods that reduce wildfire risk, while maintaining other landbase values;
- Range values are understood and considered including the revenue generated to the government and the ranchers;
- Risks to other environmental factors are understood and considered in the tactical planning exercise; and
- First Nations are an integral part of the planning process and active contributors.

Moving to a proactive purpose driven approach, the tools will be in place to provide direction to navigate the ever changing reality of resource managers. However, to move to this proactive purpose driven management regime there are several barriers that need to be overcome:

1. Institutional barriers: there are many parties that have to 'buy-in' to the process to effectively implement the management regime. For example in Kamloops there are 2 different forest districts, the regional office and the project is driven out of Victoria. Additionally there are forest licensee, several community forest holders (overlapping landbase requirements) and no less than 7 First Nation bands. The suggestion is to have a working group with all parties represented that meet on an ongoing basis be responsible for implementing the purpose driven management regime;

2. Short term priorities: the overwhelming strength of status quo will be difficult to overcome as the practitioners carrying out forest operations will carry on accessing the easiest wood possible. There must be a plan to effectively communicate the tactical direction to the doers, and the tools and support necessary to implement the plan;
3. Financial incentive: In many cases the purpose driven management regime may involve a higher cost to one party that benefits others. There must be a mechanism for accounting for this and compensating as required. For example, a licensee can modify its harvest location and harvest system to generate range, however, the value goes to the Government via grazing fees and the rancher via cattle. Similarly the harvest system that reduces wildfire risk will have high social value, reduce the Governments firefighting costs, but will increase the harvest costs to the licensee.

7.2 Data Gaps and Information Needs

Data gaps and future information needs that were identified through this process include:

- Ecosystem mapping: The Kamloops TSA does not have ecosystem mapping which is valuable for capturing many of the environmental values and also for understanding the productivity of the managed stands;
- Growth and yield monitoring program that considers the effects of climate change, forest health factors and silviculture treatments on stand growth;
- Improved ecosystem restoration mapping will help to better identify appropriate stands for ER treatments - this would be enhanced with the above mentioned ecosystem mapping;

7.3 Related Plans and Strategies

Continue to explore ways to align silviculture strategies with other related plans and strategies to maximize benefits to multiple forest users and values.

The analysis dataset and tools should be made available and encouraged for use in other planning processes in the TSA.

7.4 Monitoring

Monitoring should be integral to the silviculture strategy. This includes monitoring of managed stand yields and monitoring the response to silviculture activity.

8.0 APPENDIX 1: SILVICULTURE TREATMENT MAPS