
Type 1
Incremental Silviculture Strategy
TFL 15
-- Version 2.0 --

Prepared for

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1. STRATEGY AT A GLANCE

General Strategy	The focus of the silviculture strategy for TFL 15 is to change the emphasis from spacing in PI stands to other projects that will (a) improve the product quality of PI stands (b) improve the quality and growth of dry-belt stands, or (c) enhance wildlife habitat. Forest health issues must be addressed in all silviculture treatments.
Working Targets	TFL 15 does not have a long-term timber supply problem. Strategies are aimed at meeting wood quality and habitat objectives and offsetting any reductions due to the implementation of the Okanagan-Shuswap Land and Resource Management Plan.
Product Objectives	To manage stands to provide high value, small wood products. In lodgepole pine, the premium product is MSR 2x3 and 2x4s. In Douglas-fir, the premium product is appearance grade, small dimension lumber. Sensitivity of harvest volumes to product objectives will be modeled in the next MP.
Habitat Objectives	To improve the quality of habitat for California Bighorn Sheep, to provide more variation in spacing regimes, to retain Ac, Py, Lw, Fd and At snags and large stems where possible; to explore the possibility of managing a portion of the southern TFL as a wildlife emphasis area.
Major Silvicultural Strategies	<ol style="list-style-type: none"> 1. Explore the use of natural disturbance types to determine appropriate silviculture regimes and stocking standards. 2. In PP/BG areas, management for wildlife and biodiversity values is important, as there are limited opportunities for harvest. Opportunities to enhance California Bighorn sheep habitat through under-burning, spacing or other treatments in these areas will be explored. 3. In dry-belt Fdi leading stands, move towards even-aged management systems including shelterwoods, seed tree cuts and patch retention for wildlife, to reduce losses to forest health agents, increase crop tree quality and increase growth. 4. In leading pine stands where there are not existing legal obligations, use spacing only where it will improve product quality, avoid repression or maintain or improve wildlife habitat or biodiversity values. 5. Prune spaced PI stands or plantations to increase product quality and fertilize to increase growth. 6. Plant genetically improved seedlings, as seed is available. 7. Reduce future risks of catastrophic losses to mountain pine beetle through a reduction in the component of lodgepole pine in the IDF subzones or through other appropriate strategies. 8. Consider managing a portion of the south end of the TFL as a wildlife emphasis area. Important species in this area and their habitat requirements will be determined and appropriate strategies to enhance

habitat will be developed and implemented.

9. Rationalize reductions to the THLB and make rehabilitation of productive sites currently excluded a high priority.
10. Carry out intensive activities consistent with the Forest Health Management Plan where warranted by stand conditions.

2. INTRODUCTION

2.1 ABOUT THE INTERIM STRATEGY

The terms of a service agreement between Forest Renewal BC (FRBC) and the BC Ministry of Forests (MoF) require the MoF to develop, and FRBC to fund, what is essentially an incremental silviculture strategy. This document is in fulfillment of this contractual requirement.

Incremental silviculture is part of a suite of strategies, which together may influence the future quality, and quantity of habitat and timber supply. This document broadly analyzes the full potential range of silviculture activities in order to create a context for an incremental silviculture strategy.

An incremental silviculture strategy should not be confused with the allowable annual cut (AAC) determination process. AAC's are based on actual practice and current information at the time of the determination. This strategy on the other hand is about creating a future state of our forests. The degree to which the strategy proves appropriate and is achieved may influence future, but not necessarily present AAC determinations. The concept of an interim silviculture strategy, while a good one, will not take priority over new or additional strategies identified in MP9. Strategies identified here will be reviewed within the context of MP9.

This strategy is founded on readily available information and the knowledge of forestry professionals. It is intended as an interim strategy until a more in-depth analysis-based review is completed.

2.2 DEFINITIONS

Silviculture is "the art of producing and tending a forest" (Smith *et al.*, 1997) and involves the planned application of treatments that will influence the "establishment, growth, composition, and quality of forest vegetation" (Daniel *et al.*, 1979). Definitions of basic, intensive and incremental silviculture in the B.C. context are included in Appendix I.

3. METHODOLOGY

This strategy was prepared through the following process.

3.1 COLLECTION OF INFORMATION

Prior to the working session, a working document was prepared for distribution. This included background information on TFL 15 from the Timber Supply Review and the AAC rationale. Opportunities to increase the quantity and quality of timber supply were documented.

3.2 WORKSHOP

A meeting was held in Kelowna on January 10 and 11, 2001. Presentations were given by

- Janice Hodge (forest health),
- Alan Vyse (Douglas-fir management),
- Ken Mitchell (juvenile spacing),
- Rob Brockley (forest fertilization),
- Mike Carlson (PI tree improvement),
- Tom Sullivan (wildlife habitat and incremental silviculture of PI) and
- Brian Harris (a MELP perspective).

In addition to these speakers, attendees for the first day included:

- Ministry of Forests, Penticton District: Ken Cunningham, Alan Rasmussen, Margot Hollinger, Jerome Jang and Gene Desnoyers
- Ministry of Forests, Kamloops Forest Region: Bruce Pamplin,
- Weyerhaeuser, Kamloops: Sean Curry and Dan Livingston
- Kalamalka Research Station: John Murphy
- Weyerhaeuser, Okanagan Falls Division: Ed Collen

Gordon Lester and Mary Lester from J.S. Thrower & Associates Ltd. in Kamloops chaired the meeting. Attendees the second day were Sean Curry, Janice Hodge, Bruce Pamplin, Alan Rasmussen, Brian Harris (afternoon), Ed Collen, Gordon Lester and Mary Lester.

3.3 DRAFT STRATEGY

The discussions and recommendations from the working session were incorporated into this draft document. This version is being submitted to the participants as well as to the Osoyoos Indian Band for their comments.

3.4 FINAL REPORT

On April 5, 2001, a meeting was held in Penticton with Alan Rasmussen, Ed Collen, Steve Jones and Mary Lester to review the District comments on the second draft. Following the recommended changes, a third draft was circulated to the District and Weyco staff for final comments.

4. BASIC DATA FOR TFL 15

4.1 LANDBASE

Table 1. Operable Land Base Summary

Total Land Base	48,448.5	100%
TOTAL PRODUCTIVE FOREST	45,374.9	93.6
Problem Forest Types:		
• Non PI leading types $\geq$ age 121 and $\leq$ 19.4 m ht	1,036	
• PI leading types > age 81 and < 18.5 m ht	959	
• PI leading types age 61-80 and $\leq$ 12.7 m ht	1,762	
• PI leading types age 41-60 and $\leq$ 9.5 m ht	238	
• PI leading types $\geq$ age 21-40 and $\leq$ 5.0 m ht	188	
• PI SC4 $\geq$ age 101 and $\leq$ 15.9 m	280	
• All deciduous leading types	185	
	4,648.0	9.6
Other deductions	4,071.0	8.4
TOTAL OPERABLE FOREST	36,655.5	75.7
Long-term Available Forest Landbase	35,043.5	72.3%

4.2 SUBZONES, SPECIES COMPOSITION AND AGE CLASS DISTRIBUTION

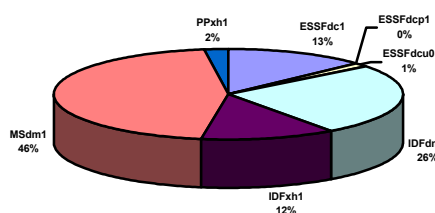


Figure 1. Distribution of area by BEC subzones.

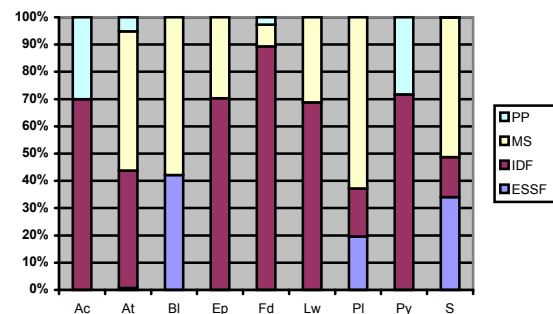


Figure 2. Leading species by BEC zone.

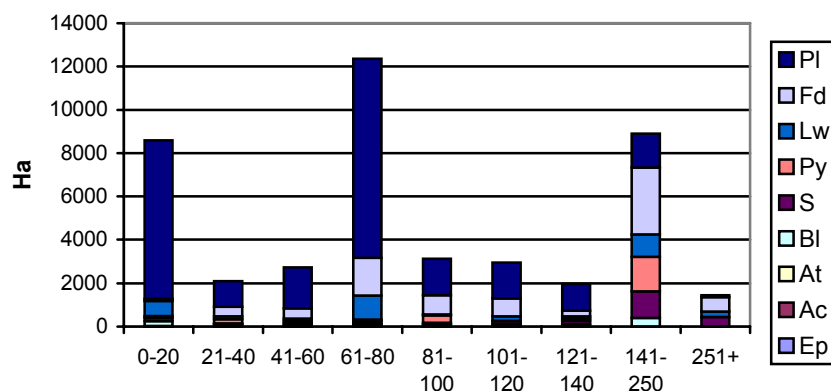


Figure 3. Age class distribution with species breakdown.

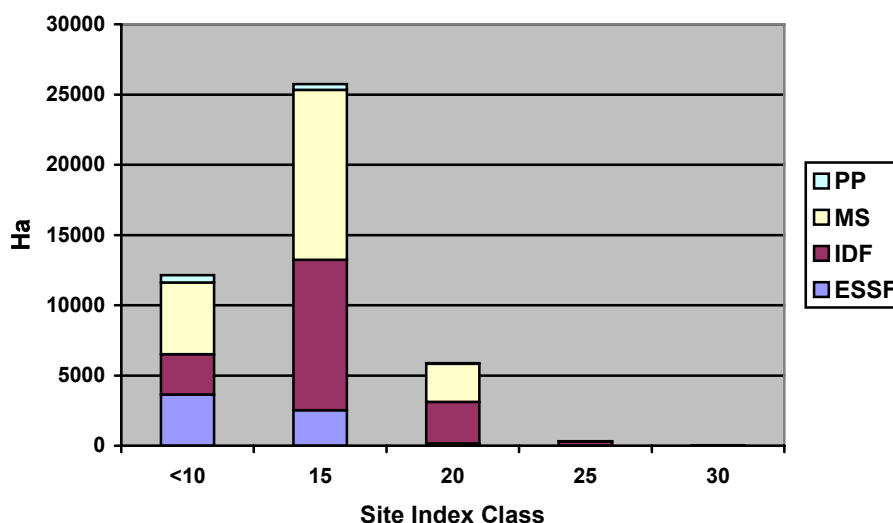


Figure 4. Site class by BEC zone from inventory files.

4.3 SILVICULTURE SYSTEMS

Clearcutting and clearcutting with reserves are the predominant silviculture systems in use on TFL 15. Selection systems are rarely used, mainly because of forest health issues. On the lower elevations, within the Mule Deer Winter Range as identified in the Okanagan Timber Harvesting Guidelines, clearcuts are generally limited to five hectares in size. A recent project (J.S. Thrower & Associates Ltd., 2000a) identified a dry-belt management unit on TFL 15 to focus future partial-cutting systems on stands which are best suited to this management regime.

In the future, strategies outlined in the Okanagan-Shuswap Land and Resource Management Plan will be implemented.

4.4 BASIC SILVICULTURE

Basic silviculture for TFL 15 follows the “Establishment to Free Growing Guidebook for the Kamloops Forest Region” except for lodgepole pine (PI). PI leading stands are managed with higher post-spacing densities as outlined in Table 28 of the Information Package as approved by the Penticton Forest District (JCM Soulmates, 1997). Broadleaf volume does not contribute to available merchantable volume but does contribute to biodiversity and wildlife habitat.

There is an aggressive approach to reforestation with good site preparation and prompt planting where appropriate. Natural regeneration or natural regeneration with minimum density planting is used on sites conducive to natural regeneration. An extensive post planting/regeneration monitoring system ensures quick discovery of problems. Prompt planning and remedial measures are undertaken to ensure that all sites are producing at or near their biological potential.

4.5 INCREMENTAL SILVICULTURE HISTORY ON TFL 15

Weyerhaeuser has carried out some juvenile spacing and pruning on PI stands on TFL 15 as summarized in Table 2. However, they feel that the objective of incremental projects should be to increase net merchantable MAI, increase product value or meet other resource values. Furthermore, historic spacing regimes have increased stand level hazard in lodgepole pine stands to lodgepole pine terminal weevil and resulted in lower wood quality.

Table 2. Summary of incremental projects, 1990 to present.

Treatment	Ha
Juvenile Spacing	1,882
Brushing	65.8
Pruning	344

4.6 TFL SUMMARY

TFL 15 is located in the south central portion of British Columbia on the height of land between the Okanagan and Kettle Valleys adjacent to OK Falls and Oliver. The total landbase is 48,448 hectares and covers five biogeoclimatic subzones over an elevation ranging from 500 to 2,200 m. The Timber Harvesting Land Base is just over 35,000 hectares or 72% of the total area of the TFL.

- Almost 12,000 hectares fall within a Wildlife Management Zone for mule deer winter range.
- An additional 2,766 hectares (outside the Wildlife Management Zone) are in a Landscape Management Zone, which is managed for visual quality objectives.
- Over 2,000 hectares are in Stocking Class 4 PI.
- Lodgepole pine is the leading species on over 59% of the area of the TFL.
- Over 11,000 hectares have been classified as dry-belt stands.

- Because of mountain pine beetle salvage harvesting, 24% of the THLB is in age class 1.
- Thirty percent of the THLB is in age class 4 and almost 85% of that age class is leading PI.

5. FOREST MANAGEMENT ISSUES

5.1 INDIVIDUAL ISSUE ANALYSIS

A key part of the Type 1 Silviculture Analysis is identifying and documenting issues and opportunities. The following information is primarily from the "Rationale for Allowable Cut Determination" for TFL 15, (Beedle, 1999) and from issues raised at the working session. Only information that is considered relevant to an incremental silviculture strategy is recorded.

Abbreviations: AAC-allowable annual cut; THLB – timber harvesting land base; IHL – initial harvest level; LTHL – long-term harvest level; CF – chief forester; TSR – timber supply review.

Fd- Douglas-fir, Bl – balsam fir, Se- Englemann Spruce, Py – ponderosa pine, Lw – Western Larch, Sx – Interior spruce, Sw – white spruce, PI – lodgepole pine, At – aspen, Ac – cottonwood, Ep – birch.

5.2 HARVEST FORECAST

Base Case B Total Harvest Volume by NDT/Biogeoclimatic Zone Variant
1998 WEYERHAEUSER CANADA TOTAL PROPERTY SIMULATION

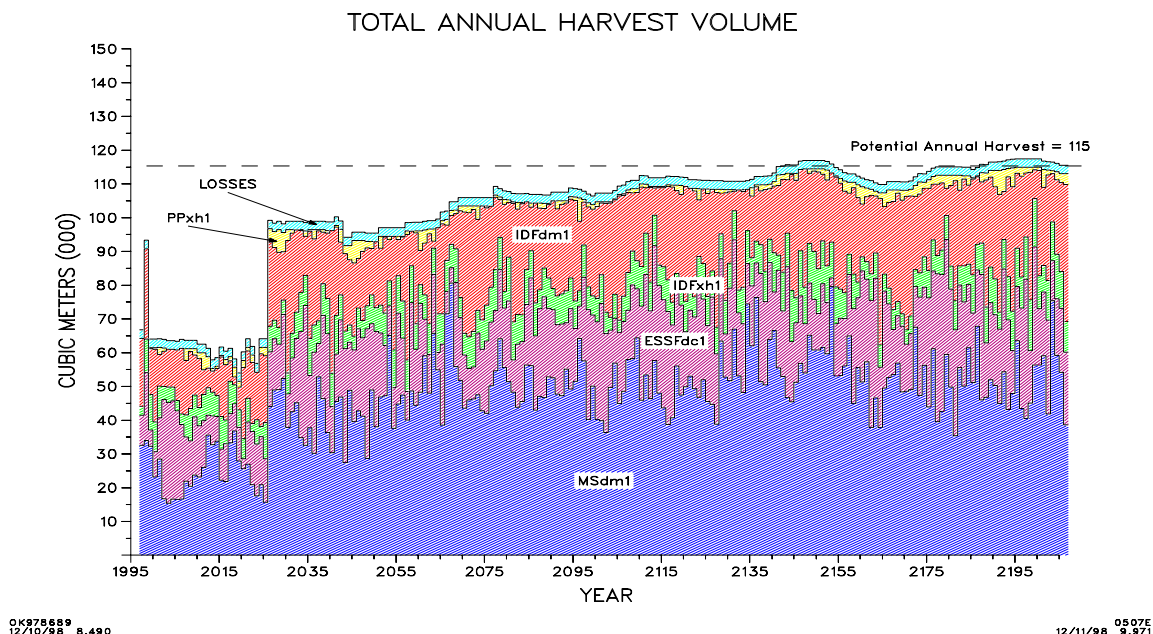


Figure 4. Projected annual harvest by subzone (from timber supply package, Dec. 14, 1998).

AAC Forecast	The AAC for TFL 15, as determined effective July 29, 1999 is 70,000 cubic metres, a reduction of 8,000 cubic metres from the previous AAC. This volume includes 3,594 cubic metres, which is administered under the Small Business Forest Enterprise Program. The base case (based on the application of biodiversity management guidelines outlined in the Biodiversity Guidebook) projects a short-term harvest level that varies from 51,000 to 62,000 cubic metres per year between 1998 and 2025. In 2026, the harvest level increases to 96,000 cubic metres per year followed by a further gradual increase to a long-term harvest level of approximately 115,000 cubic metres per year. Figure 4 shows the projected annual harvest by subzone.
Age Class	As shown in Figure 3, approximately 3% of the THLB are covered by stands more than 250 years old, 20% by stands between 140 and 250 years old, 46% by stands between 60 and 140 years and 30% by stands less than 60 years old. When Douglas-fir is excluded, the percentage of stands between ages 140 and 250 drops by 4% to 16% and the percentage of stands younger than 60 years increases by 5% to 35%.
Timber Harvesting Land Base	<p>Areas not suitable for harvest on TFL 15 are identified according to two sets of criterion: low site for immature stands or low merchantability based on age and height for mature stands. In MP8, only 32 hectares of low site immature stands were removed from the THLB. Approximately 4,650 hectares of mature stands that are physically inoperable were removed from the THLB. Now that TEM mapping has been completed, removals from the THLB must be rationalized to ensure that poor quality stands on good sites are not excluded from the THLB. There may be opportunities to rehabilitate some of these stands in the future.</p> <p>Stocking class 4 stands must also be reviewed in the context of the new TEM and site index information. Stocking class 4 stands on low sites should become PFT's but those on better sites should be given a high priority for rehabilitation.</p>
Harvest priority	Older pine stands are harvested first followed by the oldest stands of other leading species. Mid-term timber supply is very sensitive to minimum harvestable age – increasing minimum harvest age has a negative impact on timber supply beginning in decade two compared to the base case because relatively few stands are available for harvest.
Forest cover	A green-up height of three metres was used in the “General Management”, “Stocking Class 4” and “Wildlife Management” zones. At any time, no more than 30% of the productive land base may consist of stands of trees less than three metres tall. Timber supply is highly sensitive to changes in the maximum permitted percent disturbance. The existing distribution of harvested areas on the TFL limits the flexibility of future harvesting opportunities in the short- and medium-terms.

	<p>A forest landscape inventory identified 5,008 hectares of the THLB as visually sensitive. This included 1,946 hectares within a “Landscape Management Zone” as well as 3,062 hectares in the “Wildlife Management Zone”. Visually effective green-up was assumed to occur when stands achieve a height of 4.5 metres. Increasing the green-up height in the Landscape Management Zone from 4.5 to six metres had no impact on the base case harvest flow.</p> <p>Within the “Wildlife Management Zone”, it was assumed that the criteria applied in the analysis to account for wildlife would also accommodate VQO’s. Denudation remained significantly below the maximum permissible level in the modification VQO but above the permissible level in the partial retention VQO.</p>
Estimates of timber volumes	<p>A 1996 inventory audit suggests that coniferous volumes projected from the inventory file are overestimated by an average of 18% for stands older than 60 years. The medium-term timber supply is highly sensitive to decreases in existing stand volumes when compared to the base case harvest forecast.</p>
Site Quality Estimates	<p>New site index information is available which addresses concerns in the Rationale for AAC Determination. Long-term timber supply was sensitive to changes in site index determination compared to the base case.</p>
Regeneration	<p>The base case harvest forecast is very sensitive in the medium- and long-term to changes in regenerated stand yields. A total of 2,762 hectares were identified where stand regeneration would be difficult. One hundred percent of the area with severe regeneration problems and 60% of the area with moderate regeneration problems were excluded from the THLB.</p>
Douglas-fir Management	<p>A recent report (J.S. Thrower & Associates Ltd., 2000a) estimated that over 11,000 hectares of TFL 15 meet the definition of dry-belt. These stands are often complex in structure and support a wider range of users than other stand types. Little harvesting has occurred in these types in the recent past due to mountain pine beetle infestations at higher elevations and a reluctance to manage these stands under the “Correlated Guidelines” (Ministry of Forests, 1992). Management of these stands must consider their productivity, habitat requirements and forest health issues, which will have a great impact on future yields. Moving towards more even-aged management except on the driest sites will reduce forest health impacts and increase their growth potential.</p>
PI Stand Density and Wood Quality	<p>Weyerhaeuser believes that current spacing regimes will not be producing stands that meet Weyerhaeuser’s product objective of maximizing the output of MSR¹ 2x4 lumber. Concerns were expressed that current stocking spacing regimes will result in future stands with large branches, high taper and a high</p>

¹ Machine stress Rating (MSR) is a process of sorting lumber according to its structural value. Grading of MSR is similar to visual grading except that each piece of lumber produced is measured for its bending stiffness before it is visually inspected. Truly quality controlled, tested lumber is not available in visual grades.

	proportion of juvenile wood. It is unlikely that lumber produced from these stands will meet current MSR standards. Changing juvenile spacing targets had no significant impact on the base harvest forecast.
Wildlife Habitat	Many red- and blue-listed species occur on TFL 15, primarily because of the PP/Bunchgrass subzones, which occur there. Ingress of Py and Fdi on these sites reduces the value of habitat for California Bighorn sheep. Retention of aspen and Py snags is of primary importance for cavity nesting birds.
Forest Health	Almost all stands on TFL 15 are impacted by one or more forest health agents including dwarf mistletoes, root rots, western spruce budworm, Douglas-fir beetle, mountain pine beetle, <i>Comandra</i> blister rust, western gall rust, and lodgepole pine terminal weevil. In recognition of the diversity and impact of forest pests on TFL 15, a Forest Health Management Plan (FHMP, Hodge 2000) was completed in 1999. Supplementary material includes hazard maps for all major forest pests and a forest health tracking system. In addition, strategies and tactics have been developed (and approved by the District Manager) specifically for dwarf mistletoes. It is anticipated that forest health strategies and tactics, by leading species, will continue to be developed. These will complement those already outlined in the FHMP. All silviculture prescriptions and stand management plans must consider forest health issues in their development and implementation.
Mountain Pine Beetle	The area of stands susceptible to mountain pine beetle (MPB) is currently very low because the majority of these stands have been attacked by beetles and harvested over the past 20 years. However, looking at the age class distribution by species shown in Figure 3, there are approximately 8,700 hectares of leading PI stands in age class 4, which are currently considered low hazard. The susceptibility of these stands to MPB will increase with age and increasing basal area of PI in the stands. MPB populations often build at the warmer, lower elevations in the IDFdm1. Strategies to limit the component of PI in these stands may help to reduce this population buildup and may reduce future losses at higher, cooler elevations where PI is a larger component of the stands.

6. FIRST NATIONS ISSUES

TFL 15 is used by members of the Osoyoos Indian Band. At this time, an Archaeology Inventory Survey of the Inkaneep Creek, in the south part of the TFL, is underway. Results of this survey are not currently available but there are indications that some archaeological sites and trails will require some level of protection. The impact of this information on intensive silviculture is not known. Traditional Use Studies to identify other values have not been completed for TFL 15. Unfortunately, no one from First Nations was available to attend the Workshop. This document was circulated to the Indian Band but no comment was received.

7. ENVIRONMENTAL ISSUES

7.1 FISH

Natural and non-natural barriers to fish passage exist on TFL 15. Barriers including debris jams and beaver dams resulting from natural processes will not be managed. Non-natural fish barriers such as culverts are being addressed through the Watershed Restoration program. Salmon can currently access the lower reaches of Inkaneep and Vaseux Creeks. Weyerhaeuser is currently co-operating with the Inkaneep Watershed Advisory Committee to restore salmon access to Inkaneep Creek and to solve major sediment sources in that watershed. Weyerhaeuser has contributed funding to construct a major fish ladder on the lowest reach of Vaseux creek to restore fish passage. As well, the company continues to pursue FRBC eligible restoration of both these watersheds by 2003.

7.2 WATER

Watershed restoration activities have been occurring on TFL 15 since 1997. Road deactivation, hillslope stabilization and stream crossing removals have been addressing point sources of sediment since 1998. Vaseux and Inkaneep Creeks are key target watersheds.

7.3 WILDLIFE

Four issues were identified with respect to wildlife habitat:

1. Ingress of coniferous regeneration in the PP/Bunchgrass was identified as a major issue with respect to California Bighorn sheep populations.
2. Retention of snags and large older stems, particularly of cottonwood, western larch and ponderosa pine is a high priority for cavity nesting birds, several of which are red- or blue-listed. Douglas-fir and aspen stems are lower in rank but also of importance.
3. Variation in spacing regimes in PI stands would increase their value for habitat.
4. Mature cover requirements for shallow and moderate snow areas set by the LRMP will affect management regimes, particularly within the moderate snow areas (IDFdm1).

7.4 BIODIVERSITY

The requirements of the Okanagan Shuswap Land and Resource Management Plan (LRMP) will be met by the licensee. However, it is too early in the process to fully understand the impacts of this plan. The licensee will be examining ways of incorporating new directions within the time frames set in the transition section of the LRMP document.

Further details on the current issues regarding biodiversity are included in Appendix II.

8. SUMMARY OF FOREST ESTATE ISSUES BY PERIOD

8.1 SHORT-TERM (1 - 20 YEARS)

The short-term harvest levels within TFL 15 are mainly impacted by the 1996 inventory audit which suggests that coniferous volumes projected from the inventory files for stands older than age 60 may be overestimated by an average of 18%. The AAC was decreased by 8,000 cubic metres to 70,000 cubic metres effective July 29, 1999 to reflect these impacts. The current distribution of cutover areas also limits the flexibility of future harvesting opportunities in the short-term. Any increases in the allowable percentage of disturbance or a decreases in the green-up height will have positive impacts on the cut in the short- and medium-term. An increase in the minimum harvest age has minimal effect on the long-term harvest but results in severe timber shortages in the medium-term. Decreasing the minimum harvest age does smooth out the short-term harvest volume with minimal effect on the long-term harvest. An increase in the cut of age class 4 stands may help to relieve short-term harvest constraints.

8.2 MID-TERM (21 – 110 YEARS)

The medium-term harvest level is also restricted by the current distribution of cutover areas. One of the biggest issues however, is the inventory audit. The medium-term is very sensitive to decreases in existing stand volumes. Any increase in yield of regenerated stands would also have a positive impact during this period. The medium-term cut could be increased by more rapid harvest of age class 4 pine stands (>6,000 m³ hectares per year). This may not be possible however due to green-up constraints. Rehabilitation of roads, trails and landings would increase the THLB and would have positive impacts on harvest volumes in the medium-term.

8.3 LONG-TERM (111 + YEARS)

The long-term is highly sensitive to the site index and yields of regenerated stands, and the length of the green-up period. Rehabilitation of roads, trails and landings would have positive impacts on the long-term cut.

8.4 FUTURE

The Okanagan-Shuswap LRMP may have significant impacts on the future timber supply on TFL 15 but these impacts will not be known until the LRMP is fully implemented. The results of Archaeological Inventory Surveys and Assessments may also have some impact on future harvest levels.

9. HIGHER LEVEL GOALS AND OBJECTIVES

Over the past two years, FRBC has funded Type 1 Incremental Silviculture Strategies to cover all forested land in British Columbia. The objective of these strategies is to help analyze the impact of backlog and incremental silviculture investments on management objectives,

management unit conditions and operational constraints or objectives. They recognize that each management unit will require a unique combination of silviculture investments to achieve the maximum productivity of their second growth forests. The strategy developed through this process must meet the Provincial, Regional and Licensee goals and objectives outlined below. Key stewardship objectives developed at the workshop for each of the five major type groups identified for TFL 15 are included in Section 9.6.

9.1 PROVINCIAL GOALS²

Fundamentally, government's goals can be characterized as:

- sustainable use,
- community stability,
- strong forest sector.

9.2 PROVINCIAL OBJECTIVES

Until provincial targets for timber quantity and quality are established, management unit strategies are to consider the following interim provincial strategic objectives (MoF, 1998). Incremental silviculture strategies must also be in keeping with higher level plans under the Forest Practices Code.

- Objective 1: Maintain current harvest levels as long as possible without creating disruptive shortfalls in future timber supply.
- Objective 2: Create a long-term timber supply capable of supporting a steady long-term provincial harvest level similar to current levels.
- Objective 3: Minimize the interim shortfall in provincial harvest anticipated before a steady long-term timber supply is achieved.
- Objective 4: Create a long-term timber supply which will enable the timber quality profile of future harvest to be the same or better than the current profile.

It is recognized that not every management unit has the same capability to contribute to these interim objectives. Further, it is recognized that these objectives may not be attainable at current funding levels. Their purpose is to provide general guidance to the application of available funds.

9.3 REGIONAL OBJECTIVES

The objectives of the regional incremental silviculture strategy are to:

- Ensure a long-term sustainable harvest that approximates the current harvest value and volume levels and that produces a diversified mix of products necessary to create and maintain sustainable forest employment.

² Provincial and Regional Goals and Objectives are taken from the Strathcona Timber Supply Area Incremental Silviculture Strategy (Interim), Version 1.0.

- Balance treatments that enhance growth and yield with those that increase the value of the wood produced.
- Utilize incremental silviculture treatments to contribute to sustainable management of non-timber values at the landscape level.

9.4 OKANAGAN-SHUSWAP LAND AND RESOURCE MANAGEMENT PLAN

The Okanagan-Shuswap LRMP was accepted by the B.C. Legislature on January 18, 2001. Its implementation will have impacts on the management of TFL 15 but it is too early to document them at this point.

9.5 WEYERHAEUSER GOALS FOR TFL 15

One of the stated objectives of Weyerhaeuser is to maintain or increase the cut on TFL 15 over time without rapid and/or irregular fluctuations. The intent is to stabilize wood supply and employment.

9.6 KEY STEWARDSHIP OBJECTIVES

Objectives	Research Needs
PP/BG	
<ul style="list-style-type: none"> • Limited opportunities for harvest. • Calving area for California Bighorn sheep. • LRMP guidelines must be considered. • Snags are very important for cavity-nesting birds: Py and At snags were used more than Fdi snags. Ac snags and large trees are very high value where present. • All At should be retained, Fdi should be harvested over Py and older Py should be retained over younger trees. • There must be opportunities for regenerating At on some sites. 	<ul style="list-style-type: none"> • Stocking standards of 400 sph may be too high. • Distribution of stems is important - clumps of trees with open spaces between are important for sheep habitat. • Lower inter-tree distances may be appropriate
Dry-belt – Fdi leading	
<ul style="list-style-type: none"> • Forest health issues are paramount – budworm and mistletoe point to even-aged management (there are also pockets of root rot to consider). • Dry, steep slopes should contribute to wildlife values and should continue in uneven-aged management – there will be conflicts with forest health issues. • Lower slopes and wetter sites can support even-aged management. • LRMP guidelines: IDFdm1 (moderate snow pack) - 33% in mature cover within mule deer winter range; IDF xh 1,2, PP (shallow) – 15% in mature cover within mule deer winter range. • Promote mixed species wherever possible, keep PI as a smaller component or maintain high densities 	<ul style="list-style-type: none"> • Disturbance patterns should be used to help determine stocking standards and silviculture systems. • Manage stands within forest health issues. • Work is needed on how to model different silviculture systems in Fdi stands. • MoF would like to see more larch – tall, straight wood. • An age class map would show where some of the stands at the south end of the TFL fall. • The impacts of using some of these areas as wildlife areas to meet old seral retention need to be examined. • Continue work on the management protocol for dry-belt stands.

or manage on a shorter rotation (keep BA of PI below 30%)³.

- May be more opportunities for higher % of Fdi in northern portion of the TFL because of lower mistletoe intensities.

Dry-belt – mixed stands

- Particularly in the south end of the TFL, dwarf mistletoes in larch, PI and Fdi will dictate stand treatments - even-aged management should be a priority.
- Some of these stands may provide wildlife habitat instead of timber values.
- Promote mixed species wherever possible, keep PI as a smaller component or maintain high densities or manage on a shorter rotation (keep BA of PI below 30%) to minimize buildup of MPB populations.
- Aspen should be included as part of the mix.
- Problem forest types need to be mapped.
- What are the wildlife attributes and how can these stands be managed to meet them?
- Can there be a partitioned cut to meet wildlife habitat or can a strategy be developed for this?

MS – PI leading

- Maximize the probability of meeting product objectives in the most economic manner.
- Objective is to achieve 1,500 total stems/ha at harvest age.
- Shorter rotations to minimize future mountain pine beetle damage.
- Density is less of an issue on the wetter sites.
- Higher stocking (3,500 to 5,000 stems/ha) is valuable to address forest health issues.
- *Comandra* is present throughout the TFL, with higher impacts in the southern portion of the MS – species mix is a priority for reforestation, space when rust is sporulating and leave higher densities or do not space (these stands are generally left for natural regeneration); voids should be filled planted with an alternate species.
- PI dwarf mistletoe is widespread.
- Space fire-origin stands to avoid repression (not currently present on the TFL).
- Where no max density legal obligations exist, spacing of regenerated stands should take place only where wood quality is increased, and/or forest health hazards are reduced or wildlife values are enhanced.
- These stands and PI plantations currently offer the greatest potential for fertilization.
- Identify opportunities to harvest or rehabilitate PI stands currently outside the THLB that are classified as PFTs on productive sites.
- Identify stocking class 4 stands on low sites.
- Why is *Comandra* (DSC) heavier in a particular area (this area includes some of the IDFdm)?
- Does the impact of *Comandra* decrease with age and tree size?
- Continuation of work on density and branch size.
- Consistency of the strategy between planted and natural stands.
- Ingress patterns.
- Preliminary results from statistical analysis of pest incidence data, indicates increasing hazard to *Comandra* blister rust and lodgepole pine terminal weevil with decreasing stand density.
- Require further surveys to delineate *Comandra* “hot spots” and examine relationship between density and incidence/impact.
- Consider establishment of monitoring plots in young stands.
- Mountain beetle hazard over time – new basal area information from VRI should be incorporated if the attributes are appropriate.
- Dwarf mistletoe response to spacing in fire origin stands should be examined.
- Is there a height response to fertilization on higher density stands? Are there opportunities for fertilization on SI=13 stands without stocking control or at higher stocking? Can these stands be fertilized without compromising wood quality?
- Site index of PFTs should be compared to SI of existing stands – where poor quality stands occur on good sites, they should be targeted for

³ The warmer, lower elevations are often where MPB populations build. Reducing the component of PI, promoting mixed stands or managing PI so that it is harvested before it becomes susceptible may reduce the opportunity for this to occur.

<ul style="list-style-type: none"> To reduce the susceptibility of these stands to mountain pine beetle losses. 	<ul style="list-style-type: none"> rehabilitation. Need to identify stands currently designated as PFTs that may be economical to harvest. Stocking class 4 stands on low sites should be designated as PFTs. A small wood inventory is needed to explore the economics of harvesting repressed PI stands in the future. Investigate opportunities for two-pass harvesting in age class 4 stands to maintain green-up and leave vigorous stands which may be less susceptible to beetle damage
<p>High elevation</p> <ul style="list-style-type: none"> Very few forest health issues except for PI dwarf mistletoe, spruce beetle and western balsam bark beetle. Minimize BI because of low MSR value. Low value of BI for birds. BI leading stands will be converted to spruce leading. BI stands should not be spaced unless the treatment will add value to the stand. 	<ul style="list-style-type: none"> Spruce beetle hazard rating, present and over time is required.

10. OPPORTUNITIES TO INCREASE TIMBER SUPPLY

This section reviews the range of opportunities to increase timber supply on TFL 15. Many of these were identified in the Timber Supply Analysis document and additional opportunities were identified in the working session. A discussion of each issue is followed by comments on the potential opportunities that currently exist on TFL 15.

10.1 OPPORTUNITIES IDENTIFIED THROUGH TSR SENSITIVITY ANALYSES

For MP8, Weyerhaeuser undertook a significant number of timber supply analyses and sensitivity analyses. A summary of these has been added into the following section. Notations on the graphs (e.g. 3a, 3b) refer to specific analyses in the TFL 15 Timber Supply Analysis document (December 14, 1998).

10.1.1 Minimum Harvest Age

The minimum harvestable age for a particular stand of timber is an estimate of the time needed for the stand to grow to a specified volume. For this analysis the minimum harvest age was determined by specifying minimum harvest volumes for various sites and converting those volumes to ages. Minimum harvestable ages define when second growth will be available for harvest and thus determine how quickly stands may be harvested.

Reducing the minimum harvest age by 10 years (3a) has minimal effect on the long-term harvest volumes but does smooth out the short-term harvest volume a little with fewer smaller dips in volume availability. The total effect is masked by the short-term specified harvest in the General Management Zone.

Increasing the minimum harvest age by 10 years

(3b) has minimal effect on the long-term harvest level and significant impact on the short-term harvest levels with severe timber shortages occurring between 2017 and 2026. These effects are shown in Figure 5.

10.1.2 Green-up Periods

Green-up period refers to the estimated number of years required before the trees on a previously disturbed site reach a required height. This period also includes the delay between disturbance and commencement of growth. On TFL15, green-up heights range from 4.5 m in the landscape management zone to 3 m in the other zones. Green-up ages vary by species, site and analysis unit.

The harvest schedule is very sensitive to changes in the time to green-up. Increase of Green-up Period (9a) illustrates what happens to harvest volume over the planning horizon for the entire TFL when green-up periods are increased by five years. Harvest volume falls rapidly to

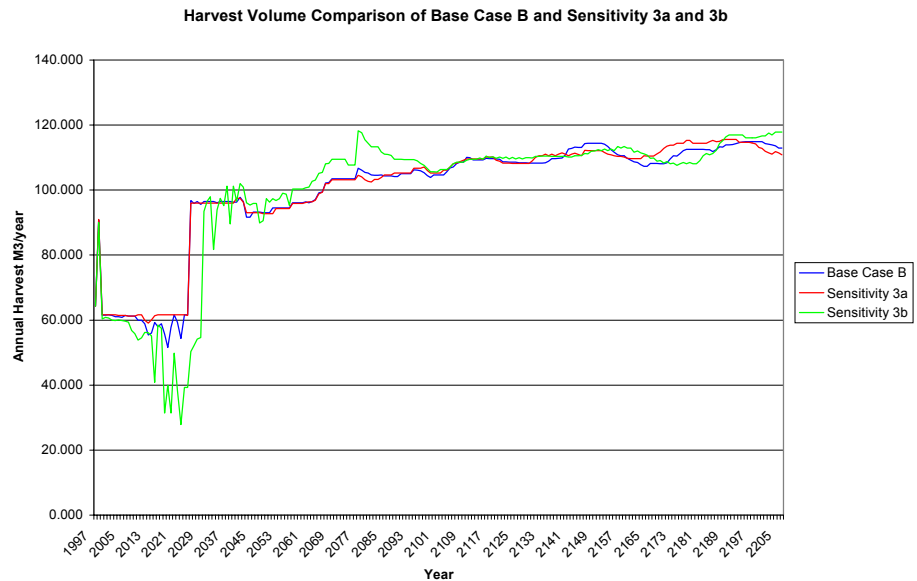


Figure 5. Sensitivity of harvest to minimum harvest age.

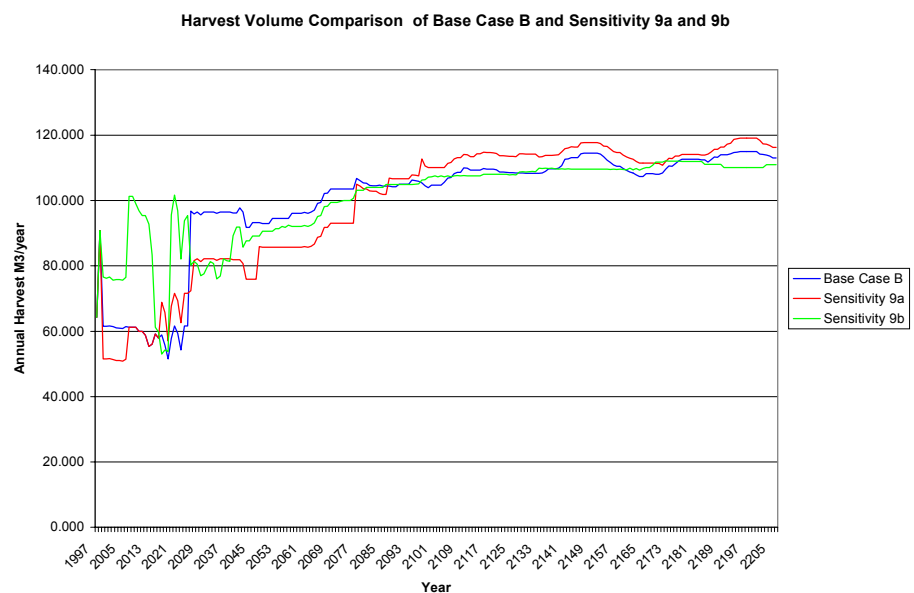


Figure 6. Sensitivity of harvest volumes to green-up age.

52 M m³+ in 1999 then rises in small jumps to 82 M m³ in 2027 before climbing slowly to the PAH by the end of the planning horizon.

Opportunities: Use of genetically improved seed is one of the only opportunities to decrease the time to green-up. Fertilization and spacing have little impact on height growth of PI, which is the major species for reforestation on TFL 15. Genetically improved seed will be used wherever possible and its use will focus on areas where future green-up is an issue. To date, just over 18,000 PI seedlings from genetically improved seed have been planted on TFL 15. There may also be some opportunities to use a two-pass harvesting system in age class 4 PI stands: the first pass would meet green-up requirements and would allow some removal of volume from stands that might not otherwise be available for harvest. This may help to alleviate some short-term restrictions to harvesting.

10.1.3 Site index opportunities

There has been substantial effort by industry and government in recent years to improve site index and yield estimates for post-harvest regenerated (PHR) stands with the goal of achieving more realistic timber supply modeling and forest-level planning.

A major component of the timber supply information is estimates of site index that adequately represents the expected growth of PHR stands. In the TFL area, like most areas in B.C., the site index estimates in the inventory under-estimate the expected growth of PHR stands for many of the areas and stand types.

J.S. Thrower & Associates Ltd. are completing a site index adjustment project for Weyerhaeuser. The project includes support from Bob Macdonald, *RPF*, and Albert Nussbaum, *RPF* from the Ministry of Forests.

The primary objective of this project is:

To develop reliable estimates of potential site index (PSI) for PHR stands for the major commercial tree species and ecosystems in TFL 15.

Opportunities: Preliminary results from Site Index Adjustment sampling on TFL 15 show an increase in SI for lodgepole pine in the IDFdm1 from 15.8 to 19.2 and in the MSdm1 from 14.5 to 19.0 (based on average field site index; this does not represent adjusted potential site index). An interim report was completed for March 31, 2001 and these results will be used with other inventory and silviculture information to generate managed stand yield tables (MSYTs) for application in the timber supply analysis for the TFL.

10.2 PRELIMINARY IDENTIFICATION OF SILVICULTURE OPPORTUNITIES

The key to enhancing the yield of regenerated stands is to capture as much as possible of the potential productivity of each site. Basic silviculture practices deserve most of the credit for

impressive gains already achieved through reduced regeneration delay and enhanced site occupancy. The opportunities for further increases are somewhat limited because site resources are essentially fixed (Ministry of Forests, 1999a). We can add to the pool of site resources with fertilization or improving plantation growth rates by using improved stock. We can also effectively increase yields by reducing losses to pests and by avoiding treatments that can impair site occupancy.

10.2.1 Fertilization

The Fertilization Option looks at the impact of fertilizing select stands on TFL 15. For this option the selected stands are 50% of the PI leading stands. At this point in time only PI leading stands were selected for fertilization although other stands may also benefit from fertilization.

There is an ongoing “Optimum Nutrition” research project located on TFL 15 (UBC – Dr. G.F. Weetman) which has

shown interesting results in early fertilization of

lodgepole pine. However, the figures for growth increases from fertilization are not based on specific measurements from operational trials on TFL 15.

After looking at the literature available on the growth response of PI to fertilizer and discussions with MoF staff, a very conservative estimate of 10 % was selected to model the impact of applying fertilizer to PI leading stands at ages 25, 35, 45 and 55. This results in a modeled 10% increase in merchantable volume at age 65. Two sensitivity analyses were completed for this option. Sensitivity 1a looks at a 5% increase, to 15%, in merchantable volume, while Sensitivity 1b looks at a 5% decrease.

For modeling purposes all PI leading stands are used and one half of the total gain selected is applied to all stands (for the Fertilization Option this means that $0.5 * 10 \% = 5 \%$).

Opportunities: Opportunities for fertilization on TFL 15 occur mainly in age class 1 and 2 leading PI stands within the MS subzone. The latest inventory information shows 3,086 hectares of stands with $\geq 80\%$ PI in age class 1 in the MS subzone and an additional 408

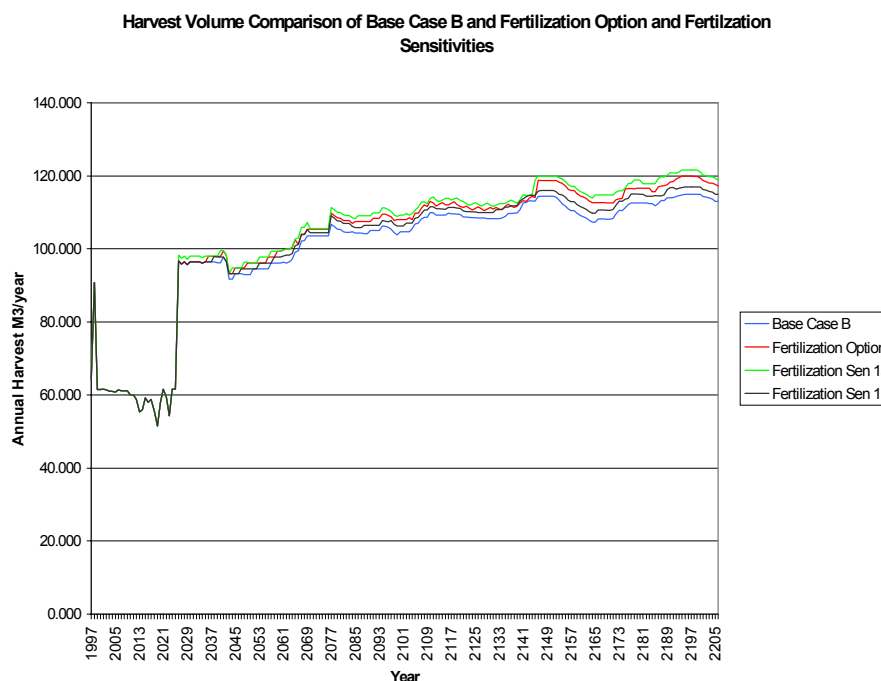


Figure 7. Sensitivity of harvest volumes to fertilization.

hectares in age class 2. Further work would be necessary to identify the densities of these stands and their suitability for fertilization. There may be some opportunities in age class 4 leading PI stands if these stands have no forest health issues that would be exacerbated by fertilization, the stems have good live crowns and densities are less than 2,000 stems/ha. There are over 9,000 hectares of age class 4 PI leading of which 4,993 hectares with $\geq 80\%$ PI occur in the MS subzone. None of the age class 4 PI stands are in stocking class 4. Stands that have been spaced and pruned would be given the highest priority for fertilization. Where access permits, hand fertilization may be considered in place of aerial treatments. Opportunities for fertilizing in western larch and Douglas-fir should also be investigated.

10.2.2 Genetic Gains

Planting of harvested sites

is to be done with

genetically improved seed wherever possible.

Genetically improved seed is available for some areas and species and more is coming on line in the near future but there is some uncertainty as to the exact gains to be obtained and what coverage will be available with the improved seed. To

examine the effects of this uncertainty the genetic gain is held steady at 5% while the amount of area

planted with improved seed is increased (8a) and decreased by 10% (8b). In the modeling process genetic gain is applied to all planted PI and Sx on a prorated basis to simulate the application of a specific gain to a portion of the planted stands.

Opportunities: The estimated annual planting program on TFL 15 is 434,000 seedlings, 75% of which is PI. Production of low elevation seed from the Tree Improvement Program (13% of annual requirements) has started and orchards are expected to be in full production by 2007. Current orchards provide 54% of the anticipated seed requirements for the planning zone and TFLs are given first priority for orchard seed. Production of high elevation PI seed is anticipated to start in the near future and existing orchards will provide 57% of the total seed requirements for the planning zone. Gains are estimated at 12% for the low elevation orchards and 12.5% for

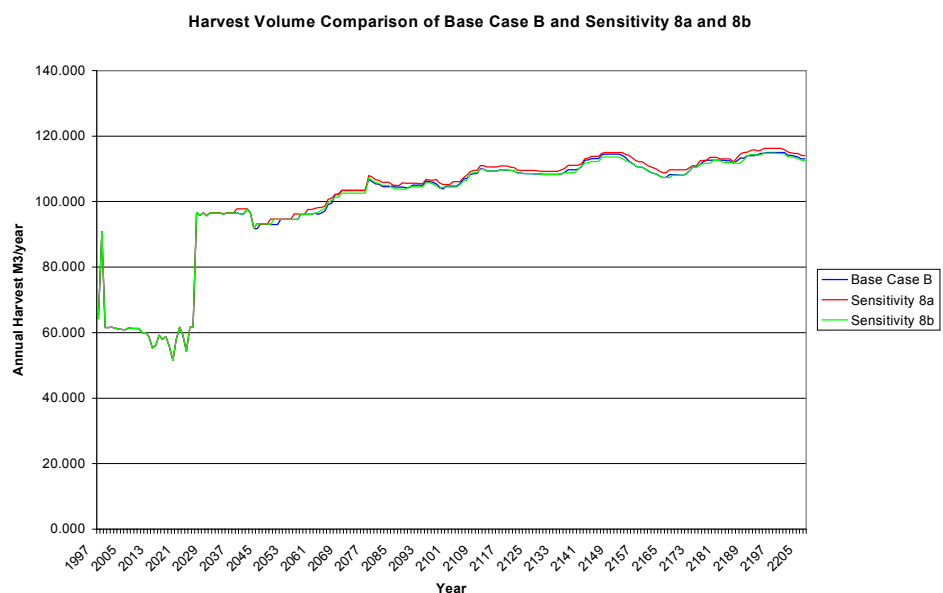


Figure 8. Sensitivity of harvest volume to genetic gains.

the high elevation orchards. The estimated increase for spruce (67,000 seedlings per year) is 12% and for larch (28,000 seedlings per year) is 70%.

10.2.3 Commercial Thinning Option

In the Timber Supply Information Package, a Commercial Thinning option was proposed subject to completion of the work needed to model the option. Currently we do not have the tools to model this option effectively so the option has not been modeled for this analysis.

Weyerhaeuser OK Falls has helped with the establishment of two Commercial Thinning Trials near Princeton, BC (J.S. Thrower & Associates Ltd., 1997). These plots were established in 1997 and re-measurements have not taken place yet.

Opportunities: Further work is required to determine what types of stands on TFL 15 may be suitable for commercial thinning, particularly with respect to forest health issues such as dwarf mistletoe.

10.2.4 Beetle-proofing

Leading PI stands in age class 4 occupy over 9,100 hectares or 35% of the area of leading PI stands in the TFL. In the future, these stands may become a huge target for mountain pine beetle.

Opportunities: There may be considerable opportunity on TFL 15 to carry out two-pass harvesting in these age class 4 PI stands. This would allow some removal of volume while meeting green-up requirements and may also reduce future losses to mountain pine beetle by producing more vigorous stands.

10.2.5 Juvenile Spacing

Many of the stands harvested on TFL 15 are PI leading that regenerate to PI after harvesting to densities that may exceed 20,000 or 30,000 stems/ha and higher. Ministry of Forests policy states that these areas must be spaced by the licensee to a much lower target density where they contain more than 10,000 countable trees/ha at time of free growing. The target density for spacing was set by the MoF and is generally about 1,200-1,800/ha in the OK Falls area. A higher target density of 2,400/ha has recently been approved for all of Weyerhaeuser's operating area in the Penticton District (J.S. Thrower & Associates Ltd., 2000c.) Figure 9 shows that changes in the target spacing to 3,000 stems/ha (17a), 2,500 stems/ha (17b) and 2,000 stems/ha (17c) have almost no impact on the harvest volume.

Weyerhaeuser's goals for spacing in the summer of 2000 were to reduce the density of treated stands to:

- Grow trees with high quality logs and high quality wood fiber, and not to degrade stands by growing trees with undesirable characteristics such as high taper, large knots, or high juvenile wood content.
- Avoid the potential negative impacts of height-growth repression.
- Leave enough trees on site to buffer against unforeseen mortality from insects, disease, or climatic damage.
- Increase the diversity in treated stands by varying spatial distribution more than is achieved under current guidelines.
- Provide a variety of densities across landscape to promote biodiversity.

These goals will be met by developing an interim prescription that:

- Uses the most recent growth & yield information.
- Focuses on biological principles and research.
- Focuses on growing the highest quality wood at the lowest cost.
- Considers the economic impacts of spacing.

A juvenile spacing trial was established in Grant Creek (J.S. Thrower & Associates Ltd., 1999a). The objective of this project was to provide data to compare growth and yield differences between the spacing regime currently approved by the MoF (2,400 /ha) and a regime of leaving a higher residual density (3,500/ha) considered by Weyerhaeuser to grow better quality wood for future products.

Opportunities: Current silviculture records show approximately 870 hectares with >60% PI with over 10,000 stems/ha. All of these stands are under age 20 but over 635 hectares of these have maximum density obligations. These numbers show very limited opportunities for spacing within PI stands in TFL 15 unless there are fire-origin stands in the future that meet the

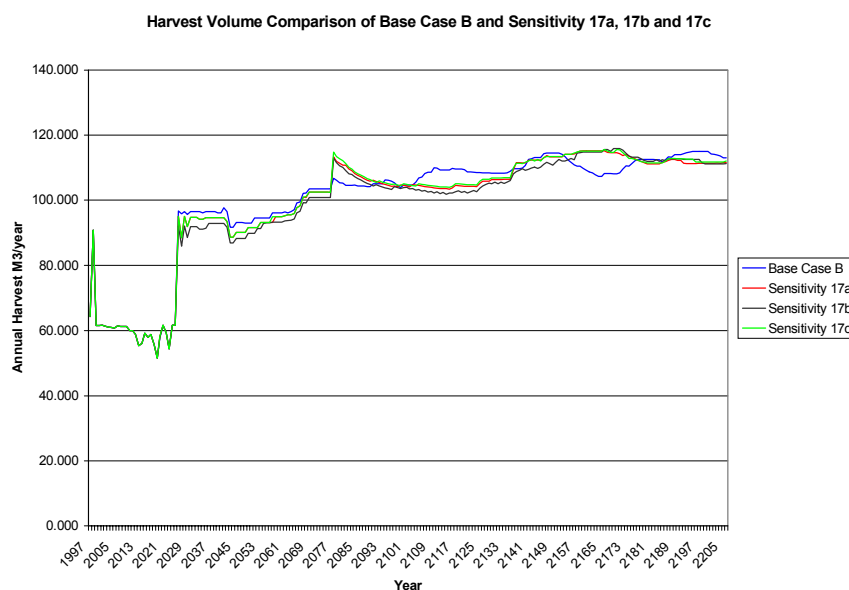


Figure 9. Sensitivity of harvest volume to changes in target spacing.

specifications. Spacing will be considered where stands are at risk of repression, to meet other forest resource objectives or to meet product objectives.

Table 3. Area of Immature Stands with >60% PI by Density and Age class.

Density Class (SPH)	Hectares by Age class			Total
	0-20	20-40	>40	
<250	21.7		112.8	134.5
250-750	108.6	53.8		162.4
750-1,250	189.2		2.8	192.0
1,250-1,750	605.4			605.4
1,750-2,750	2,210.0		48.8	2,258.8
2,750-5,250	2,096.1	50.2		2,146.3
5,250-10,250	1,721.4	111.8	78.7	1,911.9
10,250-20,250	803.5			803.5
>20,250	67.0			67.0
<i>Total:</i>	<i>7,822.9</i>	<i>215.8</i>	<i>243.1</i>	<i>8,281.8</i>

10.2.6 NSR

Current NSR is approximately 2,028 hectares, which is considerably higher than would be anticipated based on the current annual area harvested. This is due to a temporary increase in cut in 1992 to 1994 to harvest mountain pine beetle infested stands but this number will drop significantly once surveys confirm restocking.

Backlog NSR is less than 128 hectares and will be reduced to zero within the term of MP8. These areas were surveyed in 2000 and most of the areas are stocked.

Opportunities: There are very limited opportunities to increase the harvest levels on TFL 15 through backlog reforestation. However, if any stands currently classified as Problem Forest Types (PFTs) are on productive sites, they should be given a priority for rehabilitation.

10.3 OPPORTUNITIES IDENTIFIED IN WORKING SESSION

10.3.1 *Alternative approaches to Douglas-fir management*

Weyerhaeuser has taken a proactive approach to addressing the Ministry of Forests' goal of planning a variety of silviculture systems across the Penticton Forest District. Within TFL 15 a dry-belt management unit has been defined to focus partial-cutting systems on stands which are best suited to this management regime. Weyerhaeuser plans to develop a strategic planning tool that can handle the combinations of species and sites within the dry-belt unit.

The Dry-belt Douglas-fir Management Protocol (J.S. Thrower & Associates Ltd., 1999b) developed for Merritt is currently available and can be applied to the dry-belt unit in TFL15 to assist in silviculture planning. The protocol was originally developed for stand-level planning, but the Terrestrial Ecosystem Mapping (TEM) now available for TFL 15 may allow the protocol to be applied at a landscape level. A small test was performed to illustrate the differences in

stand classification possible through intensive photo typing (as recommended by the current protocol process) and by using the current inventory and TEM information for TFL 15 (J.S. Thrower & Associates Ltd., 2000a). The expectation of this type of management is that there is probably an opportunity to increase the amount of wood recovered per hectare in the long-term based upon higher MAIs in more even-aged stand structures.

Opportunity: Approximately

11,060 hectares of dry-belt stands were identified on TFL 15. Of this area, approximately 13% is excluded from the THLB for low site index⁴ or as a problem forest type⁵ (Table 4). An additional

Table 4. Dry-belt summary.

Total Dry-belt area	11,062 ha
Site index <=8.4	Outside THLB 1,193 ha
Age >=121, Ht <=19.4 m	Problem 277 ha
	Forest Type
Net land base	9,592 ha

3,486 hectares have site indices between 8.4 and 14.0, which would be a low priority for management. The distribution of dry-belt by subzone and the distribution of xeric and subxeric sites where partial cutting systems may be best suited from a silviculture viewpoint is shown in Table 5. Although Douglas-fir is the leading species on 55% of these stands, Py or PI are the leading species on 32% of the stands and Lw is the leading species on 10% of the stands. This shows many opportunities to create mixed stands on these sites following harvest or through stand tending projects.

Forest health issues, visual quality objectives, habitat issues, First Nations and other IRM objectives will also have to be addressed in the management of any dry-belt stands.

Table 5. Subzone and species distribution of dry-belt stands.

Distribution of Productive Sites (ha)	PPxh1	IDFxh1	IDFdm1	MSdm1	Total
Total area in dry-belt:	710	4,552	4,195	135	9,592
Area on xeric or subxeric sites ⁶	69	560	462	82	1,173
Distribution of Non-productive Sites (ha)					
PFT or outside THLB:	589	645	226	10	1,470
Species composition:	Fd	PI	Lw	Py	
Leading species:	5,359	1,519	955	1,535	9,368
Leading species > 80% of volume:	2,212	788	182	941	4,123

⁴ Site index less than or equal to 8.4.

⁵ Non PI leading types >=age 121 and <=19.4 m height.

⁶ Based on TEM mapping.

10.3.2 Rehabilitation of Stocking Class 4

Approximately 2,023 hectares of stocking class 4 PI stands occur on TFL 15. The base case assumes that 1,436 hectares of this type will be converted over the next 45 years. More rapid conversion of these stands does increase the timber supply in the medium-term compared to the base case.

Opportunity: Adjacency concerns may preclude this increase. The age class distribution of the stocking class 4 stands is as follows: 55% age class 5, 22% age class 6, 1.3% age class 7, 0.8% age class 8 and 0.2%

age class 9. With the new TEM and site index information, these stands can also be ranked on potential site index. Low site stocking class 4 stands should be reclassified as problem forest types. The economic value of these stands must also be evaluated and considered in determining their harvest potential.

10.3.3 Roads and landings

In the timber supply analysis, an option was examined to rehabilitate 50% of all landings and 5% of all roads built prior to 1997 to 100% of pre-construction productivity. As rehabilitation efforts will target the better sites, these areas are regenerated to the average site index of the two highest site index analysis units for each growth type/analysis unit combination.

This treatment provides no short-term impact on harvest volume. The harvest volume rate is identical to Base Case B until about 2042.

Opportunities: There are approximately 361 hectares of landings where rehabilitation could take place.

10.4 FOREST HEALTH AND SILVICULTURE

The workshop included a presentation on forest health by Janice Hodge, of JCH Forest Pest Management, who has carried out extensive ground surveys to determine the incidence and

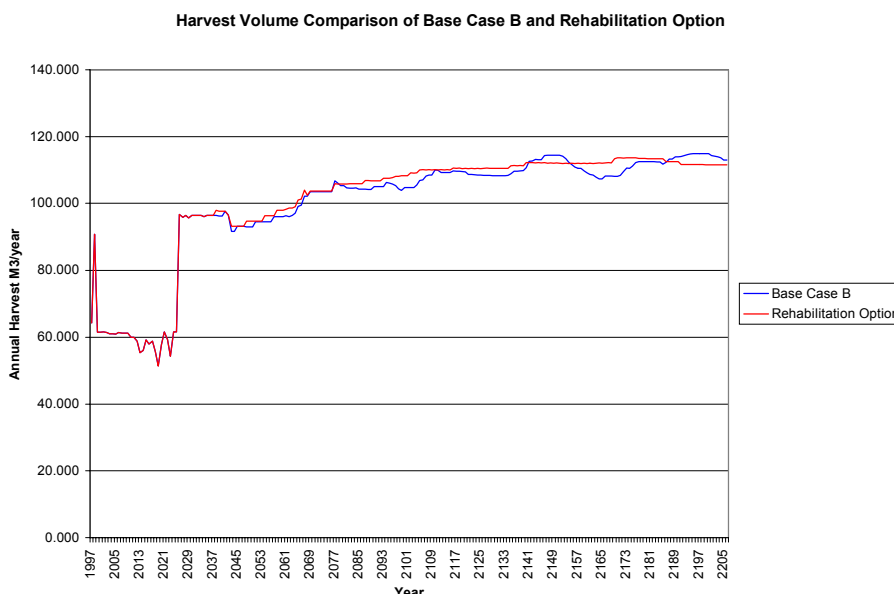


Figure 10. Sensitivity of harvest volumes to rehabilitation of roads and landings.

severity of forest pests. Statistical analysis of this data has provided insight into the dynamics of these pests and defined relationships between stand attributes and anticipated hazard. A Forest Health Management Plan, an overview summary by biogeoclimatic variant, hazard maps and a forest health tracking system are available. A copy of Janice Hodge's presentation from the workshop is included in Appendix III.

Weyerhaeuser has three objectives with respect to forest health issues on TFL 15:

1. To maintain a standing inventory of mature, standing, live trees to satisfy the inventory needs of Weyerhaeuser Company Limited, Okanagan Falls Division;
2. To minimize unsalvaged losses by addressing forest health problems in an environmentally sound and timely fashion; and,
3. To regenerate and tend young stands so as to achieve optimum productivity and diversity goals while maintaining healthy and productive stands through to rotation.

A short summary of the main forest health issues is given here. Further information is available in the "Forest Health Management Plan" for TFL 15 (Hodge, 2000).

10.4.1 Bark Beetles

The hazard and associated impact of mountain pine beetle is less in mixed-species stands than it is in pure pine stands. Creating age and species mosaics and access planning will help to reduce beetle impacts in the long-term.

For existing pine stands, research has demonstrated that the susceptibility to mountain pine beetle can be lessened by reducing stand density (Cochrane *et al.*, 1994; Mitchell *et al.*, 1983). It is not clear that density management alone will preserve pure pine stands in a major outbreak. Commercial thinning of older stands is currently viewed as a short-term tactic that will help delay rather than prevent beetle attack. Given the widespread incidence of lodgepole pine dwarf mistletoe, any gains derived from commercial thinning must incorporate the volume losses associated with increased dwarf mistletoe severity.

10.4.2 Spruce Budworm

The stand structures that will be most affected by spruce budworm are those that have susceptible species in both the upper and lower strata (multi-layered stands). For example, in stands where Douglas-fir dominates several strata, prolonged infestations will decimate the lower stratum, particularly those stems less than 7.5 cm in diameter and those ≥ 1.3 m in height. The potential impact of spruce budworm can be lessened by silvicultural practices in two ways. The first is promoting the establishment of mixed-species stands. The second is to prescribe fewer applications of silvicultural systems that lead to relatively pure and vertically stratified stands of Douglas-fir—i.e., single-tree selection and the uniform shelterwoods with substantial overstory.

High hazard Douglas-fir stands resulting from selective logging and fire exclusion are common on TFL 15.

10.4.3 Root Diseases

The potential impacts of *Armillaria* and *Phellinus* can also be reduced by promoting the establishment and development of mixed-species stands. Some silvicultural treatments, such as brushing, juvenile spacing and commercial thinning, can increase root disease risk in stands where root disease is present. Current silviculture guidelines discourage treatments in stands with obvious symptoms of root disease, but many low-level infections are difficult to diagnose. A prudent approach is to minimize post-establishment interventions in ecosystems in which *Phellinus* and *Armillaria* are prominent. Recent statistical analysis of pest incidence surveys indicates that landscape level hazard to *Phellinus* and *Armillaria* is low, with the exception of moderate hazard in Douglas-fir leading stands the IDFdm1.

10.4.4 Dwarf Mistletoes

Weyerhaeuser has developed a dwarf mistletoe management strategy that has been approved by the Ministry of Forests. Implementation of this strategy will help to reduce future impacts of mistletoes on the TFL. Key points are:

- Dwarf mistletoe has increased in both incidence and intensity across the landscape in the absence of fire.
- Dwarf mistletoe is a significant component of this ecosystem and may require acceptance at free growing.
- Tactics to reduce the risk to regenerating stands will include favouring non-host species during silvicultural treatments, girdling or removing leave trees within 10 years of harvest, removal of residuals and promoting a mix of species where silviculturally appropriate.
- Careful consideration will be given to silviculture system, site preparation methods and cut block designs to minimize the risk.

10.4.5 Comandra Blister Rust

Recent forest health surveys on TFL 15 have identified the presence of *Comandra* in 62% of young PI stands. It is more widespread in the MS but has greater impact in the IDFdm. Infections ranged from 1 to 36% of total stems and infections occurred over all stand densities. However, high-density stands do provide a buffer against future mortality. The risk of new infections decreases substantially after age 15. Recommendations for managing stands with the risk of *Comandra* infection include increasing target stocking, using alternate or mixed species, particularly in the IDFdm and favouring non-host species during stand treatments. Further work is also required to delineate *Comandra* “hot spots” and to determine losses in relation to tree size and stand density.

10.5 TIMING OF THESE OPPORTUNITIES

10.5.1 Short-term (1-20 years)

- Increasing the rate of cut in stocking class 4 stands increases the short-term cut but results in a decrease in mid-term cut. Long-term cut is the same regardless of the rate of cut in these stands.
- Juvenile spacing will have no effect on volume.

10.5.2 Mid-term (21-110 yrs)

- Site index work that shows higher site indices than indicated in the current FIP files will have a significant positive effect on mid- and long-term harvest levels.
- Fertilization has positive impacts on available harvest volumes in the mid- and long-term.
- Conversion of Fdi stands from multi-layered to even-aged would have the same impact as an increase in site index. This would have a positive impact on mid- and long-term harvest volumes.
- Rehabilitation of roads and landings has a small positive impact on the mid- and long-term harvest volumes.
- Any work that reduces the impacts of forest health on tree growth will have positive impacts in the mid- and long-term.

10.5.3 Long-term (111 + yrs)

- Site index work shows that higher site indices than indicated in the current FIP files will have a significant effect on mid- and long-term harvest levels.
- Planting of genetically improved stock has positive impacts on the long-term harvest volume.

10.6 AVAILABLE INFORMATION REGARDING POTENTIAL TREATMENTS AND TREATABLE AREA

Comment	Stand Characteristics
Juvenile Spacing	
<ul style="list-style-type: none"> • Fire-origin stands with potential repression should be spaced. • Discussions are on going with the MoF regarding stocking standards. 	<ul style="list-style-type: none"> • Leading PI stands with densities > approx. 20,000 stems/ha. • Stands past free growing age so that crown lift has started.
Fertilization	
<ul style="list-style-type: none"> • Opportunities for hand fertilization for employment opportunities. • Late age class 1 and age class 2 stands, particularly those that have been spaced offer the best opportunities. • Opportunities in older stands will depend on stand vigour, density and disease issues. • Fertilizing in stands with dwarf mistletoe will 	<ul style="list-style-type: none"> • Age class 1 and 2 stands, leading PI, in the MS subzone with density control. • Age class 4 stands with good crown length, moderate stocking and low disease impacts. • Methods of using fertilization to minimize time to green-up should be addressed.

exacerbate the problem.	
Commercial Thinning	
<ul style="list-style-type: none"> Is there enough crown to have any response? Few stands may be economical for the treatment – have to take out large stems to pay for the treatment and then the response is low. Watch for mistletoes. 	<ul style="list-style-type: none"> Age class 4 or 5 stands with densities < 2,000 stems/ha, good live crown, no dwarf mistletoe.
Rehabilitation	
<ul style="list-style-type: none"> Impacts from rehabilitation of roads and landings are long-term. More important under stewardship than from a timber supply viewpoint. May be opportunities to rehabilitate stands currently classed as PFTs that are on productive forestland. 	<ul style="list-style-type: none"> There are currently about 361 hectares of landings. Repressed PI leading stands that are uneconomical to harvest.
Backlog NSR	
<ul style="list-style-type: none"> Will be completed within MP8. 	
Tree Improvement	
<ul style="list-style-type: none"> By 2010 improved PI seed will be available with an estimated increase in volume of 15.7%. There is little planting of Sx or Lw. There is no improved Fdi seed for this area. Will there be a benefit to planting areas which would normally be left for natural regeneration? 	<ul style="list-style-type: none"> TFLs get first priority for improved seed when it is available.
Fdi spacing	
<ul style="list-style-type: none"> Need to be addressed from a forest health point of view – longer rotations and dwarf mistletoe will create problems. What is the current stand structure? What are the sites? Distribution of low productivity sites. 	<ul style="list-style-type: none"> Douglas-fir stands with an established understory and low dwarf mistletoe infestations. SI > 14.

10.7 SUMMARY OF COMMENTS FROM SESSION SPEAKERS ON VOLUME IMPACTS

10.7.1 Dr. Ken Mitchell, RPF, Stand Modelling Research Leader, Ministry of Forests, Victoria

In the 1970's, the stage was set for large juvenile spacing projects. Spacing was strongly promoted for two main reasons: it was widely practiced in Europe, New Zealand and other countries, and the Wind River Trials in the Pacific Northwest showed increased height growth, volume and piece size of Douglas-fir with wide espacements. In the 1980's, Section 88 allowed for an increase in AAC if current treatments elevated future harvest volumes. Combined with government funding of spacing projects, the economics were very favourable for this treatment.

There was very little data available with respect to volume response but the Forest Productivity Council estimated that an extra 10 to 15% could be anticipated. Alan Vyse and the Research Branch confirmed that high establishment densities in naturally regenerated lodgepole pine did result in reduced height growth and dramatic volume reductions. However, data from MacMillan Bloedel on the Coast discouraged them from continuing spacing on their private lands. At the 1976 Juvenile Spacing Workshop in Nanaimo, Dave Handley stated "I am now doubtful if we will get any increase in merchantable yield." The Ministry's biologically oriented growth and yield models usually predicted a reduction in volume in spaced stands.

Why was juvenile spacing so popular in other countries? In New Zealand, Radiata pine of poor form had been introduced and unacceptable trees had to be removed to upgrade quality. They are now moving away from spacing. Historically, in Europe, there was such a high demand for wood that a program of frequent, light, low thinning was warranted. Windthrow was also a problem and thinning was done to increase stand stability. Recently, economics have changed.

Responses at Wind River turned out to be neither extensive nor representative. Section 88 is gone, the Allowable Cut Effect may still be a benefit but the industry is responsible for the majority of the costs. However, research done by Mike Carlson and Wayne Johnstone at Barnes Creek show that spacing is a concern in lodgepole pine at stand densities in excess of 15,000 stems/ha of similar age and height. High densities on dry sites may also be problematic.

Are there benefits to juvenile spacing if it is not likely to increase volume in most stands? Spacing does increase average diameter but not forever. Looking at the entire population of trees, in many cases, spacing just removes the smaller trees. In effect, we are trading small trees for larger ones with little change in volume per hectare. However, if we favour uniformity over retention of the largest trees at the time of spacing, we will reduce the volume per hectare and lose the benefits of spacing entirely.

Product quality is not improved by spacing: spaced stems have a larger core of juvenile wood, lower wood density and decreased lumber strength.

Sound density management prescriptions must consider biological, economic and forest-level effects. "Guidelines for Developing Stand Density Management Regimes" (Ministry of Forests, 1999a) provides a decision making process for making site specific density management prescriptions.

10.7.2 Rob Brockley, RPF, Research Silviculture, Forest Productivity, Kalamalka

- Within TFL 15, lodgepole pine offers the greatest potential for fertilization at this time. There is virtually no fertilization response information available for Fdi within the IDF BEC zone, nor is there much information available for Lw within the IDF or MS.
- MS subzone will provide the best fertilizer response – responses are generally higher in this subzone than in drier subzones. In the MSdm2 subzone (which is not present on TFL 15), it may be necessary to combine N with S to maximize growth responses.
- Fertilization may ameliorate harvest flows in the mid- to short-term.
- The greatest potential for using fertilization within TFL 15 appears to be within late age class 1 and age class 2 stands, particularly within those stands that have had density control. By undertaking early stand density control to maintain healthy stands with good live crown ratios, we are creating many future opportunities for mid and late rotation fertilization. Plantations would also meet the requirements for fertilization.⁷
- The opportunities for fertilizing older lodgepole pine stands may be scarce because of unfavourable stand structures generally associated with older stands (e.g., poor live crowns, stem disease). However, older stands have been shown to respond well following fertilization in cases where stand structure is favourable.
- Research results indicate that height gains for lodgepole pine following fertilization are generally small relative to increases in radial increment, especially at wider spacings (e.g., <1,100 st/ha).
- At higher densities, some of the benefits of fertilization may be lost to mortality.
- There appears to be a fairly low risk to squirrel damage unless it was evident prior to the treatment. The majority of damaged stands appear to be of fire origin.
- Because of the modest potential for height response, there is apparently not much potential for fertilizing young lodgepole pine stands in order to minimize the time to green-up.

10.7.3 Dr. Tom Sullivan, Applied Mammal Research Institute, Summerland, Brian Harris, RPBio, Habitat Protection Officer, Penticton Forest District

- There is a strong fertilization effect with respect to cattle: they prefer fertilized areas. This may be useful to move cattle out of riparian areas.
- Forest health conditions were evaluated after 10 years on densities of 500, 1,000, 2,000 and unthinned stands of PI – there were no significant differences among stands in the incidence of terminal weevil, western gall rust or squirrel damage.
- MELP would like to see some variety in stocking levels – both high stocking (thickets) and low stocking.
- Preferably, distribution of different densities would be of fairly significant areas (a whole block rather than portions of several blocks).

⁷ Personal communication, Rob Brockley, April 6, 2001.

10.7.4 Dr. Mike Carlson, Research Scientist, Interior Tree Breeding, Kalamalka

- First generation of PI orchards are based on volume only but second generation orchards will include some quality attributes (density and branching characteristics)
- Second generation seed will be available by 2030 for Thompson Okanagan (low) and Nelson (low) but there are no plans for a second-generation orchard for Thompson Okanagan (high).
- Estimates of volume gain are summarized in Table 6.

Table 6. Availability and gain estimates for lodgepole pine in TO and NE seed planning zones.

	2010 (mm*/%Gain)	2020 (mm/%Gain)	2030 (mm/%Gain)
TO Low (6.3 mm annual req.)	3.4/10.3 1.5/15.7		
1 st Generation:	4.9/12.0	6.3/15.7	
2 nd Generation:	---		6.3/24.0
TO High (6.5 mm annual req.)	1.0/11.0 2.7/13.0		
1 st Generation:	3.7/12.5	6.5/13.0	6.5/13.0
2 nd Generation:	No breeding underway or planned		
NE low (5.1 mm annual req.)	3.4/1.07 1.7/16.0		
1 st Generation:	5.1/12.5	5.1/16.0	

*- million potential seedlings

10.7.5 Alan Vyse, RPF, Research Forester and Group Leader, Kamloops Forest Region

- There is a great deal of research work now being conducted in dry Douglas-fir stands in the Southern Interior. However, most of the research is long-term and has only recently been established. Preliminary results from B.C. studies can be used to guide management decisions.
- Current stand structures in dry-belt Douglas-fir stands are a very poor guide to how these stands should be managed – many of the multi-aged, multi-sized stands are ideal environments for root disease and defoliating insects.
- Many types of cutting practices are possible in these dry stand types when accompanied by artificial regeneration. Natural regeneration of PI is usually not a problem but successful natural regeneration of Fdi may be a problem in the south of the province. Defoliators, seed predators and drought all appear to inhibit Fdi regeneration success on a regular basis.
- Patch cuts or shelterwoods should be applied on a wider basis and a mix of species should be used.
- Regeneration of aspen/conifer mixes is easily achieved and should be considered in prescriptions.

10.7.6 Janice Hodge, Forest Health Consultant, JCH Forest Pest Management

- TFL 15 is unique in the combination of forest health agents present.
- Modification of existing structures of Douglas-fir stands, promotion of species and age class mosaics, higher densities in young lodgepole pine stands, and a move towards even-aged stands are necessary strategies to reduce losses to forest health agents.
- SMP's and SP's must include an assessment of forest health hazards and risk.

10.8 POTENTIAL STRATEGIES BY RESPONSE TIME FRAME

Response Time Frame	Potential Strategy Action	Discussion/Current Status	Anticipated Result	Harv Forecast(000 x m3/yr)
Short-term (1-20 yrs.)	<i>The primary challenge in the short-term is to shorten time to green-up where possible.</i>			
	<ul style="list-style-type: none">Commercial thinning.	Will investigate opportunities to remove volume from age class 4 PI stands.	Volume recovery from stands not yet merchantable, may fill in short-term gaps in available volume, may be opportunities in green-up issues.	
	<ul style="list-style-type: none">Use of genetically improved seed.	Improved seed will be used when available.	Decreased time too green-up, increased growth. Improved seed for Sx and Lw is available now but little is planted. PI improved seed for low elevation (13% or 43 k trees/year) available by 2008; seed for high elevation (87% or 274 k trees/year) available after 2010.	
Short-term summary			SUMMARY OF INCREASES	
Mid-term (21-110 yrs.)	<i>Harvest levels are severely restricted in the mid-term until 2025 when the annual harvest volume increases from 65 M m³ to over 100 M m³. There are minor fluctuations beyond that point with the potential annual harvest increasing over the remainder of the mid-term to approximately 110 M m³. The mid-term harvest level is restricted mainly to meet landscape level biodiversity goals.</i>			
	<ul style="list-style-type: none">Conversion of Fdi stands from uneven-aged to even-aged with a mix of species and stand structures.	This will involve a change in management strategy.	Increased growth reduced losses from dwarf mistletoes, spruce budworm.	
	<ul style="list-style-type: none">Site index adjustmentFertilization.	Project underway. The effects of fertilization on branch diameters and taper must be examined.	Increase in SI on PI stands. Increased growth of 1-2 m ³ /ha/year over a 6-year response period.	
	<ul style="list-style-type: none">Road and Landing rehabilitation.Rehab of current repressed PI stands on productive sites.	Target better sites. Use TEM to determine if any stands classified as PFTs. warrant rehab work.	Potential increase in THLB.	
	<ul style="list-style-type: none">Planting of improved stock.	As above.	As above.	

Mid-term Summary

Long-term (111 + yrs.)	<i>The harvest levels in the long-term are not restricted and show a gradual increase to approximately 112,000 m³ over the planning period. The long-term objectives for TFL 15 are to minimize losses to damaging agents through the use of management techniques that promote healthy stands and to maintain or increase the yield from regenerated stands. Increases from intensive silviculture will also help to offset any decreases from implementation of the LRMP.</i>		
• Planting of genetically improved PI stock.	Low elevation seed needs (34% of projected PI planting) will not be met by orchards until after 2008. High elevation seed needs (66% of projected PI planting) will not be met by orchards until after 2010. No 2 nd generation breeding for quality is planned for high elevation orchards.	Increased yield from planted PI stands.	
• Maintain PI stands at high densities (objective 1,500 total stems/ha at rotation).	Wood quality is most important objective.	Maintain high-density wood, low juvenile wood core, small branches and encourage branch mortality.	
• Conversion of dry-belt stands to even-aged with mixed species and low % of PI, sanitation spacing to remove trees of poor form and vigour.	Reduce losses to damaging agents, reduce build-up of MPB at lower elevations.	Reduce volume lost to damaging agents, increase stem quality. Potential through regeneration of mixed stands to decrease the build-up of MPB at lower elevations and reduce long-term losses in MS subzone.	
• Landing rehab and rehab of repressed PI stands on productive sites.	Use TEM to determine if any stands classified as PFTs warrant rehab work.	Potential increase in THLB.	

Long-term Summary

11. OPPORTUNITIES TO IMPROVE TIMBER QUALITY

One of the objectives of the Type 1 Silviculture Analysis to examine the type of future products we expect to grow on the TFL and understand how the objectives may impact the silviculture programs for the TFL.

11.1 INTRODUCTION

This issue has been discussed a number of times in the past, including a workshop on November 3, 1999, that looked at “Density Management Consequences For Wood Products” and had representatives of Weyerhaeuser Company Limited, MoF Penticton District, and MoF Forest Practices Branch. The workshop involved a mill tour, a field tour and discussion of the importance of wood quality to the Okanagan Falls Division of Weyerhaeuser. Although this meeting did not resolve any issues it did help to focus on-going work.

11.2 PRODUCT OBJECTIVES

Weyerhaeuser:

Okanagan Falls Division of Weyerhaeuser is focused on producing high quality lodgepole pine MSR 2x3 and 2x4s. This requires knots less than 7/8” in diameter, low juvenile wood percentage and high wood density. At present, Fdi, Lw and Py are shipped to Kamloops for processing. The main market is Home Depot and the product objective is appearance grade 2x4, 2x6 and studs. Future products will not be from large trees – Weyerhaeuser is in the market to produce high quality, engineered wood products.

Ministry Objectives:

The Licensee sets the objectives and the strategy must be consistent with them.

Premium log concept:

- Premium product for TFL 15 is a PI MSR product.
- Premium product for Fdi and larch is not size.

11.3 AVAILABLE INFORMATION REGARDING POTENTIAL TREATMENTS AND TREATABLE AREA

Treatment	Potential Treatment Regimes Effect on Wood Quality	Stand Characteristics
Spacing	<ul style="list-style-type: none"> • Spacing will increase knot size, the amount of juvenile wood and forest health hazards. • Spacing will decrease wood density. 	<ul style="list-style-type: none"> • Space fire origin stands or stands with similar ingress patterns where initial densities are very high.
Sanitation Spacing in Fdi	<ul style="list-style-type: none"> • Spacing in Fdi stands should be focused on retaining healthy, superior phenotypes. 	<ul style="list-style-type: none"> • Spacing to follow harvesting of overstory stems.

	<ul style="list-style-type: none"> • Move to even-aged stands would reduce defects from dwarf mistletoes and spruce budworm. 	
Commercial thinning	<ul style="list-style-type: none"> • This treatment may be used in age class 4 PI stands. 	<ul style="list-style-type: none"> • Free of mistletoe. • Harvest must be economical.
Pruning	<ul style="list-style-type: none"> • There may be opportunities for pruning PI stands that have already been spaced to increase product value. Knot sizes must not exceed grading standards prior to pruning. 	<ul style="list-style-type: none"> • Previously spaced stands with densities < 1,200 stems/ha. • Approx. 950 ha with 250-1,750 sph; some may already have been pruned.
Prune/ Fertilize	<ul style="list-style-type: none"> • Once stands have been spaced and pruned, fertilization may increase volume and reduce rotations with minimal negative effects on quality. 	<ul style="list-style-type: none"> • Spaced and pruned stands over age 20 – 344 ha have been pruned to date.
Tree Improvement	<ul style="list-style-type: none"> • 2nd generation low elevation orchards will be selected for branch size and wood density. • Approximately 34% of PI planted on TFL 15 is low elevation, approximately 122k per year. 	<ul style="list-style-type: none"> • All areas to be planted as seed is available.

11.4 SUMMARY OF COMMENTS FROM SESSION SPEAKERS ON LOG QUALITY

11.4.1 Dr. Ken Mitchell

Spacing has a negative impact on product quality – it creates a larger core of juvenile wood and decreases wood density and lumber strength.

11.4.2 Rob Brockley

Results from thinning and espacement research indicate there is a negative relationship between stand density and branch size. We presently have little data, but fertilization will likely exacerbate this relationship. As such, fertilization (especially repeated fertilization) of widely spaced stands may potentially have a negative effect on wood quality.

11.4.3 Dr. Mike Carlson

Second generation PI orchards for low elevation will be selected with quality considerations including branching characteristics and wood density. There are no plans for second generation orchards for high elevation PI.

11.4.4 Janice Hodge

Any reduction in the incidence of damaging agents will improve wood quality, particularly stem form.

11.5 POTENTIAL STRATEGIES BY RESPONSE TIME FRAME

The following strategies have potential to increase timber quality. These were identified in the district working session. The response time frame is the period in which the anticipated result is expected, not the period in which actions must necessarily commence.

Table 7. Potential strategies by response time frame.

Response Time Frame	Potential Strategy/Action	Discussion/Current Status	Anticipated Result
Short-term (1-20 yrs.)	<ul style="list-style-type: none"> • None 	<ul style="list-style-type: none"> • Current harvest is from stands that will not be treated. 	
Mid-term (21-160 yrs.)	<ul style="list-style-type: none"> • Reduce spacing in PI stands. • Prune already spaced stands. • Fertilization. • Genetically improved stock. 	<ul style="list-style-type: none"> • 2nd generation orchards for low elevation PI will be selected for wood quality attributes. 	<ul style="list-style-type: none"> • Increase in product value (MSR rated lumber). • Increase value due to smaller knot sizes. • Decreased value due to lower wood density, higher taper. • Increased value because of smaller branches and higher wood density. • Reduced losses to forest pests.
Long-term (161+yrs.)	<ul style="list-style-type: none"> • As above 		

12. FIRST NATIONS ISSUES

The Osoyoos Band was unable to attend the workshop and provided no response to the draft document.

13. OPPORTUNITIES TO IMPROVE WILDLIFE HABITAT

13.1 EXISTING INFORMATION

Approximately 4,510 hectares of TFL 15 have moderate wildlife values, based on the current ESA inventory. None of this area was removed from the THLB to specifically account for wildlife values. A "Wildlife Management Zone" covering 11,989 hectares was modeled as mule deer

winter range. Management constraints within this zone must follow the recommendations recently approved in the Okanagan-Shuswap LRMP.

Approximately 600 hectares for stream riparian reserve zones and 56 hectares for lakes and wetlands were excluded from the THLB. A 25% volume retention was assumed for all stream classes except for S6 streams where a 5% retention was assumed. An equivalent of 322 hectares was deducted for riparian management zones for streams and 175 hectares for lakes and wetlands.

13.2 RED- AND BLUE-LISTED⁸ TERRESTRIAL VERTEBRATES POTENTIALLY PRESENT ON TFL 15

TFL 15 includes portions of 7 biogeoclimatic subzones as shown in Figure 1 and Figure 2. These include the BGxh1 (a very small portion of the study area), ESSFdc1, ESSFdcp1, ESSFdcu0, IDFdm1, IDFxh1, MSdm1 (which makes up almost half of the study area), and the PPxh1. The Conservation Data Centre lists 10 red-listed and 17 blue-listed that have been recorded within TFL 15 (Table 13 in Appendix IV). Most of these species are found in the drier zones (BG, IDF, PP), while few are found in the ESSF and MS.

13.3 RARE ECOSYSTEMS

The Conservation Data Center also collects information on rare and endangered vascular plants, vertebrate animals and plant communities in B.C. Rarity ranks are determined based on the following quantitative and qualitative criteria: number of element occurrences, range, trend, protected status, threats and fragility. Rare plant associations found on TFL 15 are summarized in Table 14 in Appendix IV.

13.4 ASPEN MANAGEMENT STRATEGIES FOR TFL 15

Aspen plays an important role in TFL 15, particularly for cavity nesting birds, habitat for small mammals and a food source for deer. It is also very important for biodiversity in a landscape where it is relatively rare.

Weyerhaeuser is in the process of finalizing an aspen management strategy for TFL 15 (J.S. Thrower & Associates Ltd., 2000b). The licensee determined that it would be more efficient to develop a strategy for managing aspen on the TFL as a whole rather than dealing with each block individually. The inventory for TFL 15 identifies approximately 309 hectares of broadleaf-leading stands. The licensee excluded approximately 6,756 cubic metres of broadleaf volume to account for broadleaf trees occurring in predominately coniferous stands.

⁸ Red list – Includes any indigenous species or subspecies (taxa) considered to be extirpated, endangered or threatened in British Columbia. Blue list – Includes any indigenous species or subspecies (taxa) considered to be vulnerable in British Columbia. (B.C. Conservation Data Center).

When the aspen strategy is approved, it will be incorporated into MP9 and the recommendations that impact intensive silviculture practices will be implemented.

13.5 KEY MANAGEMENT SPECIES

The key species that may be impacted by intensive silviculture on TFL 15 include California Bighorn sheep, cavity nesting birds and mule deer. Further work is required to identify the key wildlife species in a proposed wildlife management unit (see next Section).

13.6 HABITAT OBJECTIVES (QUANTITY AND QUALITY)

Based on the issues identified at the working session, the following habitat objectives have been set for TFL 15:

- To reduce the amount of ingress on PP/BG sites and increase the value of these areas as range for California Bighorn sheep.
- To ensure that snags and decadent stems are retained wherever possible. In order of importance for wildlife, these species should be retained: cottonwood, western larch, ponderosa pine, Douglas-fir and aspen.
- To provide more variety in spacing regimes – to manage some areas to very low densities and others to very high densities to provide the maximum range in habitat.
- To provide mature cover requirements for mule deer winter range as outlined in the Okanagan Shuswap LRMP.
- To map problem forest types with the intention of managing a portion of the southern end of the TFL as a wildlife emphasis unit.

13.7 COMMENTS FROM SESSION PRESENTATIONS

13.7.1 Dr. Tom Sullivan

- Heavy thinning in young stands can accelerate old-growth attributes including diameter growth, crown volume, herbaceous vegetation, multi-layered stand structure, total structural diversity, species richness and diversity of small mammals.
- Fertilization of young PI stands significantly stimulated growth of herb and shrub vegetation. Both deer and moose appear to use there fertilized habitats in both summer and winter. This may have considerable relevance to evaluation of winter range in different aged forest stands.

13.7.2 Brian Harris

- A study from the Rock Ovens area near Naramata shows the importance of aspen and ponderosa pine snags or living decadent aspen for cavity nesting birds.
- Conifer encroachment onto grasslands or ingress within open forest stands increase predation of California Bighorn sheep. Prescribed burning on sheep winter ranges can increase forage and decrease coniferous stocking along key movement corridors.

13.8 OPPORTUNITIES TO IMPROVE HABITAT QUALITY/QUANTITY

The effects of incremental silviculture on the future quality/quantity of wildlife habitat were not analyzed explicitly in the MP8 Timber Supply Analysis. The issue was discussed during the working session. As with timber quantity/quality, it is possible that many of the silviculture opportunities identified impact on habitat availability. As part of the characterization of these opportunities, each treatment was assessed with respect to its probable impact on habitat. These assessments are summarized in the following table.

Table 8. Available information regarding potential treatments and impact on habitat.

Treatment	Impact on old Growth	Impact on Deer Winter Range	Impact on Bighorn Sheep	Impact on Cavity nesting birds
Juvenile spacing	+	0	0	0
Fertilization	+	+	+	0
Commercial Thinning	+	+	+	0
Conversion of Dry-belt stands to even-aged	-	-	-	0
Tree Improvement	0	0	0	0
Pruning	0	+	+	0

+ = positive, 0 = neutral, - = negative.

13.9 STRATEGIES/PRIORITIES

Identification of key species and habitat Requirements:	Comments:
<ul style="list-style-type: none"> Key species in the dry, southern end of the TFL must be identified. Their habitat requirements must be determined before a strategy can be developed to enhance the habitat. 	
Habitat enhancement <ul style="list-style-type: none"> Planting <u>Ceanothus</u> was not cost effective because it is needed on such a large scale. Forest ingrowth is a serious problem on the California Bighorn sheep range. 	<ul style="list-style-type: none"> Areas adjacent to grasslands where Py and Fdi are encroaching.
Underburning <ul style="list-style-type: none"> Many public issues with burning. Would be of value for wildlife habitat – ceanothus requires heat to germinate. Knapweed control would have to be implemented in conjunction with burns. Slashing of understory Py one year prior to burning would be required. 	<ul style="list-style-type: none"> Brian Harris is to provide a map of high value sheep range. Studies must be implemented prior to burning to look at important attributes for other species and how they would be impacted by burning.

Potential Habitat Strategies by Response Time Frame

Response Time Frame	Potential Strategy/Action	Discussion / Current Status	Anticipated Result
♦ Immediate			
	<ul style="list-style-type: none"> Juvenile spacing 	<ul style="list-style-type: none"> Provide a wider range of densities with some stands at low densities and some at very high densities. Heavy thinning in young stands can accelerate old-growth attributes. Provide some thickets and openings within spacing projects. 	<ul style="list-style-type: none"> More variation in habitats produced. Old-growth attributes can be provided by younger stands.
	<ul style="list-style-type: none"> Retain snags wherever possible. 	<ul style="list-style-type: none"> Py and At snags are of higher value than other species. 	<ul style="list-style-type: none"> Maintenance of habitat for cavity nesting birds.
♦ Short-term - (1 – 20 yrs)			
	<ul style="list-style-type: none"> Identify key wildlife species and habitat requirements, particularly in southern portion of TFL. 	<ul style="list-style-type: none"> Stands cannot be managed to produce habitat attributes until they are clearly identified. 	<ul style="list-style-type: none"> Once attributes are defined, management activities can be planned to maintain or enhance them.
	<ul style="list-style-type: none"> Fertilization 	<ul style="list-style-type: none"> Stimulated growth of herb and shrub layers. 	<ul style="list-style-type: none"> May increase value of winter ranges
	<ul style="list-style-type: none"> Habitat Enhancement 	<ul style="list-style-type: none"> Spacing standards to increase the value of California Bighorn Sheep range should be developed for the PP/BG and IDFxh subzones. Other projects may be proposed once key wildlife species and their habitat attributes are clearly defined. 	<ul style="list-style-type: none"> Reduced perdition in the sheep population.
♦ Mid-term - (21–80 yrs)			
♦ Long-term - (81+ yrs)			

14. INCREMENTAL SILVICULTURE STRATEGY

This section synthesizes the preceding background information and analysis into an incremental silviculture strategy for the TFL.

14.1 STRATEGIES TO INCREASE THE QUANTITY OF FUTURE TIMBER SUPPLY

The following strategies have the potential to increase the quantity of the timber supply of TFL 15:

- Plant genetically improved stock wherever it is available.
- Fertilize spaced and pruned PI stands at approximately 10-year intervals.
- Move to even-aged management of dry-belt stands to reduce impacts of damaging agents and to increase their yield.
- Establish mixed stands in the IDF subzones to reduce the potential build up of mountain pine beetle populations.
- Consideration of forest health issues in all treatments to reduce future losses.
- Space fire origin PI stands where establishment densities are in excess of 20,000 stems/ha.

14.2 STRATEGIES TO INCREASE THE QUALITY OF FUTURE TIMBER SUPPLY

The following strategies have the potential to increase the quality of the timber supply of TFL 15:

- Prune stands that have been juvenile spaced to reduce branch sizes and decrease the juvenile wood core.
- Sanitation space dry-belt stands to remove trees of poor form.
- Use second generation improved PI seed when it is available.

14.3 STRATEGIES TO INCREASE THE QUANTITY OR QUALITY OF FUTURE HABITAT SUPPLY

The following strategies may have the potential to increase the quantity and/or quality of habitat supply of TFL 15:

- Retention of snags and decadent stems of cottonwood, Western larch, ponderosa pine, Douglas-fir and aspen in all treatments.
- Variation in spacing and planting densities to provide some blocks with low densities and others with high densities.
- Underburning in winter ranges of California Bighorn sheep to improve forage and reduce predation.
- Evaluate habitat values and site productivity on the southern end of the TFL to define opportunities to enhance habitat.
- Map Old Growth Management Areas to meet LRMP requirements to maintain old growth attributes across the land base.

14.3.1 Incremental Silviculture Program

The following table indicates the silviculture treatments that meet the strategy determined for TFL 15.

Table 9. Silviculture Opportunities and Priorities.

Treatment	Opportunity Ha/yr	Timber Supply			Quality	OG	Habitat		Direct Silv. Jobs	Direct Cost \$/ha	Priority
		Short	Mid	Long			Riparian	Wildlife			
<u>Surveys</u>	1,500 ha	+	+	+	0	0	0	0	0.05 days/ha	\$20	High
<u>Pruning</u>	100 ha/year	0	0	0	+	0	0	+	5 days/ha	\$1,200	High
<ul style="list-style-type: none"> Pli stands previously spaced Pli plantations 	~960 ha with less than 1,750 stems/ha; some may already been pruned										
<u>Fertilization</u>	100 ha/year	0	+	+	-	+	0	+	0.8 days/ha	\$375	Moderate
<ul style="list-style-type: none"> Pli stands spaced and pruned Pli plantations Trial required for other species Fertilization should be by hand 	344 ha pruned, 1,882 spaced under intensive; Approx. 2,350 ha planted to Pli since 1987										
<u>Even-aged mgmt of Fdi</u>	100 ha/year	0	+	+	+	0	0	0	2 days/ha	\$800	High
<ul style="list-style-type: none"> Sanitation cutting, improvement cutting, rehabilitation 	Work is required to identify opportunities in dry-belt stands										

<u>Rehabilitation of repressed PI Stands</u>	25 ha/year	0	+	+	+	0	0	+	5 days/ha	\$2,000	Moderate
<ul style="list-style-type: none"> Appropriate methods need to be determined 	A small wood inventory is necessary to locate these stands										
<u>Habitat Enhancement</u>	10 ha/year	0	0	0	0	0	0	+	5 days/ha	\$2,000	Moderate
<ul style="list-style-type: none"> Potential projects may include underburning or spacing 											
<u>Forest Health Projects</u>		0	+	+	0	0	0	0			High
<ul style="list-style-type: none"> Consistent with Forest Health Mgmt Plan 											
<u>Landing Rehabilitation</u>		0	+	+	0	0	0	+			Moderate
<ul style="list-style-type: none"> To meet ECA and increase THLB 	361 ha of landings										
<u>Spacing of fire-origin PI stands</u>		0	+	+	0	0	0	+			High
<ul style="list-style-type: none"> Very limited opportunities, will be funded as required 											

14.3.2 Incremental Silviculture Program

The following annual program will contribute to achieving the above goals and strategies.

Table 10. Program table - hectares treated, TFL 15, May 2001.

Year	Surveys	Pruning	Fertilization	Even-aged D-fir mgmt	Rehab of repressed PI	Habitat Enhancement	Forest Health	Landing Rehab	Total:
1	1,500	100	100		25	10			1,735
2	1,500	100	100		25	10			1,735
3	1,500	100	100	100	25	10			1,835
4	1,500	100	100	100	25	10			1,835
5	1,500	100	100	100	25	10			1,835
<i>Subtotal 1-5</i>	<i>7,500</i>	<i>500</i>	<i>500</i>	<i>300</i>	<i>125</i>	<i>50</i>			<i>8,975</i>
6-10	7,500	500	500	500	125	50			9,175
<i>Total 1-10</i>	<i>15,000</i>	<i>1,000</i>	<i>1,000</i>	<i>800</i>	<i>250</i>	<i>100</i>			<i>18,150</i>
<i>Unit cost (\$/ha)</i>	<i>\$20</i>	<i>\$1,200</i>	<i>\$375</i>	<i>\$800</i>	<i>\$2,000</i>	<i>\$2,000</i>			

Table 11. Program table \$ 000s, TFL 15, May 2001.

Year	Surveys	Pruning	Fertilization	Even-aged D-fir mgmt	Rehab of repressed PI	Habitat Enhancement	Forest Health	Landing Rehab	Total:
1	30	120	37.5		50	20	50	15	322.5
2	30	120	37.5		50	20	50	15	322.5
3	30	120	37.5	80	50	20	50	15	402.5
4	30	120	37.5	80	50	20	50	15	402.5
5	30	120	37.5	80	50	20	50	15	402.5
<i>Subtotal 1-5</i>	<i>150</i>	<i>600</i>	<i>187.5</i>	<i>240</i>	<i>250</i>	<i>100</i>	<i>250</i>	<i>75</i>	<i>1,852.5</i>
6-10	150	600	187.5	400	250	100	125	75	1,887.5
<i>Total 1-10</i>	<i>300</i>	<i>1,200</i>	<i>375</i>	<i>640</i>	<i>500</i>	<i>200</i>	<i>375</i>	<i>150</i>	<i>3,740</i>

14.3.3 Job Outcomes

The following are the anticipated job outcomes associated with the preceding program, assuming the program is maintained into the future as necessary to achieve the working targets.

Table 12. Program table – short-term job outcomes: TFL 15, May 2001 (man-years)

Year	Surveys	Pruning	Fertilization	Even-aged D-fir mgmt	Rehab of repressed PI	Habitat Enhancement	Forest Health	Landing Rehab	Total:
1	0.34	2.3	0.36		0.57	0.23	0.45	.05	4.3
2	0.34	2.3	0.36		0.57	0.23	0.45	.05	4.3
3	0.34	2.3	0.36	1.1	0.57	0.23	0.45	.05	5.4
4	0.34	2.3	0.36	1.1	0.57	0.23	0.45	.05	5.4
5	0.34	2.3	0.36	1.1	0.57	0.23	0.45	.05	5.4
<i>Subtotal Yr. 1-5</i>	<i>1.7</i>	<i>11.5</i>	<i>1.8</i>	<i>3.3</i>	<i>2.85</i>	<i>1.15</i>	<i>2.25</i>	<i>0.25</i>	<i>24.8</i>
6-10	1.7	11.5	1.8	5.5	2.85	1.15	1.15	0.25	25.9
<i>Total Yr. 1-10</i>	<i>3.4</i>	<i>23.0</i>	<i>3.6</i>	<i>8.8</i>	<i>5.7</i>	<i>2.3</i>	<i>3.4</i>	<i>0.05</i>	<i>50.7</i>
<i>Unit cost/ha</i>	<i>\$20</i>	<i>\$1200</i>	<i>\$375</i>	<i>\$800</i>	<i>\$2,000</i>	<i>\$2,000</i>			

Note: assumes 220 days of silviculture work = 1 job

14.4 SUMMARY OF INFORMATION AND RESEARCH NEEDS

14.4.1 Ongoing projects

Following is a short summary of some of Weyerhaeuser's ongoing research projects and a list of topics that were identified in the working session as requiring further research:

Project	Objectives
Lodgepole pine ingress field sampling pilot	Goal of this project is to test the feasibility of this detailed sampling approach to quantify ingress patterns of PI stands on some major site types across Weyerhaeuser's operating areas.
PI Stand Dynamics	Goal of this project is to increase our understanding of the dynamics in PHR stands and how they differ from fire-origin stands.
Lodgepole pine research trial review	The primary goal of this project is to identify PI research trials in B.C., Alberta, and the Pacific Northwest of the U.S. that may provide some information on the relationship between stand density management in PI, wood quality, log quality, and ultimately product quality.
Lodgepole pine tree improvement and planting program review	The primary goal of this project is to briefly review Mike Carlson's PI tree improvement trials in B.C. to document the potential to quantify the branching and crown patterns associated with different seed sources and genetic stock that has been and will be planted in B.C. in the next while.
Economic analysis of pruning PI	The primary goal is to provide some information on the potential economic viability to prune PI as a standard or salvage treatment.
TASS simulations of pruning PI	The primary goal is to follow-up on the preliminary work done last year (WCK-058) on simulating the potential effects of pruning PI using TASS simulations.
Optimum Nutrition Research	This project coordinated by Gordon Weetman looks at early fertilization of lodgepole pine.
Comparison to PI diameter distributions with TASS simulations	The primary goal of this project is to compare data from PRH PI stands to compare the diameter distribution and other information predicted from TASS to develop some level of comfort on how well these simulations reflect actual growth.
Commercial thinning trials	The primary goal of this project was to establish two research trials of CT regimes in young natural lodgepole pine to determine the economic viability of CT in young lodgepole pine stands. Information on the timing of entries, the level of removal that is appropriate, and the subsequent growth and yield effects will be investigated.
Grant Creek Spacing Trial	The primary goal of this project is to provide data to compare growth and yield differences between the spacing regime currently approved by the MoF (2,400 /ha) and a regime of leaving a higher residual density (3,500/ha) considered by Weyco to grow better quality wood for future products.

Many issues were raised in the working session for which answers were not available. Some areas in which further information was needed included:

- Stocking standards in the PP zone.
- Modeling silviculture systems in dry-belt stands.
- Management protocols for dry-belt stands.
- Mapping of problem forest types.
- Impacts of establishing a wildlife management unit on seral retention goals.
- Habitat attributes for a range of wildlife species and the necessary stand management techniques to achieve them.
- The implications of *Comandra* – why is it heavier in some areas, does the impact decrease with age?
- Continuation of work on stand density interactions with branch size and stem taper.
- Fertilization responses of stands under age 20 and of stands at higher densities.
- The effects of fertilization on wood quality.
- Disturbance patterns to aid in determining appropriate stocking standards and silviculture regimes.
- Delineation of problem forest types based on new TEM and site index information.
- Delineation of productive and economical stocking class 4 stands.
- Investigation of the feasibility of two-pass harvesting systems in age class 4 PI stands.

14.4.2 Recently Completed Projects

Juvenile Spacing on TFL 15 What Post-Spacing Density.	March 1998	Ed Collen and Jim Thrower
Strategies and Tactics for Dwarf Mistletoes' Management in TFL 15.	March 1999	Janice Hodge, JCH Forest Pest Management
Rationale for AAC Determination.	July 1999	Bronwen Beedle, Deputy Chief Forester
Forest Health Management Plan.	March 2000	Janice Hodge, JCH Forest Pest Management
Investigating a Process for Dry-belt stand Management in TFL 15.	March 2000	J. S. Thrower & Associates Ltd.
Draft – Strategies for the Management of Trembling Aspen on TFL 15.	August 2000	J. S. Thrower & Associates Ltd.
Interim Spacing Prescription for Lodgepole Pine Stands in the OK Falls Operating Area.	July 2000	J. S. Thrower & Associates Ltd.

Site Index Adjustment Project for July 2000 J. S. Thrower & Associates Ltd.
TFL 15 – Work Plan.

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APPENDIX I - DEFINITIONS

The complete program of activities planned through the life of the stand is a **silvicultural system** (Smith *et al.*, 1997).

It is customary to categorize silvicultural treatments as:

- **Basic silviculture** treatments are those that facilitate the establishment of a stand. (Canadian Forestry Service).
- **Intensive silviculture** describes practices such as thinning, fertilization and genetic improvement that “increase the capability of the forest to produce fiber” (Franzese *et al.*, 1978).

In British Columbia, the categorization of treatments is based on the regulatory context in which they are applied.

Basic silviculture is therefore defined as “harvesting methods and silviculture operations ... that are for the purpose of establishing a free growing crop of trees of a commercially valuable species and are required in a regulation, pre-harvest silviculture prescription or silviculture prescription.” (Ministry of Forests, undated.)

Incremental Silviculture is a Ministry of Forests term that refers to the application of silvicultural treatments in addition to mandatory silviculture required by law. Under this definition, incremental silviculture extends beyond the traditional activities of spacing, pruning and fertilization. It also includes pre-free growing silviculture activities that are in excess of legal requirements, as well as commercial thinning and backlog reforestation. This means that a particular silvicultural treatment, such as pruning, could be regarded as either basic or incremental depending upon the regulatory situation under which it was applied.

APPENDIX II - BIODIVERSITY ISSUES

A total of 1,495 hectares were deducted from the THLB to account for stand-level biodiversity. It was assumed that up to 50% of the wildlife tree patch requirements would be met in riparian management areas and other constrained areas.

At a landscape unit level, a distribution of 45% lower, 45% intermediate and ten- percent higher biodiversity emphasis was used. Within the lower emphasis areas, the old seral constraint at an initial level of one-third the requirement was applied, increasing to the full requirement by the end of the third rotation.

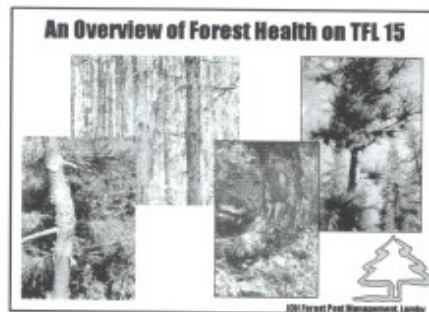
Old seral requirements were easily met throughout the planning horizon in NDT3 subzone variants which comprise 56% of the productive forest land base. Within NDT4 areas, old seral requirements were not met initially, but were readily achieved within the first 80 years of the simulation.

Sensitivity analysis showed a significant reduction in medium- and long-term timber supply compared to the base case if old seral forest retention objective is not reduced to one third of the requirement in the lower biodiversity emphasis areas. Assuming the intermediate biodiversity emphasis option severely impacted timber supply throughout the planning horizon compared to the base case. Applying the lower emphasis option to the entire TFL resulted in an increase in short- and medium-term timber supply from 62,000 cubic metres per year to 86,000 cubic metres per year. Old seral stage requirements significantly limit flexibility in the magnitude and duration of the initial harvest level on TFL 15.

APPENDIX III - FOREST HEALTH PRESENTATION NOTES

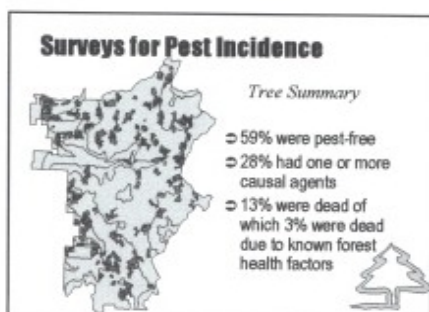
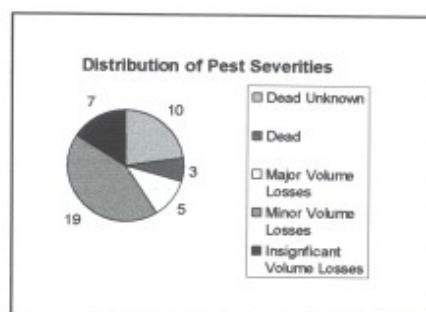
Forest Health Overview – TFL 15

March 2001



Background

- ⇒ FRBC funded project
- ⇒ 3 years of landscape level surveys for pest incidence (1997-1999)
 - 1662 plots completed with approx 84,000 trees assessed
- ⇒ Development of a Forest Health Management Plan for TFL 15
 - Based on NDT's
 - Included mountain pine beetle and Douglas-fir beetle hazard rating, and western spruce budworm overlay analysis

Pests causing Mortality

- ⇒ Bark beetles
- ⇒ Comandra blister rust
- ⇒ Armillaria and laminated root diseases
- ⇒ Abiotic



Pests causing volume losses

- ⇒ Dwarf mistletoes
- ⇒ Lodgepole pine terminal weevil
- ⇒ Western spruce budworm
- ⇒ Needle diseases
- ⇒ Squirrel feeding



JCH Forest Pest Management, Lumby, BC

1

Forest Health Overview – TFL 15

March 2001

Landscape Level Surveys
Stand Level Comparison

	TFL 15	TFL 49	DPE
DMP	68	52	66
DMF	82	1	20
DML	11	0	0
IWP	83(12)	92(5)	83(2)
DSC	62	29	52
DRA	12	17	12
DRL	17	37	85
DSG	88	92	96

Factors Affecting Forest Health

- ⇒ Fire exclusion
- ⇒ Silviculture practices
- ⇒ Other resource concerns



Effects of Fire Exclusion in the NBT4

- Changes to stand structure and species composition
 - multi-layered, un-even aged stands, composed of more shade tolerant species i.e. Douglas-fir
- Increased susceptibility to insects and diseases due to:
 - nutrient and moisture demands on some sites;
 - relative susceptibility of Douglas-fir;
 - selective harvesting history.



Western Spruce Budworm

Only recorded infestation
1986-1992



Year	Area	% of BPP
1986	2202	9
1987	3485	14
1988	4153	16
1989	5099	21
1990	2112	8
1991	3228	13
1992	2814	12

Western Spruce Budworm

- ⇒ Highest hazard occurs in overstocked multi-layered Fd stands



- ⇒ Volume loss and reduced wood quality
- ⇒ Mortality of suppressed and intermediate trees

Western Spruce Budworm Overlay Analysis 1909-1999



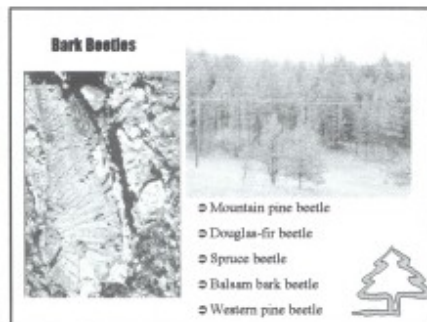
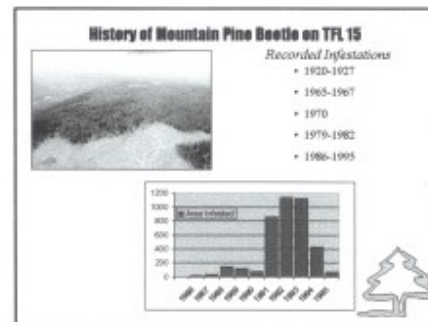
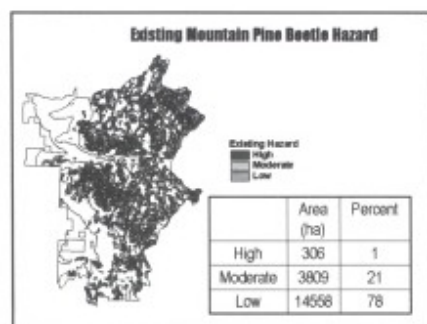
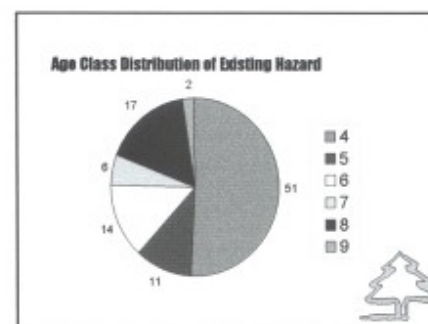
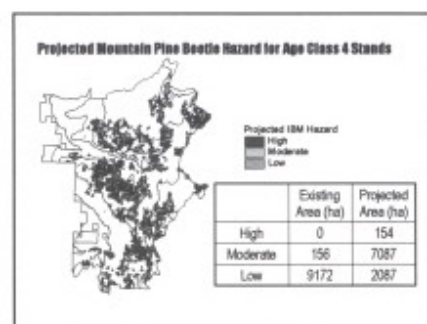
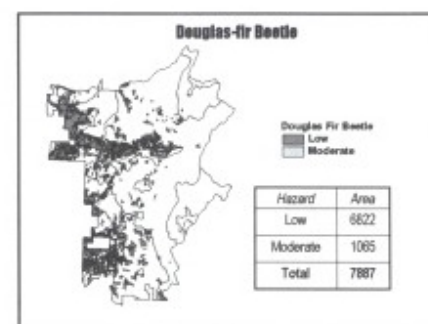
of Consecutive Years

- 1-2
- 3-4
- 5-6

# of Consecutive Years	Area (ha)	% of TFL
1	4889	18
2	2486	9
3	2248	8
4	794	3
5	72	<1
6	248	<1

Forest Health Overview – TFL 15

March 2001



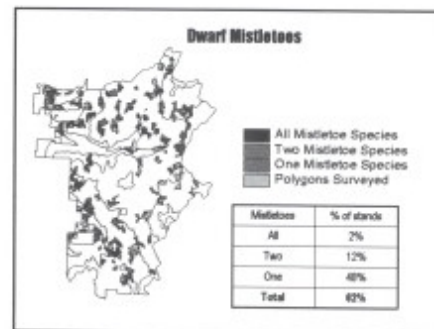
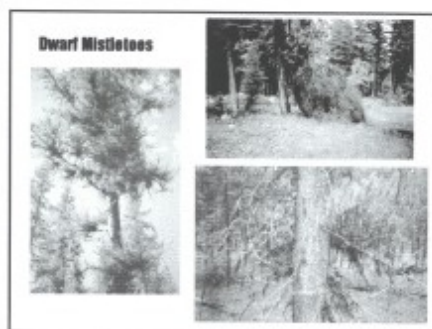
Forest Health Overview – TFL 15

March 2001

Dwarf Mistletoes

- Multi-layered single species stands have the highest hazard
- Moderate/severe infections required before volume losses are notable.
- Reduce tree growth, lower wood quality and may cause mortality.
 - larger knots, abnormal grain and reduced wood strength

"In the absence of fire dwarf mistletoe will respond by increasing in both incidence and intensity across the landscape."

Dwarf Mistletoes Management

Strategies and Tactics for Dwarf Mistletoe Management in
New Forest, Canada BC

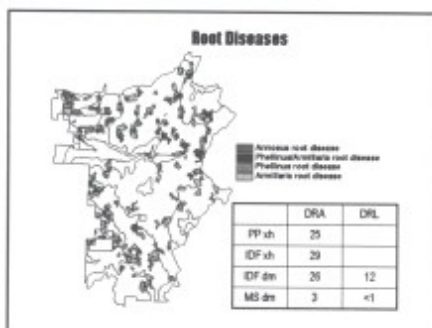
1. **Assessment**

2. **Management Objectives**

3. **Management Strategies**

4. **Management Tactics**

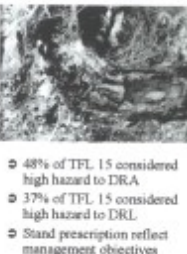
5. **Monitoring and Evaluation**

Laminated Root Disease



Armillaria Root Disease



- 48% of TFL 15 considered high hazard to DRA
- 37% of TFL 15 considered high hazard to DRL
- Stand prescription reflect management objectives

Forest Health Overview – TFL 15

March 2001

Lodgepole Pine Terminal Weevil

- ⇒ found in 78% of the young lodgepole pine stands examined
- ⇒ more common in MS
- ⇒ range within infested stands 1-48%
- ⇒ 46% current attack, 35% one attack, 18% greater than one attack.

Lodgepole Pine Terminal Weevil

- ⇒ High hazard stands <1400 sph in IDF and MS
- ⇒ Stem deformities = creases, crooks, forks or stagheads
- ⇒ Trees 10-25 years old most commonly attacked
- ⇒ In infested stands (+10%) spacing should be delayed to >5m ht or leave 2000-2400 sph
- ⇒ Delayed spacing can improve log quality

Comandra Blister Rust

- ⇒ found in 62% of the young lodgepole pine stands
- ⇒ more widespread in MS but greater impact in IDF dm
- ⇒ range of infection 1-36% of the stems within affected stands
- ⇒ occurred in all stand densities

Comandra Blister Rust

- ⇒ High density stands provide a buffer against rust-caused tree mortality
- ⇒ Risk of new infections decreases after age 15
- ⇒ Increase target stocking as per FPC Guidebook
- ⇒ Consider alternate species/mixed species establishment in IDF dm
- ⇒ Favour non-host species during stand treatments

Forest Health Strategies for the NDT4

- ⇒ Encouraging even-aged systems and promotion of alternate species (Pl, Py, Lw, Se **where appropriate**) ex. Patch clearcuts
- ⇒ Promotion of species mix at the regeneration or stand management phase in un-even aged and even-aged systems where silvically appropriate
- ⇒ Removal of overstorey forest health hazards, where possible.
- ⇒ Modifying existing stand structures i.e. thinning and underburning to reduce IDW and DM hazards.

Forest Health Strategies for the NDT3

- ⇒ Consider stand treatments of 60-100 year old, mod/high hazard stands to reduce IBM hazard
- ⇒ Consider regeneration of a species mix, especially in transitional stands to reduce future IBM hazard.
- ⇒ Ensure stand management prescriptions consider forest health hazards and risks:
 - Target stocking should incorporate expected losses to forest health agents
- ⇒ Remove overhead forest health hazards where possible.

APPENDIX IV - RED AND BLUE LISTED SPECIES POTENTIALLY PRESENT ON TFL 15

Table 13. Forest-using red and blue-listed species potentially present within the study area.

Scientific Name	Common Name	BGC Zone	Prov. List
<i>Aeronautes saxatalis</i>	White-Throated Swift	BG PP IDF	Blue
<i>Ambystoma tigrinum</i>	Tiger Salamander		Red
<i>Antrozous pallidus</i>	Pallid Bat	BG PP IDF	Red
<i>Catherpes maxicanus</i>	Canyon wren		Blue
<i>Chondestes grammacus</i>	Lark Sparrow		Red
<i>Chrysemys picta</i>	Painted turtle		Blue
<i>Coluber constrictor</i>	Racer	BG IDF PP	Blue
<i>Corynorhinus townsendii</i>	Townsend's Big-Eared Bat	BG IDF PP	Blue
<i>Crotalus viridis</i>	Western Rattlesnake	PP BG IDF	Blue
<i>Empidonax wrightii</i>	Gray Flycatcher	BG PP	Blue
<i>Euderma maculatum</i>	Spotted Bat	BG IDF PP	Blue
<i>Falco peregrinus anatum</i>	Peregrine Falcon		Red
<i>Hypsiglena torquata</i>	Night snake		Red
<i>Icteria virens</i>	Yellow-breasted chat		Red
<i>Melanerpes lewis</i>	Lewis's Woodpecker	BG PP IDF	Blue
<i>Myotis thysanodes</i>	Fringed Myotis	BG PP IDF	Blue
<i>Oreoscoptes montanus</i>	Sage thrasher		Red
<i>Otus flammeolus</i>	Flammulated Owl		Blue
<i>Otus kennicottii macfarlanei</i>	Western Screech-Owl, <i>macfarlanei</i> subspecies	BG PP IDF	Red
<i>Ovis canadensis californiana</i>	California Bighorn Sheep	IDF BG PP MS	Blue
<i>Perognathus parvus</i>	Great Basin Pocket Mouse		Blue
<i>Picoides albolarvatus</i>	White-Headed Woodpecker	PP	Red
<i>Pituophis catenifer deserticola</i>	Gopher Snake, <i>deserticola</i> subspecies	BG IDF PP	Blue
<i>Reithrodontomys megalotis</i>	Western harvest mouse		Blue
<i>Spea intermontana</i>	Great Basin Spadefoot Toad	BG PP IDF MS ESSF	Blue
<i>Sphyrapicus thyroideus thyroideus</i>	Williamson's Sapsucker, <i>thyroideus</i> subspecies	IDF MS	Blue
<i>Spizella berweri berweri</i>	Brewer's sparrow		Red

Table 14. Rare Plant Associations within TFL 15.

Biogeoclimatic Subzone/variant	Site Series Code	Plant Association		Prov. CDC Rank	Prov. List
		Scientific Name	Common Name		
PPxh1	01	<i>Pinus ponderosa</i> / <i>Elymus spicatus</i> - <i>Festuca idahoensis</i>	Ponderosa pine / Bluebunch wheatgrass-Idaho fescue	S2S3	Blue
PPxh1	02	<i>Pinus ponderosa</i> / <i>Aristida longiseta</i>	Ponderosa pine / Red three-awn	S3	Blue
PPxh1	03	<i>Artemisia tridentata</i> / <i>Elymus spicatus</i> - <i>Balsamorhiza sagittata</i>	Big sage / Bluebunch wheatgrass-Balsamroot	S2	Red
PPxh1	05	<i>Pinus ponderosa</i> / <i>Elymus spicatus</i> – <i>Festuca campestris</i>	Ponderosa pine / Bluebunch wheatgrass-Rough fescue	S2S3	Blue
PPxh1	06	<i>Pseudotsuga menziesii</i> / <i>Symphoricarpos albus</i> / <i>Calamagrostis rubescens</i>	Douglas-fir / Common snowberry / Pinegrass	S3?	Blue
PPxh1	08	<i>Pseudotsuga menziesii</i> / <i>Betula occidentalis</i> – <i>Acer glabrum</i>	Douglas-fir / Water birch-Douglas maple	S1S2	Red
IDFxh1	02	<i>Pseudotsuga menziesii</i> - <i>Pinus ponderosa</i> / <i>Elymus spicatus</i>	Douglas-fir – Ponderosa pine / Bluebunch wheatgrass (Balsamroot)	S3	Blue
IDFxh1	03	<i>Pseudotsuga menziesii</i> - <i>Pinus ponderosa</i> / <i>Elymus spicatus</i>	Douglas-fir – Ponderosa pine / Bluebunch wheatgrass (Balsamroot)	S3	Blue
IDFxh1	04	<i>Pseudotsuga menziesii</i> - <i>Pinus ponderosa</i> / <i>Ceanothus velutinus</i>	Douglas-fir – Ponderosa pine / snowbrush	S3?	Blue
IDFxh1	05	<i>Pseudotsuga menziesii</i> - <i>Pinus ponderosa</i> / <i>Festuca idahoensis</i>	Douglas-fir – Ponderosa pine / Idaho fescue	S3?	Blue
IDFxh1	08	<i>Pseudotsuga menziesii</i> – <i>Betula papyrifera</i> / <i>Acer glabrum</i>	Douglas-fir – Paper birch / Douglas maple	S3	Blue
IDFxh1	91	<i>Festuca idahoensis</i> – <i>Elymus spicatus</i>	Idaho Fescue – Bluebunch wheatgrass	S2	Blue
IDFxh1	92	<i>Artemisia tridentata</i> / <i>Elymus spicatus</i> – <i>Balsamorhiza sagittata</i>	Big sage / Bluebunch wheatgrass – Balsamroot	S2	Red
IDFxh1	93	<i>Elymus spicatus</i> – <i>Balsamorhiza sagittata</i>	Bluebunch wheatgrass – Balsamroot	S2S3	Blue
IDFxh1	94	<i>Artemisia tridentata</i> - <i>Elymus spicatus</i> - <i>Balsamorhiza sagittata</i>	Big sage – Bluebunch wheatgrass – Balsamroot	S2	Red
IDFd1	02	<i>Elymus spicatus</i> – <i>Koeleria macrantha</i>	Bluebunch wheatgrass – Junegrass	S2	Red

IDFdm1	03	<i>Pseudotsuga menziesii</i> - <i>Pinus ponderosa</i> / <i>Elymus spicatus</i>	Douglas-fir – Ponderosa pine / Bluebunch wheatgrass (Balsamroot)	S3	Blue
MSdm1	01	<i>Picea engelmannii</i> x <i>glauca</i> / <i>Pachistima</i> / <i>Pleurozium</i>	Hybrid white spruce / Falsebox / Feathermoss	S2?	Blue
MSdm1	04	<i>Pinus contorta</i> / <i>Arctostaphylos</i> / <i>Calamagrostis rubescens</i>	Lodgepole pine / Kinnikinnick / Pinegrass	S3?	Blue
