Integrated Stewardship Strategy for the Merritt TSA

Analysis Report

Version 1.1

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Project 419-36

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Overview

This document summarizes the modelling results for the Integrated Stewardship Strategy (ISS) scenarios conducted for the Merritt TSA. The ISS Base Case scenario included most assumptions used in the latest 2016 Timber Supply Review (TSR) but adjusted others for riparian reserves, fisheries sensitive and temperature sensitive watershed management, alternate hydrologic recovery curves, Williamson Sapsucker management, Coastal Tailed Frog management, and targets for harvest patches and very early seral patches. A number of other parameters are also modelled and reported on, including moose habitat, marten habitat, equivalent clearcut area for watersheds (linked to a cumulative effects project), mature-plus-old seral stage amount and patch size distributions, and mature contiguous pine patch size distribution. The reserve scenario explored tactics aimed to maintain the harvestable area while providing a wide range of values on the land base by overlapping or co-locating these values where possible. The harvest scenario explored tactics aimed to improve timber harvesting opportunities and to determine if harvesting could be used as a tool to manage wildfire impacts without unduly impacting timber supply. The silviculture scenario explored tactics to enhance timber quantity and quality over the mid- and long-term within a $3M per year budget over the forest 20 years of the planning horizon. The Combined Scenario integrated key elements form all other scenario in order to guide the development, implementation, and monitoring of tactical plans over the first 20 years of the planning horizon.

The long-term timber harvesting land base (THLB) was estimated to be 525,382 hectares, which is approximately 13,627 hectares (2.5%) below the TSR Benchmark (which attempted to mimic the latest TSR). The important differences between the TSR and ISS land base definition include assumptions related to: hydrologic recovery on identified watersheds, excluding habitat for Williamson's sapsucker, and increasing riparian reserve areas in the Nicola temperature sensitive watershed. These land base differences, plus additional management assumptions, resulted in a short-term harvest level that was about 2.5% higher than the TSR Benchmark; most likely because of the decision to apply a single-step transition between the mid- and long-term harvest levels rather than multiple steps used in the TSR Benchmark scenario. In the long-term, the ISS Base Case harvest flow was only 0.9% lower than the TSR Benchmark.

The Reserve Scenario indicated that only three of the twelve landscape units have sufficient NHLB area that meet the old seral forest targets. Consequently, to meet the old seral requirements, the model occasionally had to select old seral stands from THLB or mature areas (NHLB or THLB). When spatial OGMAs are considered NHLB the candidate reserves resulted in a net area of 22,596 hectares that would be released back as THLB. As well, the overall score of the candidate reserves was 57% higher than the OGMAs, suggesting that there was an improvement in the quality of areas reserved through this process.

The Harvest Scenario explored three tactics: 1) minimum harvest criteria partitions, 2) harvest feasibility, and 3) priority on wildfire management. Reducing the minimum harvest criteria to 75 m^3/ha improved short-/mid-term harvest levels by approximately 4%, and long-term harvest levels by approximately 8.5% when compared to the ISS Base Case. Almost none of the long-term increase is from stands less than 150 m^3/ha. Harvest levels decline by 3.1% and 4.6% over the short- and long-term, respectively, as a result of reduced yields for future managed stands to reflect fire management stocking standards within wildland urban interface areas. Focusing more harvest within fire management priority areas during the first 10 years was achievable without unduly affecting harvest levels.

The Silviculture Scenario indicated that a budget of $3 million per year could be spent in the first 20 years of the planning horizon to make use of advantages from the silviculture tactics; increasing the short-term harvest flow by 6.0%. Most of the treated area involved enhanced basic silviculture tactics (all harvested stands eligible), while contributions from treating areas with fertilization and stand rehabilitation tactics were less prominent.

The Combined Scenario considered key elements from all other scenarios, including a comparison of using existing spatial OGMAs versus the candidate reserves developed in the Reserve Scenario. Using the existing spatial OGMAS was selected for developing the tactical plan and for reporting the more detailed metrics for the Combined Scenario. Compared to the ISS Base Case run, this scenario resulted in a 9.3% increase in harvest levels between years 51 and 65 (~1.6 million m^3), plus 1.4% average increase beyond that. Moreover, several key harvest indicators (i.e., slope class, harvest age, small harvest openings, partial cutting, and wildfire management) were improved.

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List of Acronyms

AAC	Allowable Annual Cut
BCTS	BC Timber Sales
BEO	Biodiversity Emphasis Option
BEC	Biogeoclimatic Ecosystem Classification
BCTS	British Columbia Timber Sales
CF	Community Forest
CFLB	Crown Forest Land Base
ESSF	Engelmann Spruce Subalpine-Fir
FPS	Forest Planning Studio
GW	Genetic Worth
GIS	Geographic Information System
LRMP	Land and Resource Management Plan
LU	Landscape Units
MAI	Mean Annual Increment
M	Modification Visual Quality Objective
NDT	Natural Disturbance Type
NRL	Non-Recoverable Losses
OGMA	Old Growth Management Area
ROC	Rate of Cut

Document Revision History

Version	Date	Notes/Revisions
1.0	Aug 31, 2017	First version distributed to project team for review and comment. Only includes results for the ISS Base Case Scenario.
1.1	March 31, 2018	Included various edits throughout the document for clarification and context. Updated document title from "Integrated Stewardship Strategy" to "Integrated Stewardship Strategy". Added List of Acronyms, Acknowledgments, Document Revision History. Incorporated material from other scenarios: • Section 3 - ISS Base Case Scenario (merged from separate, edited ISS Base Case Scenario report, version 1.1), • Section 4 - Reserve Scenario (merged from separate, edited Reserve Scenario report, version 1.1), • Section 5 - Harvest Scenario, • Section 6 - Silviculture Scenario, and • Section 7 - Combined Scenario. Added discussion section (8).

1 Introduction

This document highlights the ISS Base Case Scenario for the Merritt TSA. The ISS Base Case Scenario (i.e., ISS Base Case) is the second of 6 scenarios developed for the ISS analysis. The ISS Base Case Scenario is part of a two-step process that first develops a model to mimic assumptions applied in the latest Timber Supply Review (TSR – i.e., TSR Benchmark). The TSR Benchmark is used to compare results and confirm that the model is configured consistently. Second, some TSR assumptions were adjusted to correct errors and include new or updated information. These adjustments aim to better reflect the current situation while improving model configuration for future ISS scenarios. The adjustments include riparian reserves, fisheries sensitive and temperature sensitive watershed management, alternate hydrologic recovery curves, Williamson Sapsucker management, Coastal Tailed Frog management, and harvest patch and very early seral patch targets. In addition, a number of other parameters are modelled and reported on, including moose habitat, marten habitat, equivalent clearcut area for watersheds (linked to the cumulative effects project), mature-plus-old seral stage amount and patch size distributions, and mature contiguous pine patch size distribution.

1.1 Land Base Definition

The land base definition for the ISS Base Case (Table 1) indicates a long term Timber Harvesting Land Base (THLB) of 525,382 hectares, which is approximately 13,627 hectares (2.5%) below the TSR Benchmark. The major differences between the two land bases are discussed in section 2 below.

Table 1 Merritt ISS Base Case Scenario Land Base Definition

	Gross Areas (Ha)	Effective Areas (Ha)	Percent of Total Area (%)	Percent of CFLB (%)
Total Area	**1,131,163**	**1,131,163**	**100.0%**	
less:				
Private Land, Federal Land, etc.	195,392	195,392	17.3%	
Community Forests	12,924	12,924	1.1%	
Woodlots	14,257	14,257	1.3%	
Non-Forest (Alpine)	16,409	16,409	1.5%	
Non-Forest (Rock)	10,611	9,353	0.8%	
Non-Forest (Water)	17,890	14,738	1.3%	
Non-Forest (Vegetation)	136,997	31,985	2.8%	
Non-Forest (Low productivity)	2,351	2,176	0.2%	
Non-Forest (Urban)	10,068	6,083	0.5%	
Non-Forest (Unclassified)	253	253	0.0%	
Non-Forest (Roads)	20,423	14,522	1.3%	
Non-Forest (Landings – Aspatial)	7,709	*7,709	0.7%	
Crown Forested Land Base		**805,366**	**71.2%**	**100.0%**
less:				
Parks, Reserves and Protected Areas	17,539	13,286	1.2%	1.6%
Environmentally Sensitive Areas	67,050	45,705	4.0%	5.7%
Physically Inoperable	91,569	37,943	3.4%	4.7%
Archaeological Sites (Aspatial)		*558	0.0%	0.1%
Riparian Areas	66,944	34,240	3.0%	4.3%
Heritage Trails	933	655	0.1%	0.1%
Wildlife Habitat Areas	7,335	4,464	0.4%	0.6%
Old Growth Management Areas	114,600	51,944	4.6%	6.4%
Coastal Tailed Frog	230	44	0.0%	
Ungulate Winter Range Snow Interception Cover	45,366	29,818	2.6%	3.7%
Existing Wildlife Tree Patches	14,856	9,649	0.8%	1.2%
Wildlife Tree Retention (Aspatial, Estimated)		** 14,390*	1.3%	1.8%
Timber Harvesting Land Base (current)		**562,670**	**49.7%**	**69.9%**
less:				
Future Wildlife Tree Retention (Aspatial)		**23,484*	2.1%	2.9%
Future Roads (Aspatial)		***11,701*	1.0%	1.5%
Williamson's Sapsucker Retention (Aspatial)		2,103	0.2%	0.3%
Timber Harvesting Land Base (future)		**525,382**	**46.4%**	**65.2%**

* Aspatial netdowns are applied in the model but are not reflected in the GIS dataset areas.

** To be applied with a yield table reduction.

2 Summary of Key Differences between TSR Benchmark and ISS Base Case

Table 2 Key differences between TSR Benchmark and ISS Base Case

Factor	TSR Benchmark	ISS Base Case	Harvest Impact
Old Seral Requirements	Old Seral requirements are assumed to be met through non-legal, spatial OGMAs.	Old Seral requirements assumed to be met through non-legal, spatial OGMAs. In addition to OGMAs, a Sensitivity Analysis will include the following: Incorporated old seral targets by Landscape Unit (LU) and Biogeoclimatic Ecosystem Classification (BEC) from the Old Growth Order. Disturbance in the NHLB, including OGMAs. Current condition is approximately 34,500 hectares short of required ~107,700 hectare target. In addition, disturbance in the OGMAs will require additional retention into the future.	Base Insignificant Sensitivity Significant
Early Seral Requirements	Not modelled.	Modelled by LU/BEC for reporting purposes, but not constrained.	Insignificant
Mature-plus-old Seral Requirements	Not modelled.	Modelled by LU/BEC for reporting purposes, but not constrained. Targets set by weighted biodiversity emphasis option. Sensitivity Analysis will include the following: Constrained rather than reported Disturbance in the NHLB, including OGMAs	Base Insignificant Sensitivity Signifcant
Adjacency	Adjacency requirements for IRM modelled as maximum 33% of THLB within a fresh water atlas watershed less than 3 metres tall at all times	Adjacency modelled by implementing patch size targets for stands less than 20 years old. Although target weight is set relatively low, there is expected to be some downward pressure on harvest.	Insignificant To Slight
Harvest opening size	Not modelled. Blocks created prior to analysis by grouping similar AU/age combinations up to 20 hectares size.	Targets set for harvest blocks (within a 5 year period) as follows: ○ 0 to 5 ha : CC =0 to 5%, PC = 0 to 5% ○ 5 – 20 ha: CC = 5 to 50%, PC = 10 to 50% ○ 20 – 100 ha : CC = 10 to 70%, PC = 10 to 80% ○ 100 + ha: CC = 0 to 10%, PC = 0 to 15% Although target weight is set relatively low, there is expected to be some downward pressure on harvest	Insignificant to Minor
Mature-plus-old Seral Patch Size	Not modelled.	Modelled for reporting purposes, but not constrained. Model size/memory requirements limited analysis to NDT resolution, rather than LU/BEC.	Insignificant
Patch Size for Mature-plus-old Pine-leading Stands.	Not modelled.	Modelled for reporting purposes, but not constrained in Base Case. Targets may be implemented as a sensitivity. Model size/memory requirements limited analysis to NDT resolution, rather than LU/BEC.	Insignificant

Factor	TSR Benchmark	ISS Base Case	Harvest Impact
Riparian	Widths spatially delineated using TSR assumptions. Total CFLB area 34,785 hectares. Net THLB reduction due to riparian: 16,872 hectares. Total CFLB area underestimated by ~ 6366 hectares due to tolerance used in GIS processing.	Riparian widths increased on selected streams in the Nicola temperature sensitive watershed as follows: 30 metres each side for S4 and S5 streams, and 20 metres for S6 streams. Streams selected based on proximity to fish streams combined with stream order. Total CFLB area : 66,9444 ha Net THLB reduction due to riparian: 34,240 ha. Sensitivity Analysis: Riparian widths increased to 10 metres each side for all small streams (S4, S5, and S6).	Significant
Hydrologic Recovery Curves	Standard IWAP, with 90% recovery by 9 metres in height, full recovery by 12 metres in height. MPB mortality not considered.	Hydrologic recovery based on new recovery curves developed by Rita Winkler. Fully hydrologic recovery at 25 metres in height. ECA includes MPB mortality.	Significant
Community Watersheds	ECA limited to 30 % using IWAP hydrologic recovery curves. ECA due to MPB not considered.	ECA limited to 30% using Rita Winkler recovery curves. ECA due to MPB considered. Downward pressure expected because of revised hydrologic recovery assumptions.	Included in "Hydrologic Recovery Curves"
Fisheries Sensitive Watersheds	Not modelled.	ECA above snowline limited to 25% for selected units as per proposed GAR order. Rate of cut constraints for all FSW watersheds to be considered as a sensitivity analysis.	Minor
Nicola Temperature Sensitive Watershed	Not modelled.	Increased riparian reserves for selected S4, S5, and S6 streams.	Included in "Riparian"
Cumulative Effects Watersheds	Not modelled.	ECA above the H40 and H60 lines modelled for reporting purposes, but not constrained.	Insignificant
Stand-Level Biodiversity	8.1 % in-block retention	8.1% in-block retention. Sensitivity analyses will consider reduced levels of retention (7%), and will also assign retention based on BEC.	Insignificant Expect upward pressure for sensitivities
Moose Winter Range	Not modelled.	Maintain 15% in early seral (<25 yrs IDF/ICH, <35 years MS/ESSF). Report, but not constrain on cover (stands >= 16 m tall) in overall polygon, and within 200 metres of lakes, wetlands and streams. Report, but not constrain on proportion of cover in patches >= 20 hectares	Insignificant

Factor	TSR Benchmark	ISS Base Case	Harvest Impact
Coastal Tailed Frog	Only WHAs considered	All known CTF point locations: 33 m buffer on streams within 100 metres of the point. ECA will be reported but not constrained for watersheds where CTF are present. Sensitivity may consider 33 m buffer on all small streams within watersheds where CTF exists.	Insignificant Possibly slight downward pressure for sensitivity.
Williamson's Sapsucker	Not modelled.	29% live tree retention modelled for "Low" and "Moderate" habitat within the area of occupation, and within 500 metres on known and probable nest sites. Not applied for Dry Belt Fir selection areas. Equivalent to approximately 2,103 hectare THLB impact.	Significant
Marten	Not modelled.	Early seral within MS/ESSF zones modelled for reporting purposes, but not constrained. Mature-plus-old seral within CWHms, ESSFdc, ESSFdcw, ESSFmw, and ESSFmww zones modelled for reporting purposes, but not constrained.	Insignificant
VQOs	Modelled by VLI poly, VQO, and VAC. Polygons with null VAC not constrained. Identified Issue: VLI polygon IDs do not accurately represent the intended VLI polygons. This is an LRDW VLI dataset problem noticed late in the project.	Modelled by VLI poly, VQO, and VAC. Polygons with null VAC not constrained. VLI polygons with less than 10 hectares of CFLB not constrained. Perhaps slight upward pressure on harvest expected.	Insignificant
Natural Disturbances on non-THLB	Modelled by BEC/NDT as per Biodiversity Guidebook	Modelled by BEC/NDT as per Biodiversity Guidebook	Insignificant

3 *ISS Base Case Scenario*

3.1 Timber Objectives

To facilitate easier comparisons between subsequent scenarios, the ISS Base Case scenario applied a single-step transition between the mid- and long-term harvest levels than the multiple steps transition used in the TSR Benchmark scenario. The timing of the transition was chosen to be at the midpoint of the TSR Benchmark incremental transition and to maintain approximately proportional reductions in harvest flows reflecting the reduced THLB.

Harvest flows for the ISS Base Case, Old Seral Sensitivity, and Mature-plus-old Seral Sensitivity scenarios are compared to the TSR Benchmark scenario in Figure 1 (once the non-recoverable losses of were considered). In the short and mid-term, the ISS Base Case harvest flow is approximately 28,000 m³/year

(2.5%) higher than the TSR Benchmark. In the long-term, the ISS Base Case harvest flow is approximately 13,300 m³/year (0.9%) lower than the TSR Benchmark.

Table 3 provides a comparison of the harvest flows for the various sensitivity analyses with the ISS Base Case Scenario. Implementing the requirement to achieve the old seral targets specified in the Non-Spatial Old-growth Order results in a significant (~4.5%) reduction in short-/mid-term harvest, and a lesser, but still significant (~1.7%) reduction in long-term harvest. In comparison, implementing the biodiversity guidebook mature-plus-old seral requirements results in an approximately 2.4 % reduction in short-/mid-term harvest, and 1.3% reduction in long-term harvest.

There is no significant difference between the harvest flows when the TSR adjacency constraints (i.e. maximum 33% area less than 3 metres tall) are applied instead of using patch size targets. Likewise, implementing the FSW rate of cut (ROC) constraint has minimal impact on harvest flows.

Figure 1 Harvest Flows for TSR Benchmark and ISS Base Case Scenarios

Table 3 Comparison of Sensitivity Scenario Harvest Flows with Base Case Scenario

Scenario	Short-/mid-term Average (m³/yr)	Short-/mid-term Compared to Base Case (%)	Long-term Average (m³/yr)	Long-term Compared to Base Case (%)
ISS Base Case	1,150,990	100.00	1,455,628	100.00
Old Seral Sensitivity	1,099,113	95.49	1,430,662	98.28
Mature-plus-old Seral Sensitivity	1,122,848	97.55	1,436,110	98.66
TSR Adjacency Constraints Sensitivity	1,150,723	99.98	1,455,622	100.00
FSW Rate of Cut Constraints Sensitivity	1,148,385	99.77	1,454,016	99.89
Pl Patch Limits Sensitivity	1,151,369	100.03	1,455,786	100.01
Small Streams Sensitivity	1,135,806	98.68	1,446,024	99.34
Patch Emphasis Sensitivity	1,147,887	99.73	1,454,537	99.93

A comparison of THLB growing stock levels between the TSR Benchmark and ISS Base Case Scenario is provided in Figure 2. The model built for the TSR Benchmark scenario did not allow reporting of growing stock for that portion of the THLB that excluded in-block retention. Therefore, in order to provide a comparison with the ISS Base Case Scenario, Figure 2 shows the THLB growing stock with the in-block retention included as well as the THLB without the in-block retention.

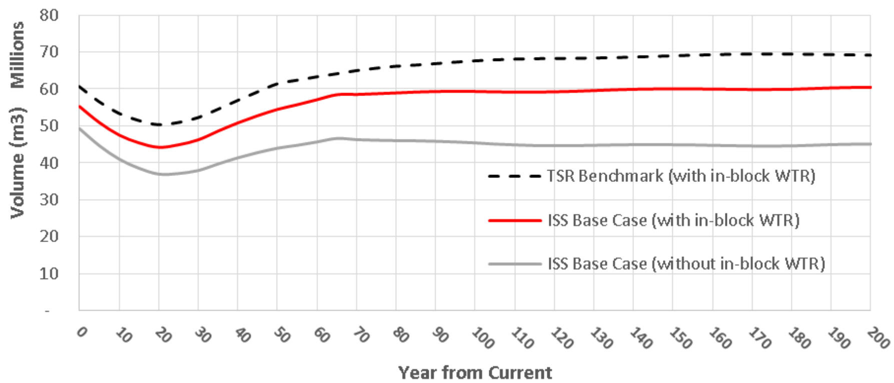


Figure 2 THLB Growing Stock for the TSR Benchmark and ISS Base Case Scenarios

The harvest profile by species indicates that dead pine salvage will be mostly finished within 5 years, and that spruce, balsam and Douglas-fir harvest will have increased for the first 30 years, before the proportion of pine harvest returns to a more level (

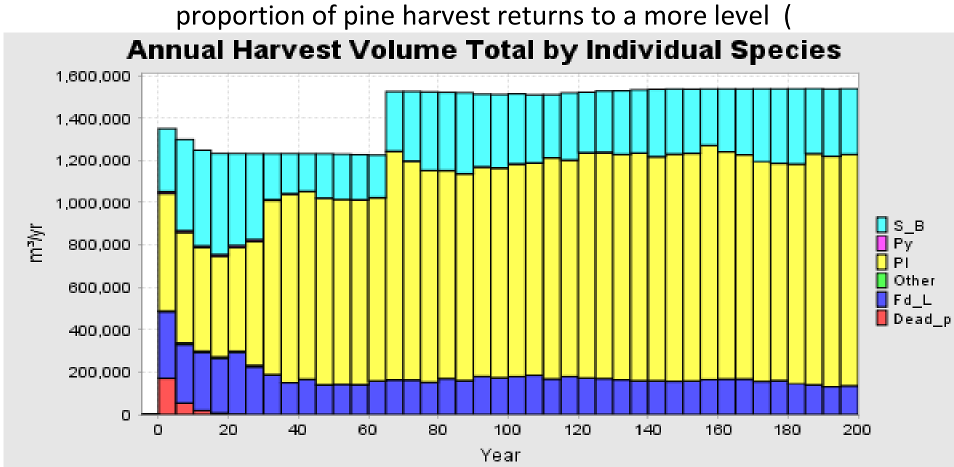


Figure 3).

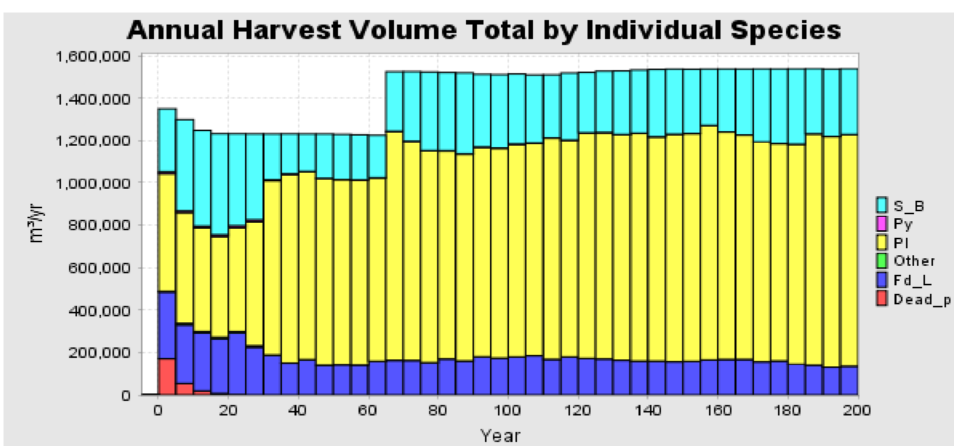


Figure 3 ISS Base Case Harvest Flow by Individual Species (Before NRL adjustment)

For clearcut harvesting, the average volume per ha increases for the first 30 years before decreasing during the mid-term. Long-term harvest volumes range between about 200 and 220 m³ per hectare (Figure 4).

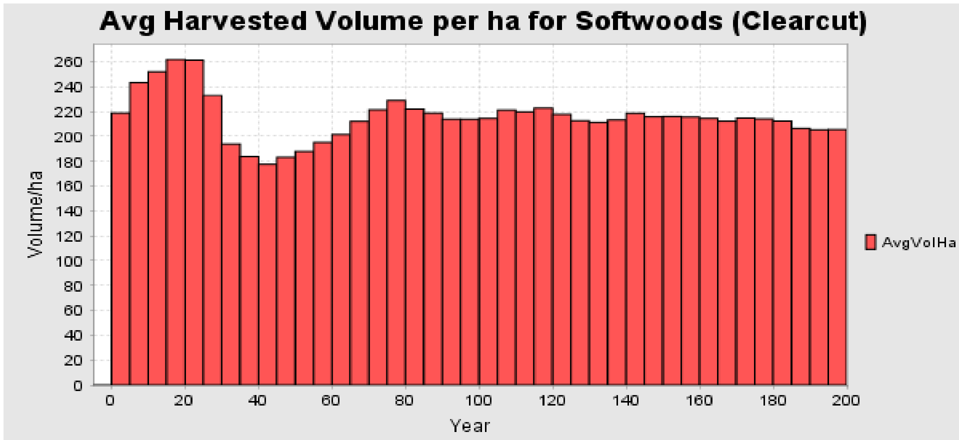


Figure 4 ISS Base Case Harvest Volume per ha (Clearcut Harvesting)

The average age of clearcut stands is between 141 and 190 years for the first 30 years, after which there is a significant reduction in harvest age during the transition to harvesting of managed stands (Figure 5). In the long term, the average harvest age stabilizes around 70 years as the model harvests more productive managed stands that reach relatively high volumes per ha at younger ages.

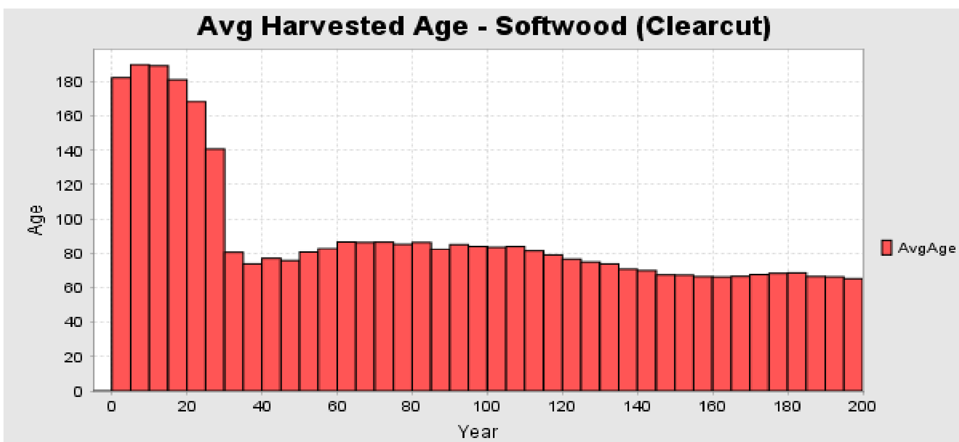


Figure 5 ISS Base Case Average Harvest Age (Clearcut Harvesting)

The average annual area harvested using selection systems (blue bars in Figure 6) averages 470 hectares, and ranges between 194 and 747 hectares. In comparison, the average annual clearcut area is 6,579 hectares, ranging between 4,473 and 7,410 hectares.

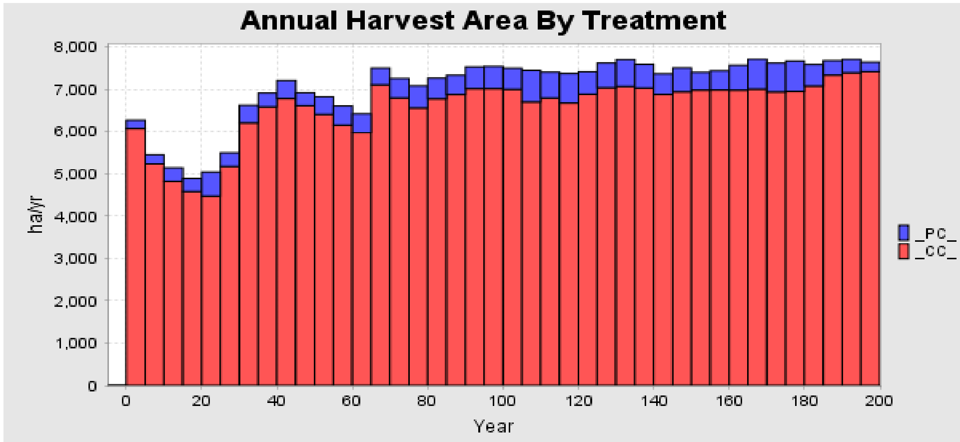


Figure 6 ISS Base Case Annual Areas by Harvest System

The age class distribution (Figure 7) indicates that the THLB transitions to a younger forest with a significant area less than 60 years of age. This is in line with the expected changes over time as the model converts the THLB to a relatively regular forest estate. On the non-THLB, the area disturbed by fires cycles through age classes over time. Despite this most of the non-THLB area is older than 260 years.

Figure 7 ISS Base Case Area over Age Classes in year 0 and 200 of the planning horizon

3.2 Non-Timber Objectives

Various non-timber objectives were reported and, in some cases, constrained either in the Base Case or sensitivity analyses. This section provides an overview of the results from these non-timber objectives.

3.2.1 Biodiversity

3.2.1.1 Old Seral Requirements

Old seral requirements were assumed to be met in the Base Case through the non-legal, spatial OGMAs that were developed for the Merritt TSA through an extensive process involving many parties. A sensitivity analysis was also completed where the old seral requirements by Landscape Unit (LU) /BEC, as identified in the Order Establishing Provincial Non-Spatial Old Growth Objectives, were set as a constraint in the model. Figure 8 summarizes the status of LU/BEC units over time relative to their target threshold, and Figure 9 summarizes the areas by old seral target status. These figures demonstrate that the non-legal, spatial OGMAs do not currently contain enough old seral to meet the requirements, and that it will take some time of recruitment before the targets are close to being met.

Furthermore, there is a small proportion of the landbase that does not meet the targets in the long term, even when the requirements are enforced. The magnitude of this shortfall fluctuates between about 700 and 1,000 hectares, and involves between 4 and 5 LU/BEC combinations during the last 25 years of the planning horizon. This shortfall can be attributed primarily to the natural disturbance that is implemented on the NHLB.

Notwithstanding this shortfall in old seral requirements, the intent of the old growth management area order is met by following a process that was developed by multiple stakeholders and First Nations over several years and approved by government. Additional areas are informally recognized by forest licensees and managed as old seral reserves through operational plans such as Forest Stewardship Plans (FSPs). Moreover, seral stage distributions of the IDF variants do not reflect the long history of partial cutting in these areas where some mature and old trees often remain after harvest and may provide some mature/old forest characteristics. In the MS variants do not reflect the extensive MPB infestation that has occurred there (up to 25% of the 'mature' forest may have been heavily infested). Some of these areas should likely be reported in the 'natural young' category.

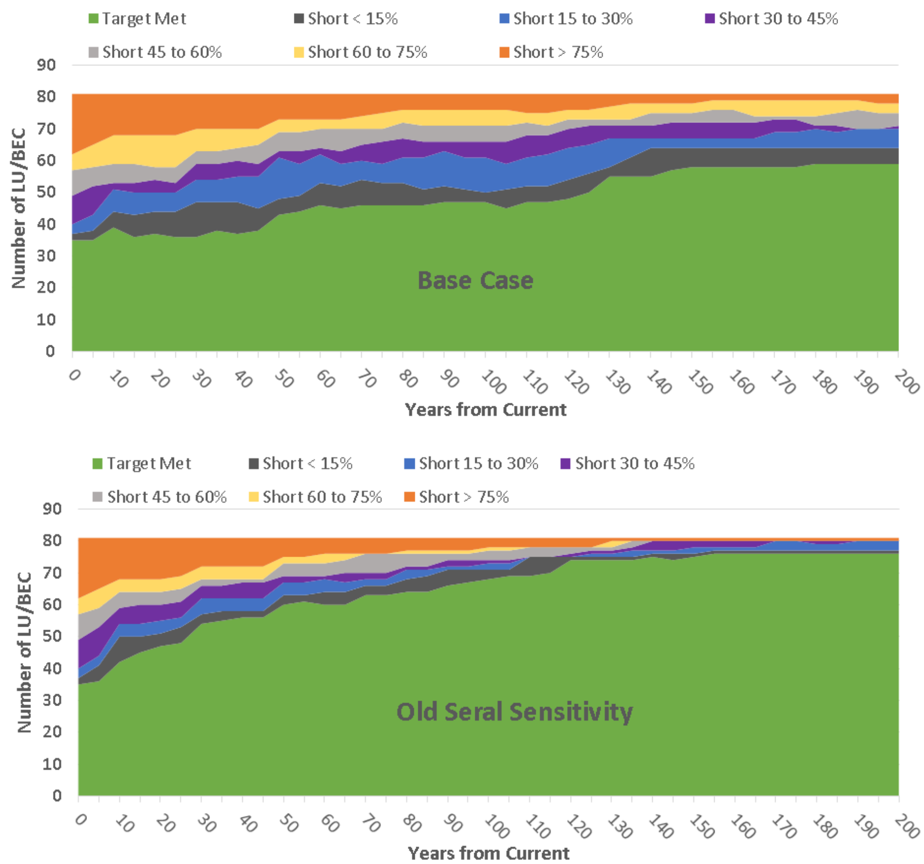


Figure 8 Old Seral Target Status by Number of LU/BEC Combinations

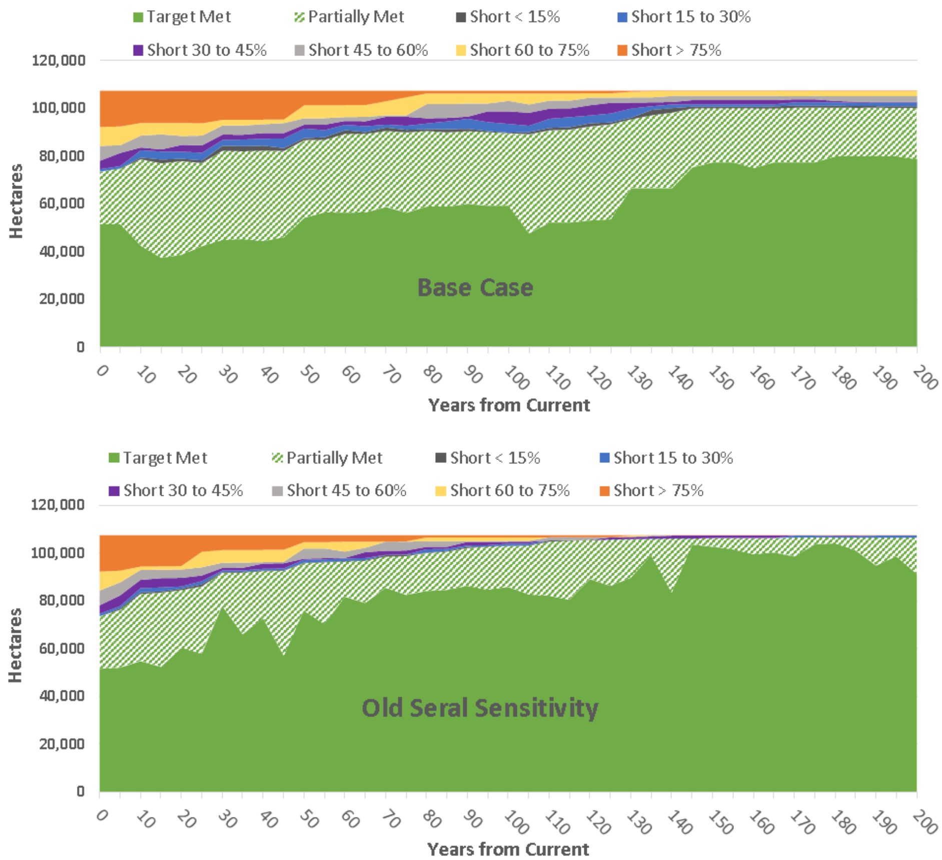


Figure 9 Old Seral Target Status by Area

3.2.1.2 Mature-Plus-Old Seral Requirements

Mature-plus-old seral requirements were not constrained for the Base Case, but rather reported relative to the Biodiversity Guidebook targets. A sensitivity analysis was undertaken to enforce these mature-plus-old targets. Figure 10 summarizes the number of LU/BEC combinations by their status relative to the requirements, and Figure 11 summarizes the areas by mature-plus-old target status. These demonstrate an overall reduction in the amount of mature-plus-old seral on the landscape over time. Applying the requirements as a constraint still allows an increase over time, in the number of the LU/BEC units that do not meet the target. However, the actual area shortfall relative to the targets is minimal, indicating that the constraints are virtually met and reflects the balancing of various objectives that Patchworks undertakes. In other words, to meet competing objectives, Patchworks has allowed very minor violations of the mature-plus-old seral constraint.

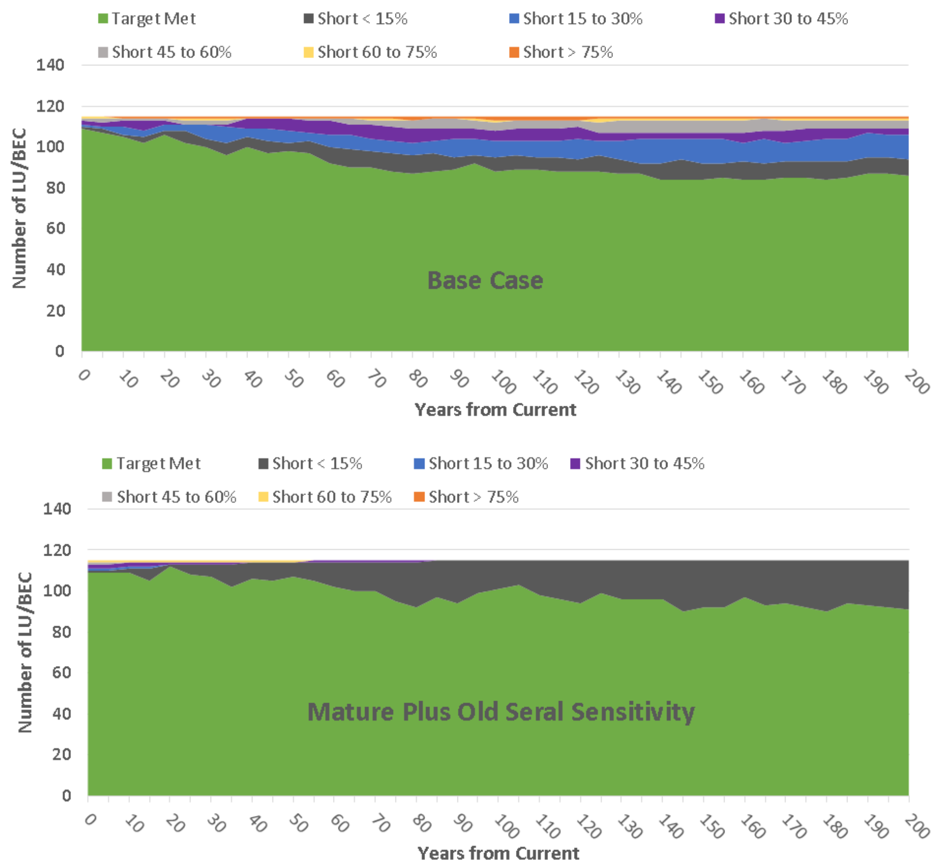


Figure 10 Mature-Plus-Old Seral Target Status by Number of LU/BEC Combinations

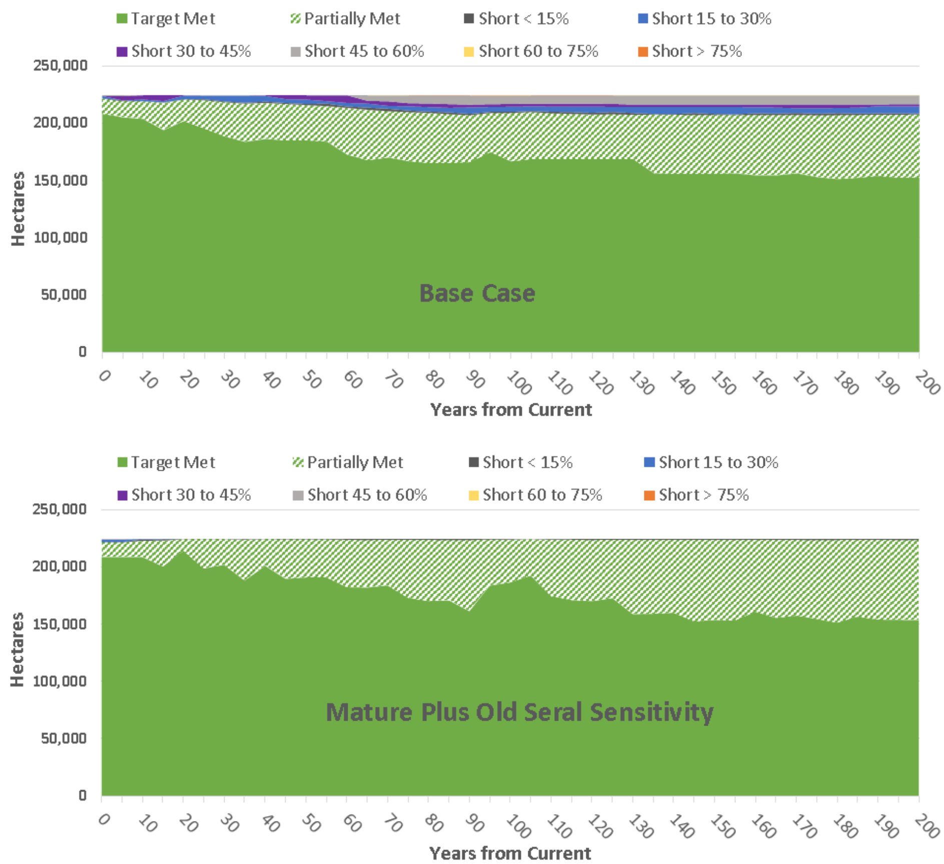


Figure 11 Mature-Plus-Old Seral Target Status by Area

3.2.1.3 Early Seral

Reporting the Early Seral (age <40 years) by LU/BEC units was done for information purposes only. No targets were set and no sensitivity analyses were undertaken. Figure 12 provides a summary of the number of LU/BEC combinations by proportion of early seral in the unit for the Base Case. Figure 13 shows the total area of early seral on the landbase by proportion of early seral for the Base Case. The area of early seral initially climbs for the first 20 years, then drops over the next 20 years before steadily climbing again. Also, most of the early seral area occurs in LU/BEC units that have between 30 and 60% early seral in them.

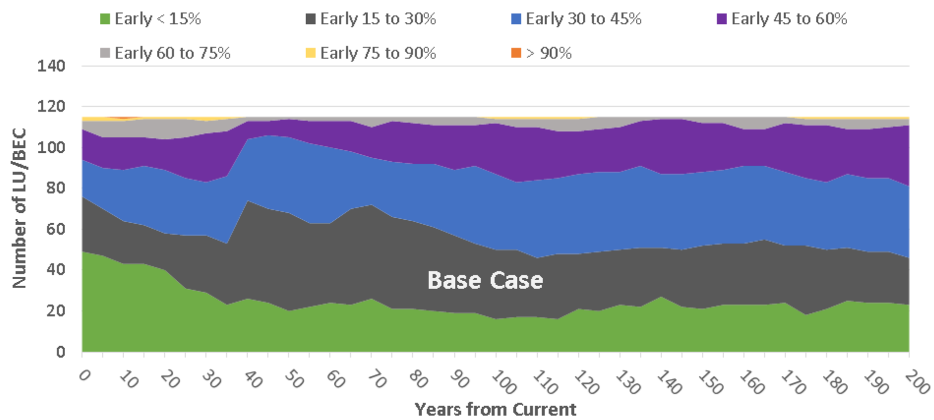


Figure 12 Early Seral Target Status by Number of LU/BEC Combinations

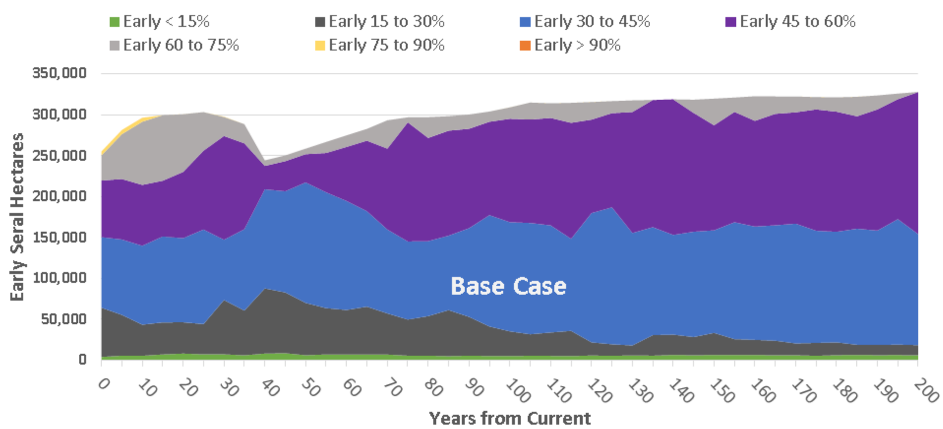


Figure 13 Early Seral Target Status by Area

3.2.1.4 Very Early Patch Size

All scenarios implemented target ranges for very early seral stage (age <20 years) by NDT, as per the guidelines in the Biodiversity Guidebook. The weights for these targets were set low so timber supply would not be unduly affected. However, a sensitivity analysis was completed – in conjunction with the Harvest Patch sensitivity – to increase the weight for the very early seral patch size targets.

Figure 14 to Figure 17 shows the patch size distributions for the Base Case and the Patch Emphasis runs for each of NDT2, NDT3a, NDT3b, and NDT4. The top two graphs in each figure show the proportion of each patch size by period throughout the planning horizon. The bottom graph provides the average and range for each patch size category over the entire planning period, relative to the target thresholds. In general, increasing the weight of the patch size targets improves the results. However, the desired distributions are still not achieved for all categories and periods.

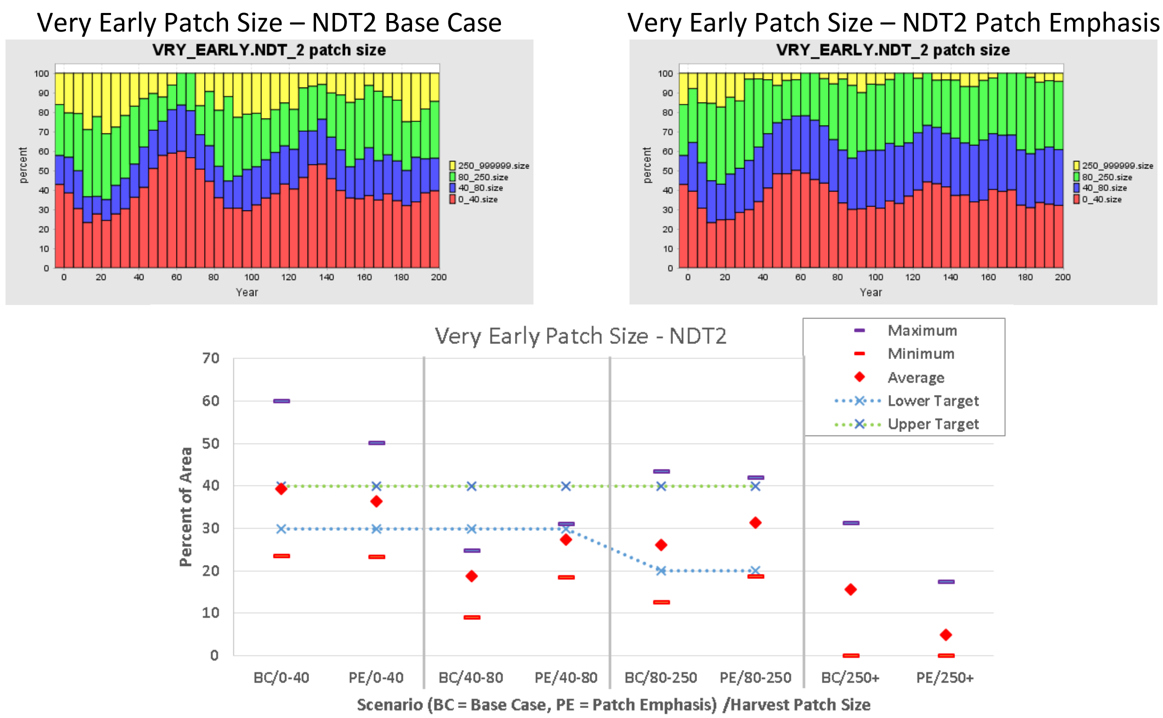


Figure 14 NDT2 - Very Early Seral Patch Size Distributions for the Base Case and Patch Emphasis Runs

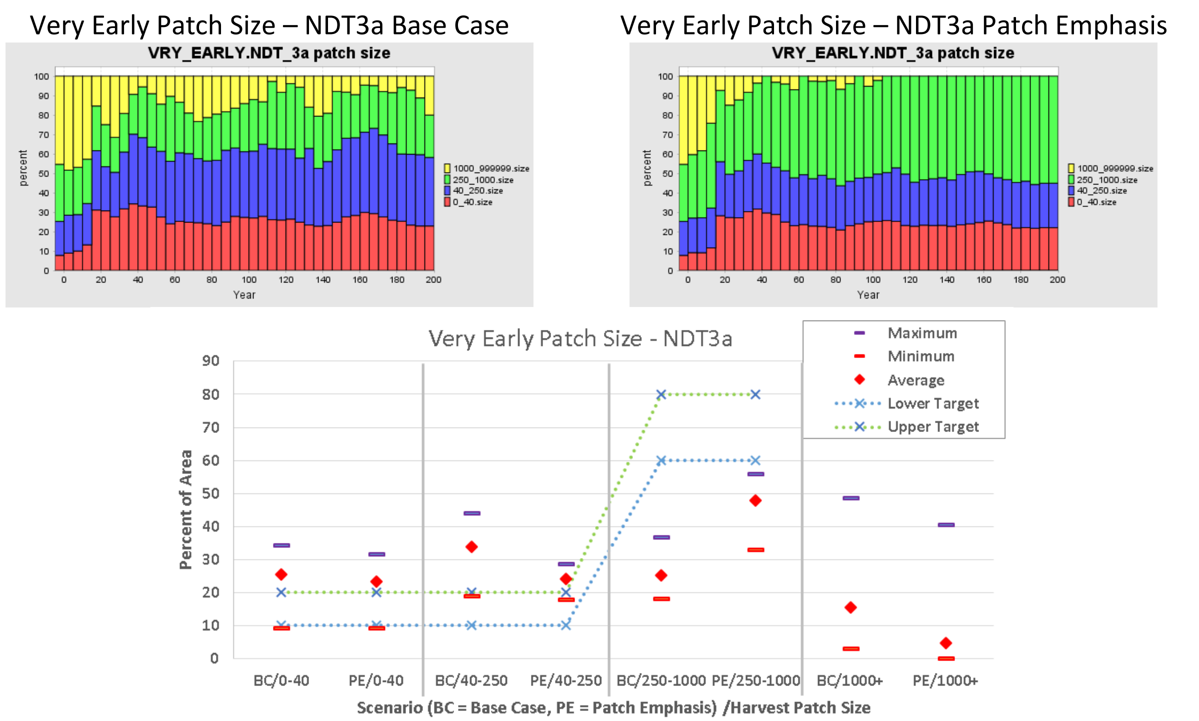


Figure 15 NDT3a - Very Early Seral Patch Size Distributions for the Base Case and Patch Emphasis Runs

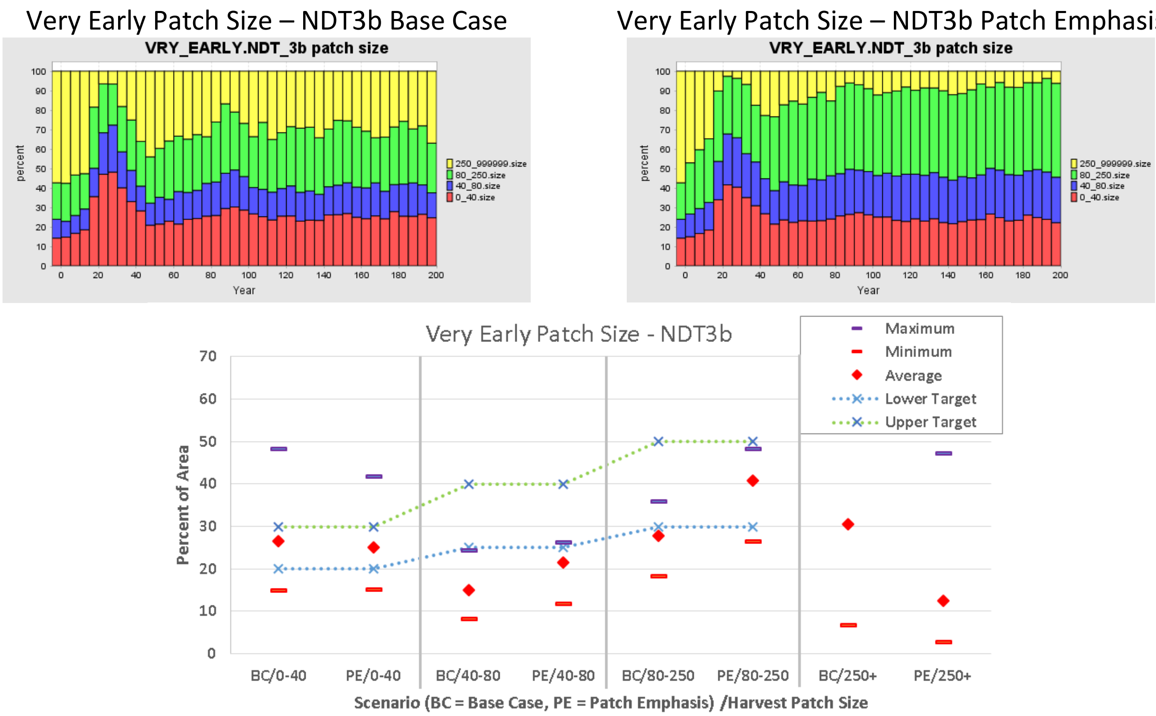


Figure 16 NDT3b - Very Early Seral Patch Size Distributions for the Base Case and Patch Emphasis Runs

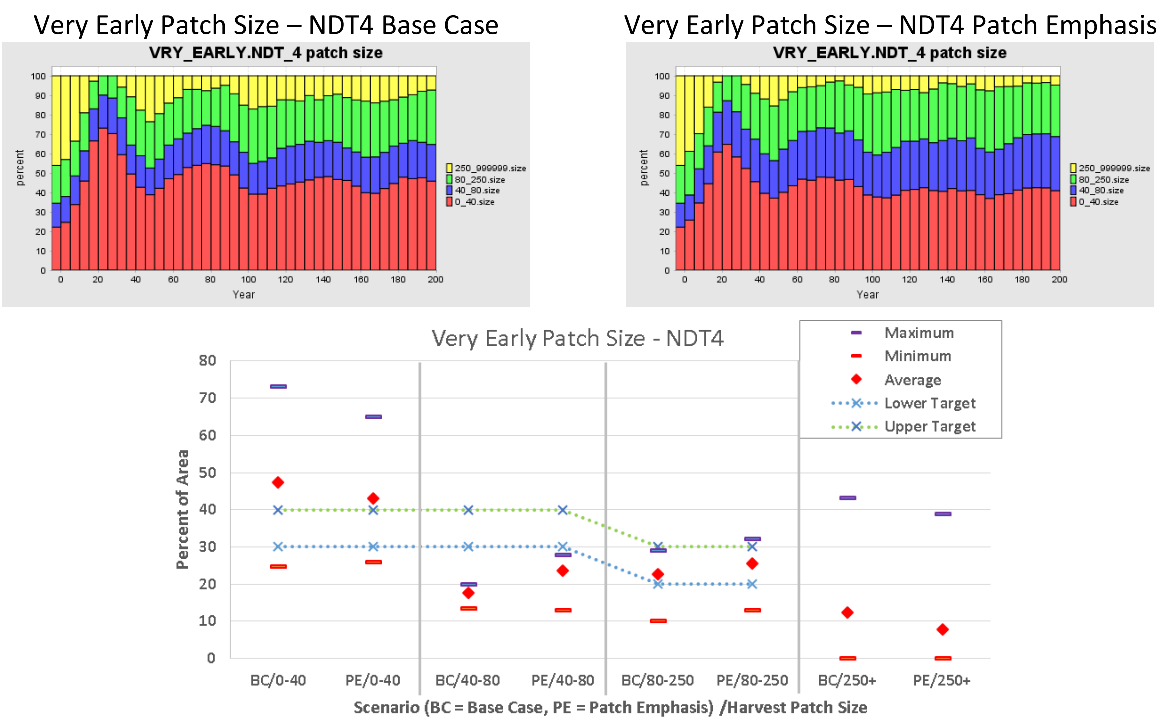


Figure 17 NDT4 - Very Early Seral Patch Size Distributions for the Base Case and Patch Emphasis Runs

3.2.1.5 Mature-Plus-Old Patch Size

There were no controls placed on the patch size distributions for mature-plus-old seral stage. However, the status was reported for each scenario so that results could be compared. For this report, the Base Case results are compared to the Mature-Plus-Old sensitivity (i.e., minimum targets on mature-plus-old seral). Figure 18 to Figure 21 show the patch size distributions for the Base Case and the Mature-Plus-Old sensitivity scenarios for each of NDT2, NDT3a, NDT3b, and NDT4. The top two graphs in each figure provides the proportion of each patch size by period throughout the planning horizon. The bottom graph provides the average and range for each patch size category relative to the targets.

Both NDT2 and NDT4 have patch size distributions that are not well aligned with the targets in the Biodiversity Guidebook. There is too much area in large patches, and not enough in small patches. This is likely the result of the spatial distribution of non-THLB on the landbase (i.e. large contiguous areas of non-THLB). In comparison, NDT3a has more area in small patches than desired, at the expense of larger patches. There is a slight improvement in the distributions when the model is configured to retain the mature-plus-old targets on the landbase. NDT3b has the best overall alignment of patch size distribution with the desired targets.

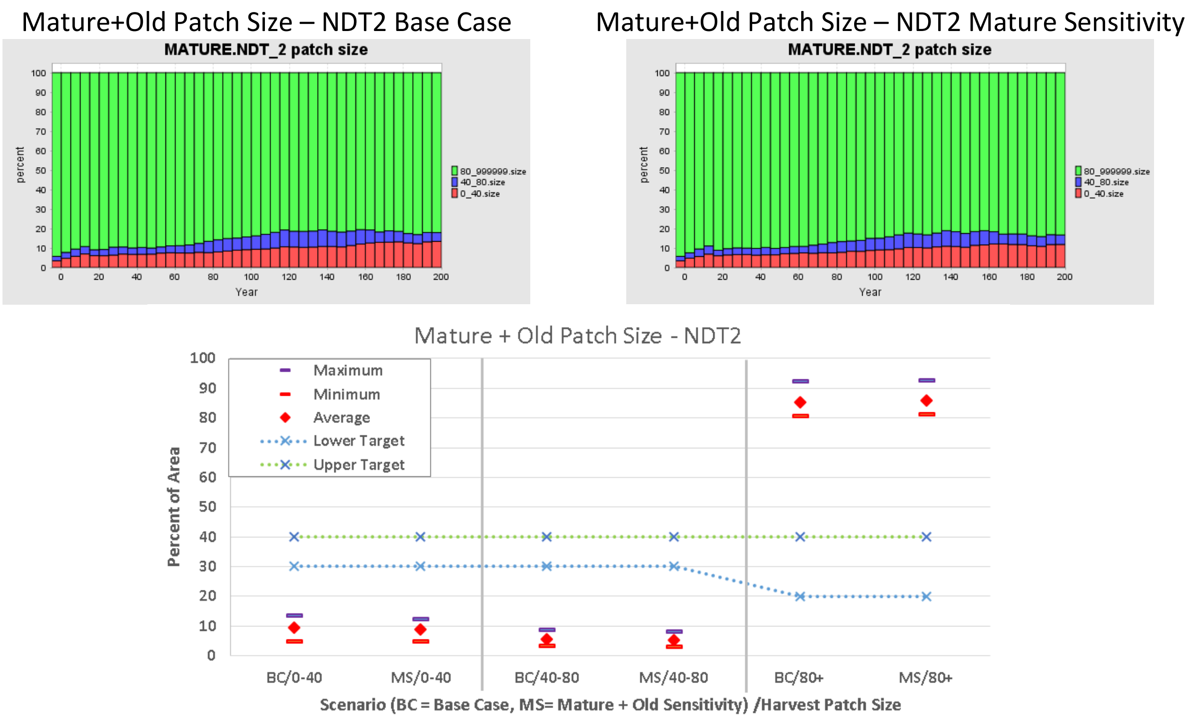


Figure 18 NDT2 - Mature + Old Seral Patch Size Distributions for the Base Case and Mature + Old Runs

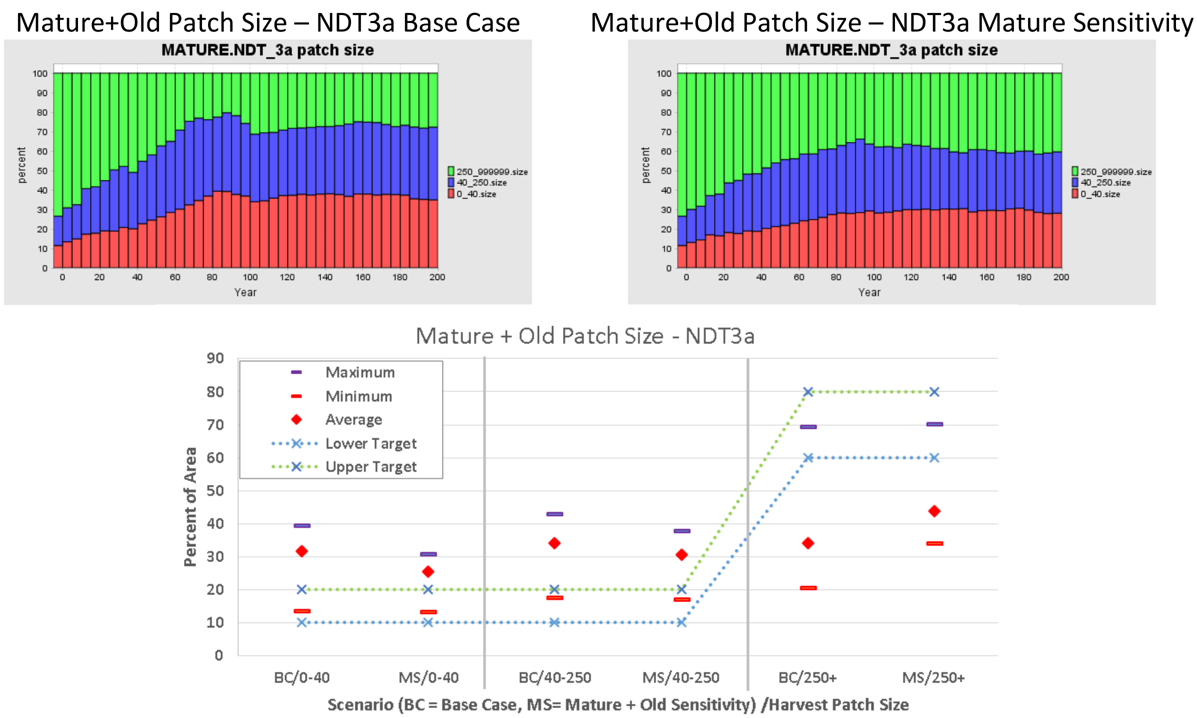


Figure 19 NDT3a - Mature + Old Seral Patch Size Distributions for the Base Case and Mature + Old Runs

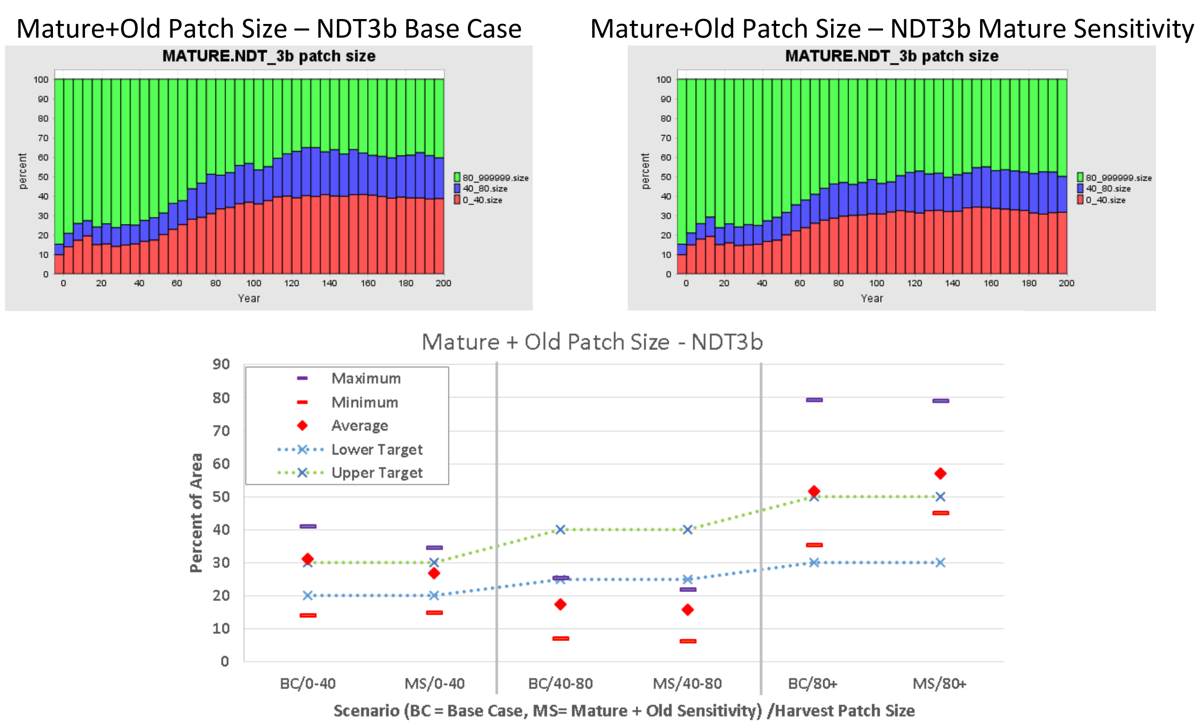


Figure 20 NDT3b - Mature + Old Seral Patch Size Distributions for the Base Case and Mature + Old Runs

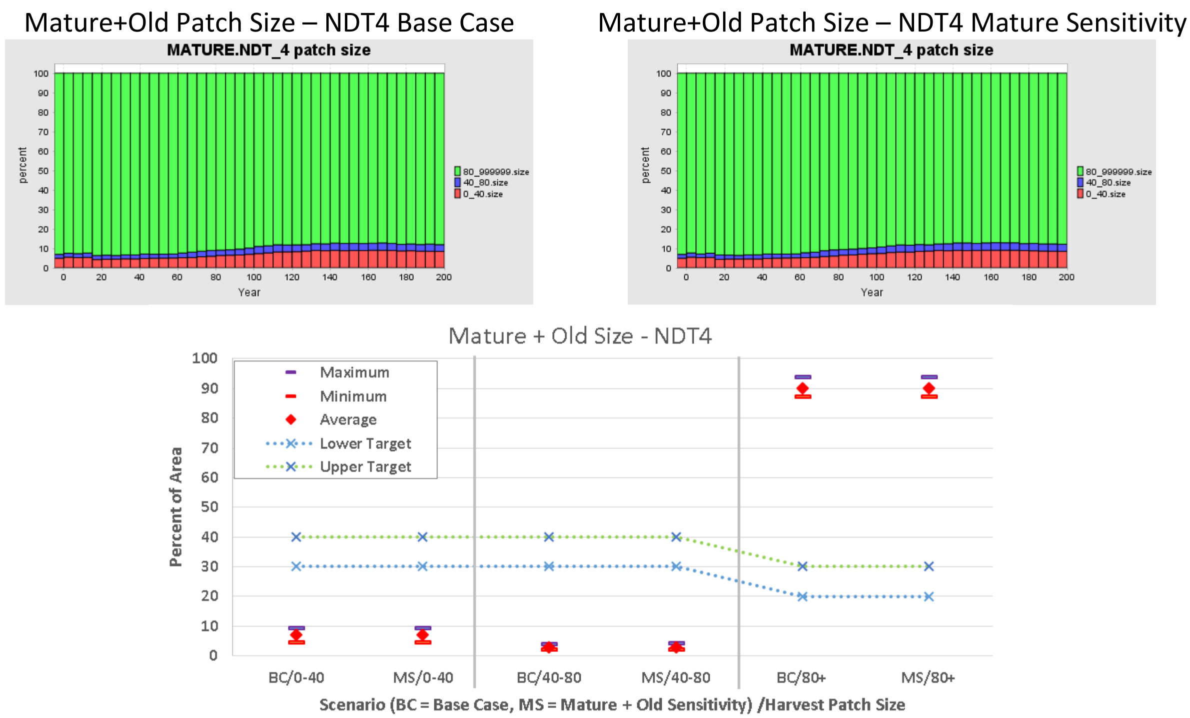


Figure 21 NDT4 - Mature + Old Seral Patch Size Distributions for the Base Case and Mature + Old Runs

3.2.2 Watershed Health

3.2.2.1 Community Watersheds

There are nine community watersheds in the Merritt TSA. The Patchworks model was configured to constrain these watersheds to a maximum of 30 percent for all scenarios. Figure 22 shows the ECA through time for the Base Case. Of the nine watersheds, three (Brook, Dillard, and Lee) had initial ECA values greater than the threshold. Lee recovers to below the threshold within 10 years, while Brook and Dillard take 20 years to recover.

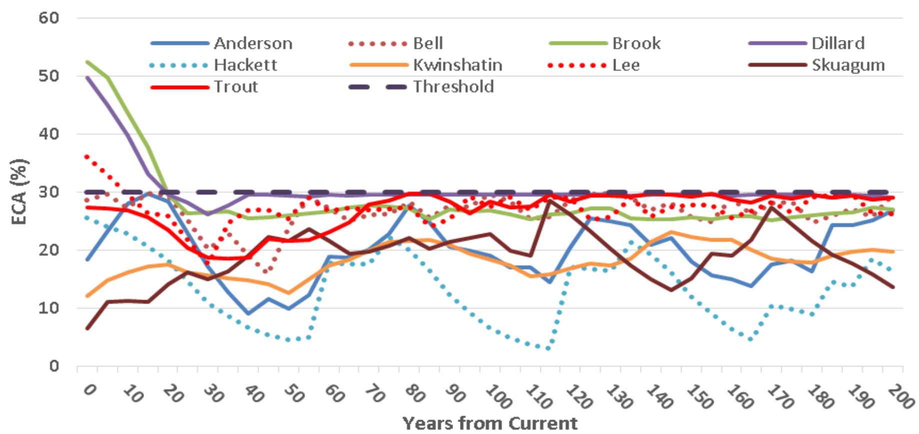


Figure 22 Community Watershed ECA for the Base Case

3.2.2.2 Fisheries Sensitive Watershed ECA

The proposed GAR order for Fisheries Sensitive Watersheds limits ECA to 25% above the snowline for sixteen watershed units. Figure 23 illustrates the ECA through time for the Base Case (watershed units are split into two charts). There are two units (Brook and East Upper Maka) that initially exceed the threshold. Several units (e.g. Juliet, July, Upper Maka, etc.) never approach the threshold, indicating that the threshold is not constraining. This is likely the result of non-forested area contributing to the gross watershed area, a low proportion of THLB relative to non-THLB, or the presence of other limiting constraints.

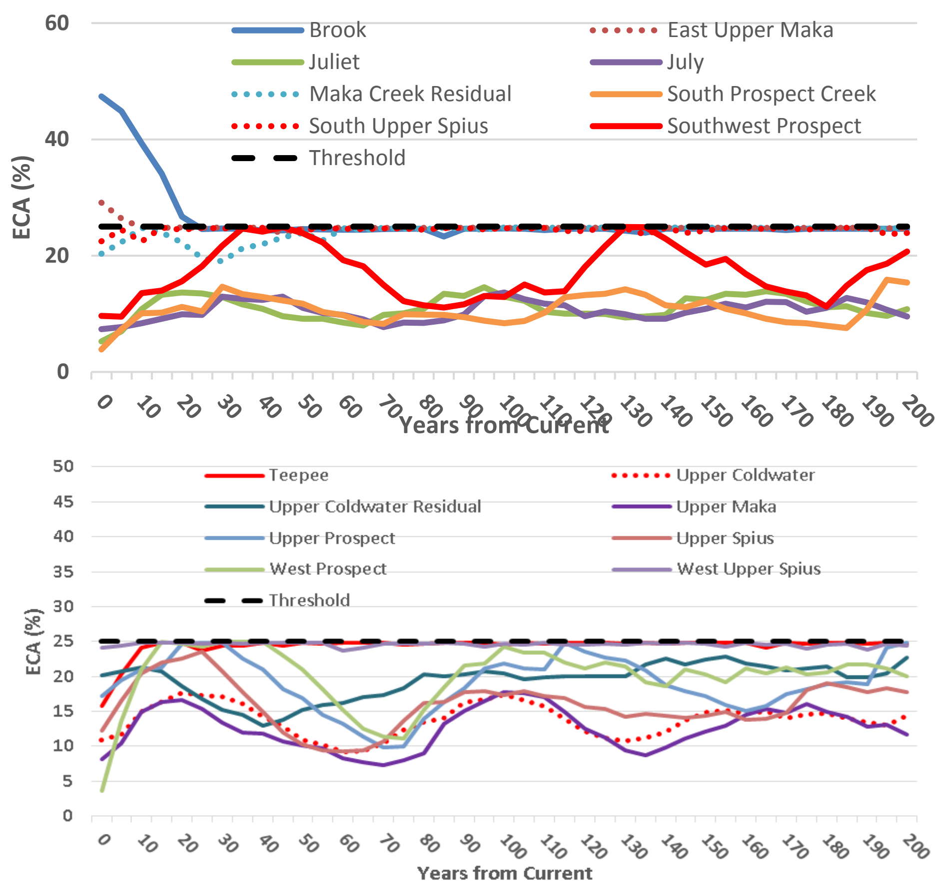


Figure 23 Fisheries Sensitive Watershed ECA for the Base Case

3.2.2.3 Fisheries Sensitive Watersheds Rate of Cut

The proposed GAR order for the Fisheries Sensitive Watersheds includes the requirement for a sustainable rate of cut within each watershed unit. While this was not modelled in the Base Case, a sensitivity analysis was completed to limit the area harvested per period in each unit within a specified range of the expected (based on average rotation age) area that could be harvested sustainably. For clearcut systems the allowable range was -10% to + 5%, and for partial cut systems it was -15% to +15%.

Figure 24 shows the number of FSW watershed units harvested that exceed the maximum sustainable rate of cut and compares the Base Case versus the sustainable rate of cut runs. Figure 25 shows the same comparison for the total clearcut area harvested. When the rate of cut constraint is implemented, the number of watersheds that exceed the maximum clearcut area each period is reduced substantially; reducing the area harvested greater than the maximum (averaging 0.6 hectares per year).

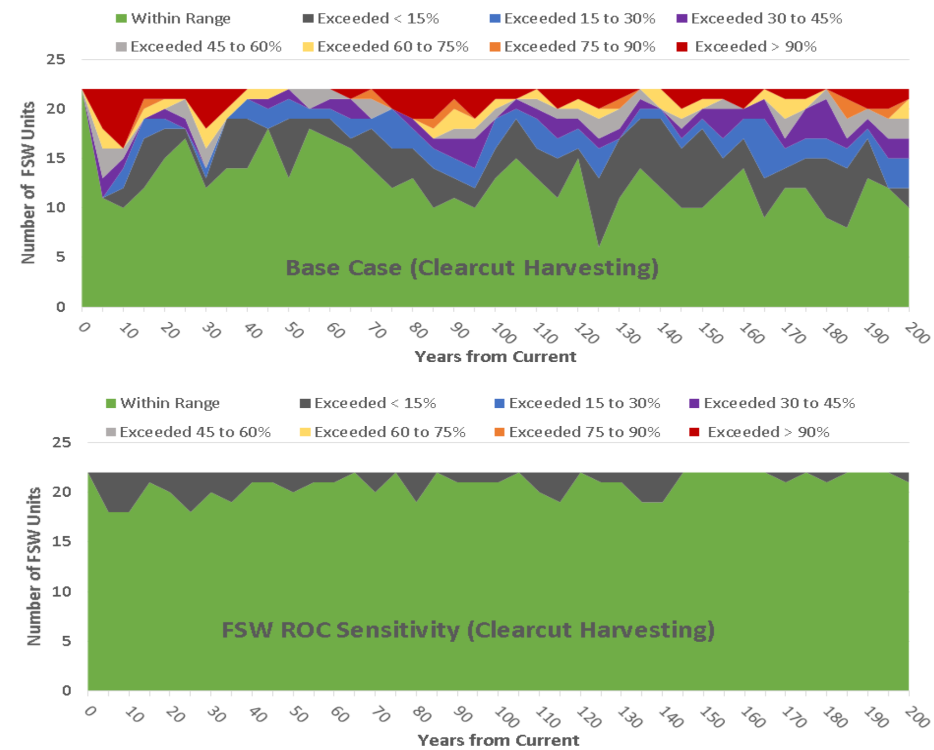


Figure 24 Number of FSW Units Exceeding Maximum Clearcut Sustainable Rate of Cut Area

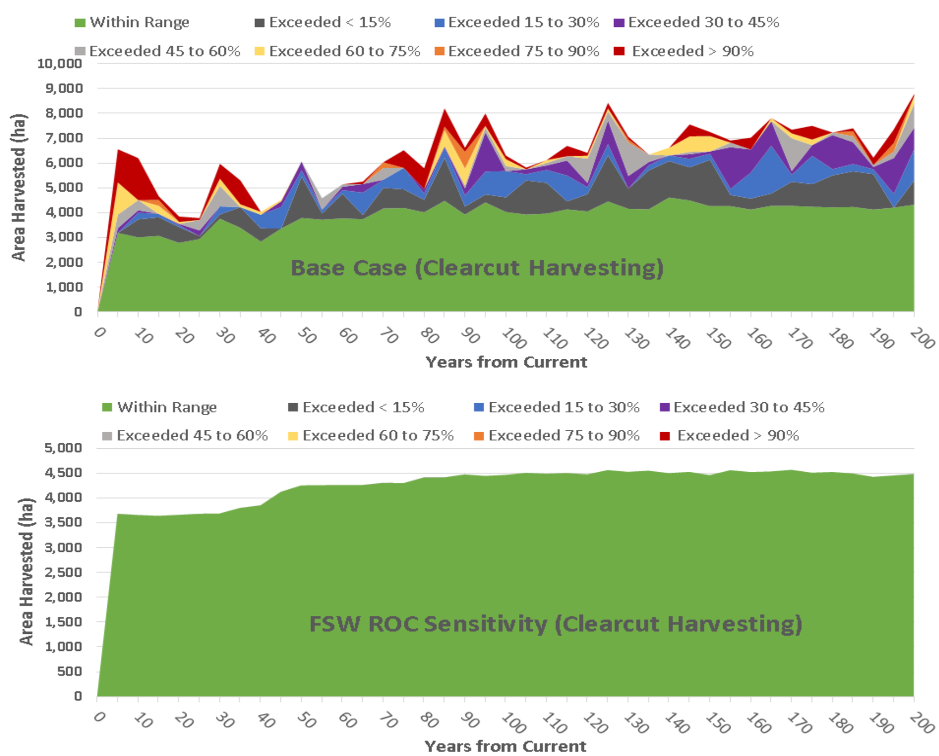


Figure 25 Clearcut Area Harvested within FSW Units by Sustainable ROC category

3.2.2.4 Cumulative Effects Watershed ECA

The ECA above the H40 and H60 snowlines was reported for a large number of cumulative effects assessment watersheds covering the majority of the TSA. Relative to defined targets, these were assessed as follows:

- 35% for units with a Low or Moderate hazard rating
- 25% for units with a High hazard rating

Figure 26 and Figure 27 show the Base Case results (number and area of watersheds by ECA category) for the High Hazard watersheds. Results for the Low/Moderate watersheds are shown in Figure 28 and Figure 29.

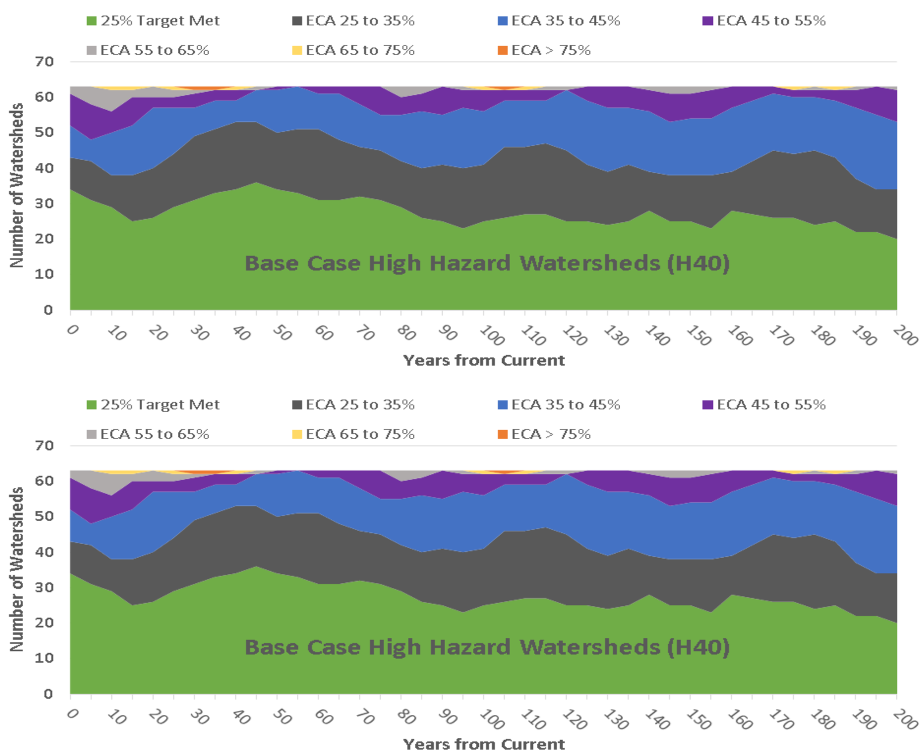


Figure 26 Number of High Hazard Watersheds by ECA Category and Snowline

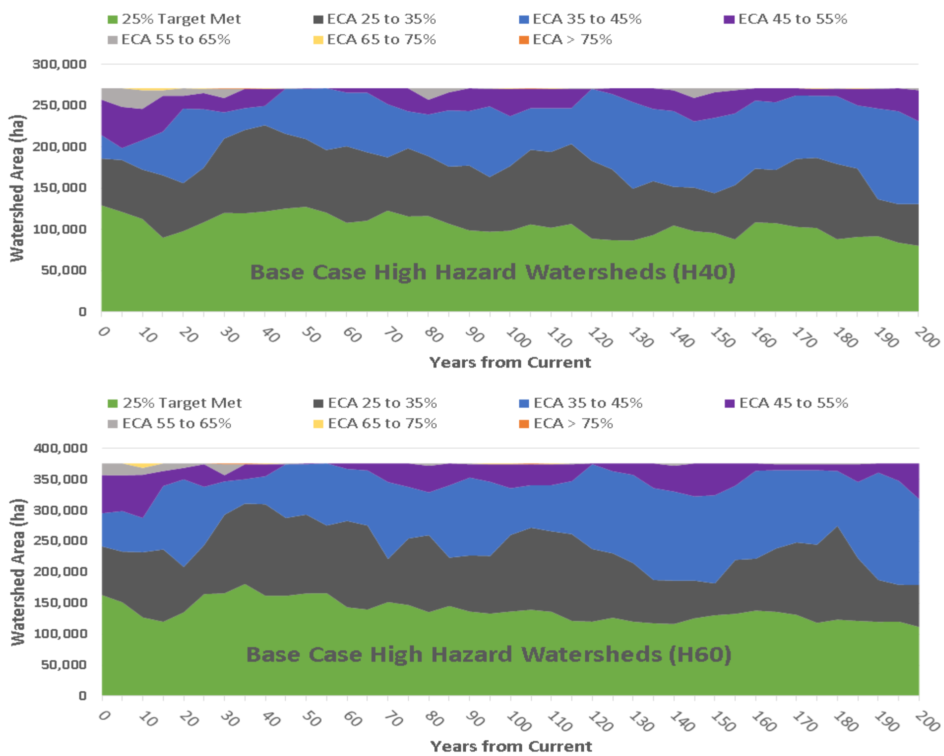


Figure 27 Area of High Hazard Watersheds by ECA Category and Snowline

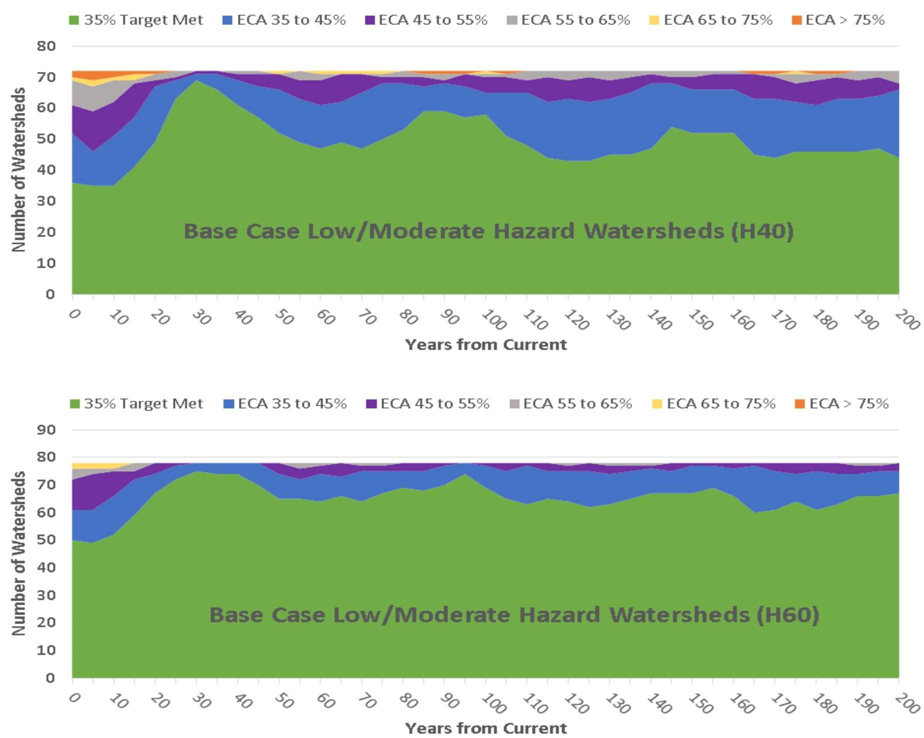


Figure 28 Number of Low/Moderate Hazard Watersheds by ECA Category and Snowline

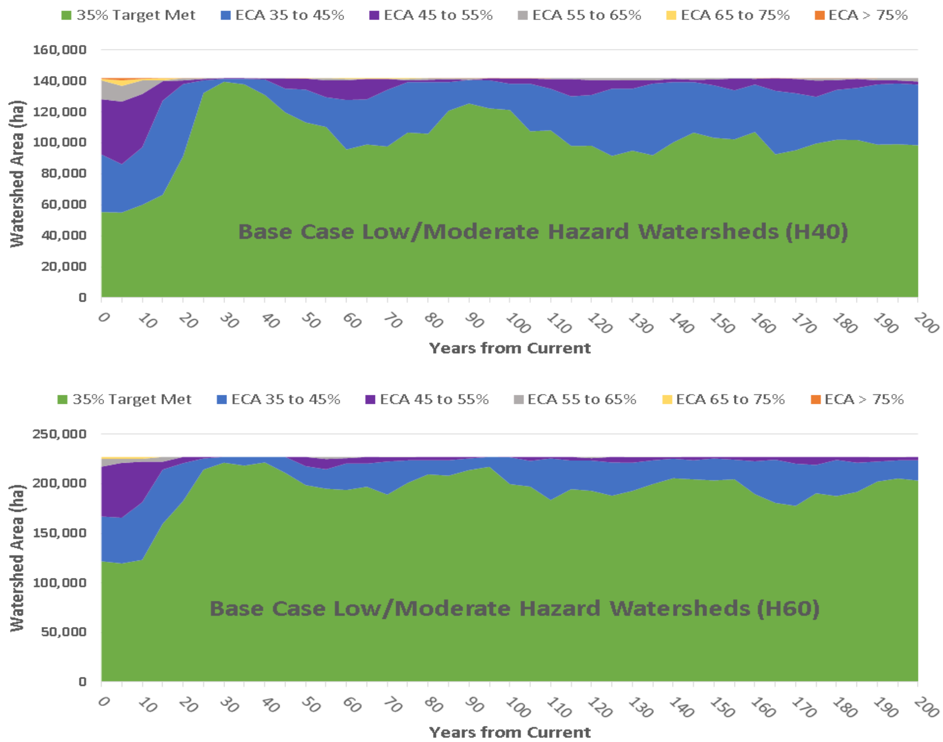


Figure 29 Area of Low/Moderate Hazard Watersheds by ECA Category and Snowline

3.2.3 Wildlife

3.2.3.1 Coastal Tailed Frog

THLB reductions were applied for Coastal Tailed Frog (CTF) wildlife habitat areas and point buffers. In addition, ECAs were monitored for a large number of watershed units (large watersheds, watersheds, basins, sub-basins and residuals), relative to a non-legal 25% threshold. Figure 30 shows the number of these units and their status relative to the threshold for the Base Case, and Figure 31 shows the area by status. Note that there is overlap in some of the units, so the actual CTF watershed area will be less than that shown in the figure. In the Base Case, a significant number and area of CTF watershed units exceed the 25% ECA.

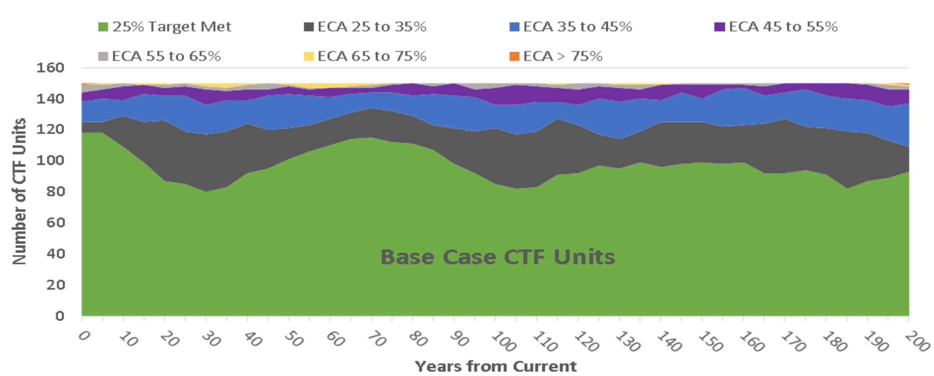


Figure 30 Number of Coastal Tailed Frog watershed units by status for the Base Case

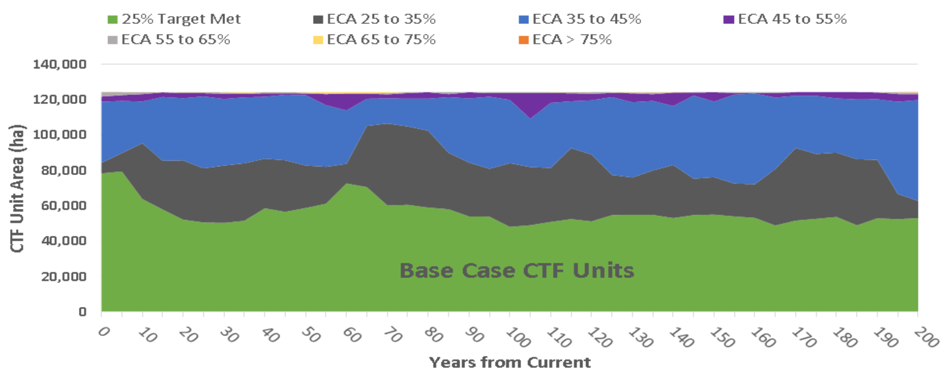


Figure 31 Area of Coastal Tailed Frog watershed units by status for the Base Case

3.2.3.2 Moose Winter Range

All scenarios implemented a minimum threshold of 15% of early seral (< 25 years of IDF/ICH and <35 years for MS/ESSF). Figure 32 shows the status of this constraint for the Base Case. This requirement is easily met throughout the planning horizon.

In addition, the status of cover (stands >= 16 metres in height) was monitored as follows:

- Area of cover within the moose polygon
- Area of cover within 200 metres of riparian features within the moose polygon
- Amount of cover in patches greater >= 20 hectares.

Figure 33 provides an overview of the cover status within the moose polygon. In summary, the area of moose cover averages about 247,000 hectares (47%) for the first 70 years, before declining to a long-term level of about 189,000hectares (37%). A significant proportion (> 75%) of the cover is located within 200 metres of riparian features and the majority (>90%) is in patches >= 20 hectares.

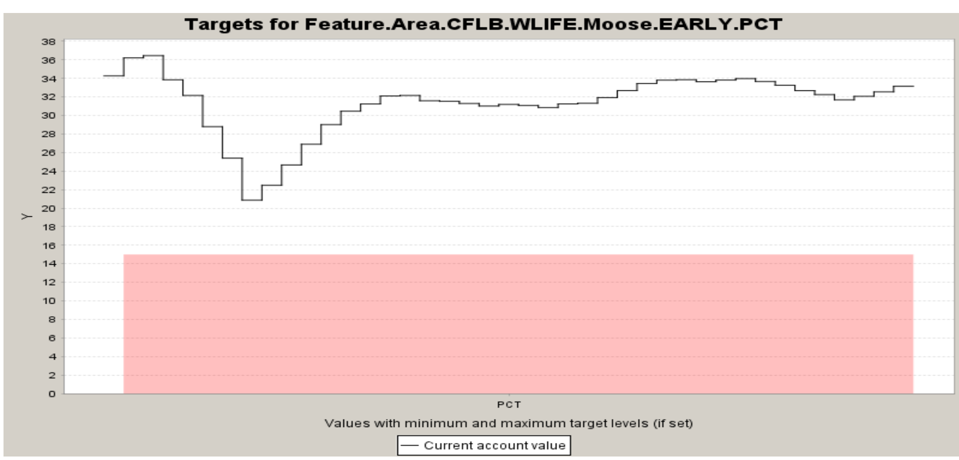
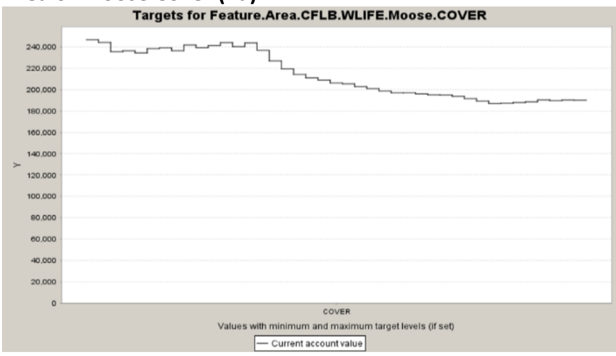
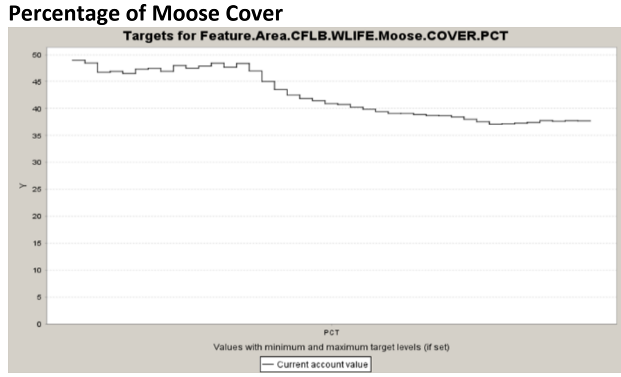


Figure 32 Moose Early Seral status for the Base Case

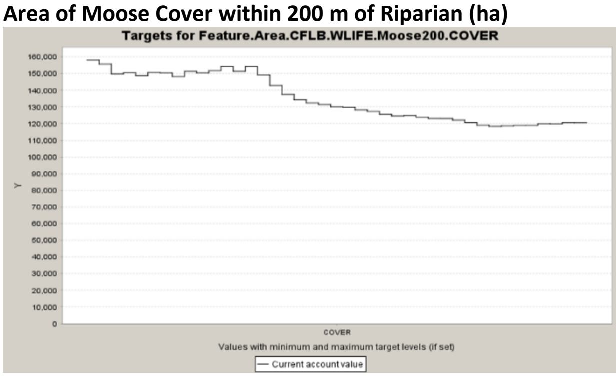
Area of Moose Cover (ha)



Percentage of Moose Cover



Area of Moose Cover within 200 m of Riparian (ha)



Moose Cover Patch Size

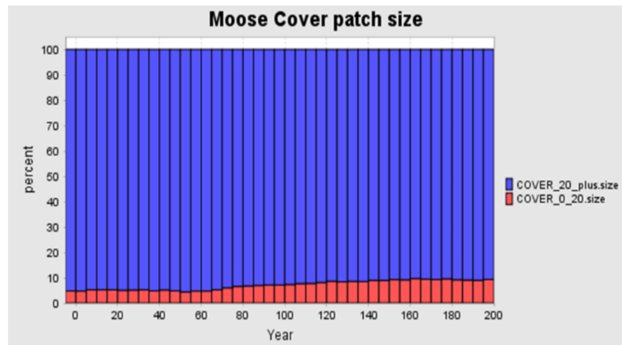


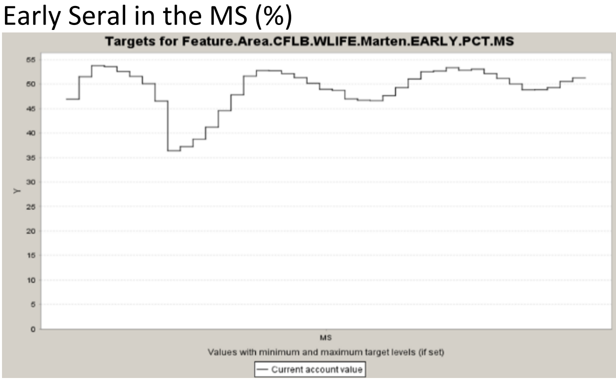
Figure 33 Moose Cover Status for the Base Case

3.2.3.3 Marten Habitat

To provide insight into marten habitat through time, the Base Case reported the amount of early seral in the MS and ESSF zones, and the amount of mature-plus-old seral in the CWHms, ESSFdc, ESSFdcw, ESSFxc, ESSFmw, and ESSFmww subzones. No thresholds were set at this time.

Figure 34 illustrates the status of early seral in the MS and ESSF zones for the Base Case. There is a cyclical pattern over time, and that overall, there is more early seral in the MS zone. Figure 35 illustrates the status of mature-plus-old seral within the subzones identified as marten habitat for the Base Case. In general, the amount of mature-plus-old falls through time, with most subzones remaining above 35% during all periods. The exceptions to this occur in the ESSFdc where the amount of mature-plus-old seral drops to approximately 20%, while the ESSFxc drops very abruptly to about 12%.

Early Seral in the MS (%)



Early Seral in the ESSF (%)

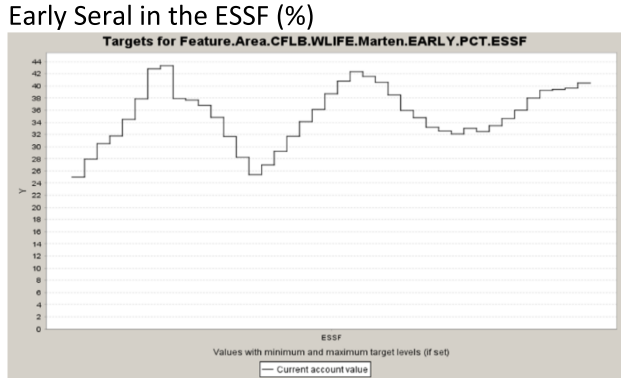
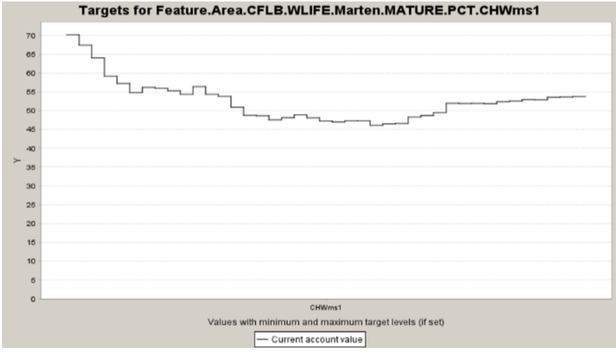
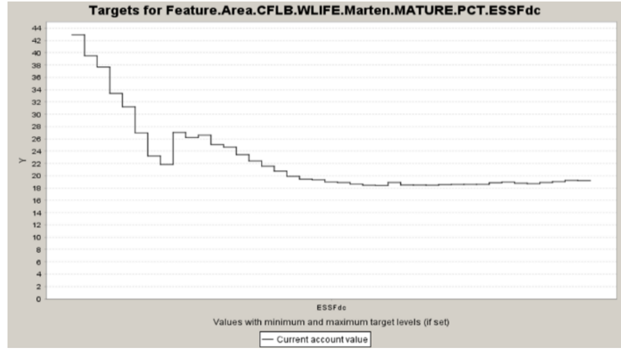


Figure 34 Marten Habitat - Early Seral Status by BEC Zone for the Base Case

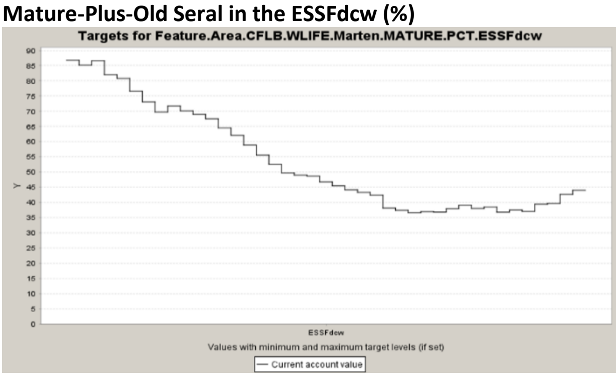
Mature-Plus-Old Seral in the CWHms1 (%)



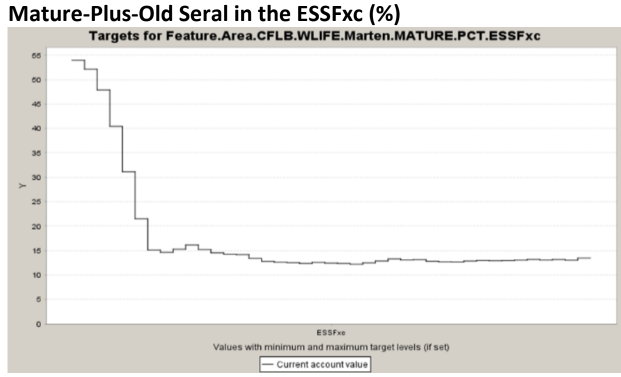
Mature-Plus-Old Seral in the ESSFdc (%)



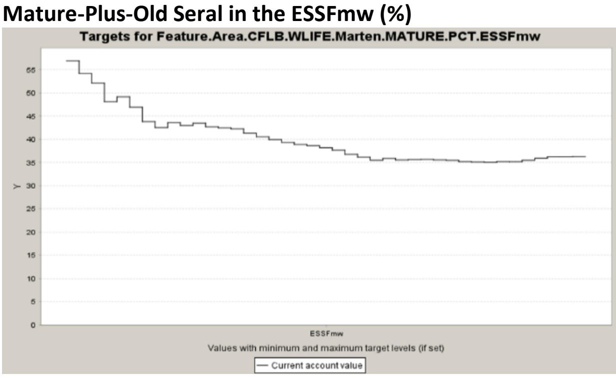
Mature-Plus-Old Seral in the ESSFdcw (%)



Mature-Plus-Old Seral in the ESSFxc (%)



Mature-Plus-Old Seral in the ESSFmw (%)



Mature-Plus-Old Seral in the ESSFmww (%)

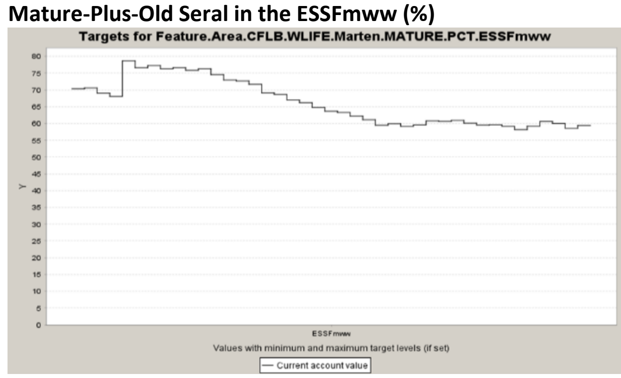


Figure 35 Marten Habitat – Mature-Plus-Old Seral Status by BEC Variant for the Base Case

3.2.4 Other

3.2.4.1 Visual Quality Objectives (VQO)

Disturbance limits were applied to individual visual polygons according to their recommended visual quality objective. As the Patchworks model makes trade-offs between the various objectives over the landbase, thresholds for some individual polygons may occasionally be slightly exceeded. No significant difference is expected in the status of VQOs between the various scenarios. Figure 36 provides examples of the status of individual Partial Retention and Retention VQO polygons for the Base Case and Old Seral Sensitivity. Although there minor differences between the scenarios, the constraints are met in both cases. These examples also illustrate that the VQO requirements are initially exceeded due to past harvesting and/or MPB on the landbase.

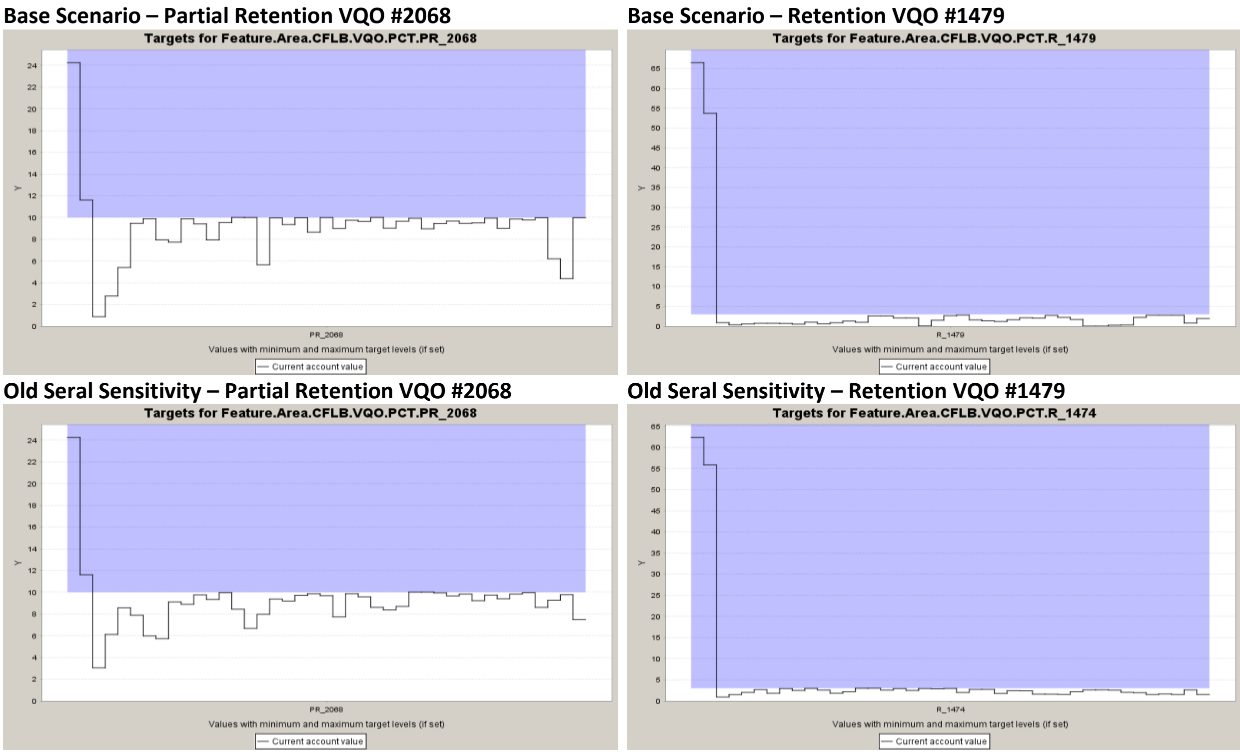


Figure 36 Examples of selected VQO polygon status for the Base Case (top) and Old Seral Sensitivity (bottom)

3.2.4.2 Harvest Opening Size

The Base Case implemented harvest opening size targets as shown in Table 4.

Table 4 Harvest Opening Size Criteria

Patch Size (ha)	Clearcut Targets	Partial Cut Targets
0-5	0 to 5%	0 to 5%
5-20	5 to 50%	10 to 50%
20-100	10 to 70%	10 to 80%
100+	0 to 10%	0 to 15%

Relatively low weights were set for these targets so that the harvest flows would not be unduly constrained. A sensitivity analysis was also completed that increased the weight for the 0 to 5 hectare harvest patches so that fewer of these would be created. Figure 37 provides an overview of the achieved clearcut harvest opening sizes for the Base Case and the patch emphasis runs, and Figure 38 shows the achieved partial cut harvest opening sizes. The top two graphs in each figure provides the proportion of each patch size by period throughout the planning horizon. The bottom graph provides the average and range for each patch size category relative to the targets.

With low weights on opening size (Base Case), the model creates more 0 to 5 hectare blocks than desired, particularly in the case of selection harvesting. When the weighting on the 0 to 5 hectare blocks is increased, there is a significant reduction in small blocks without a significant impact on timber supply (see Section 3.1). For partial cutting, there are also some periods with a higher proportion of 5 to

20 hectare blocks than desired. A possible explanation for the tendency to create smaller partial blocks is that the process used during data preparation did not result in large contiguous areas identified for partial cutting.

Clearcut Patch Size – Base Case

Clearcut Patch Size –Patch Emphasis

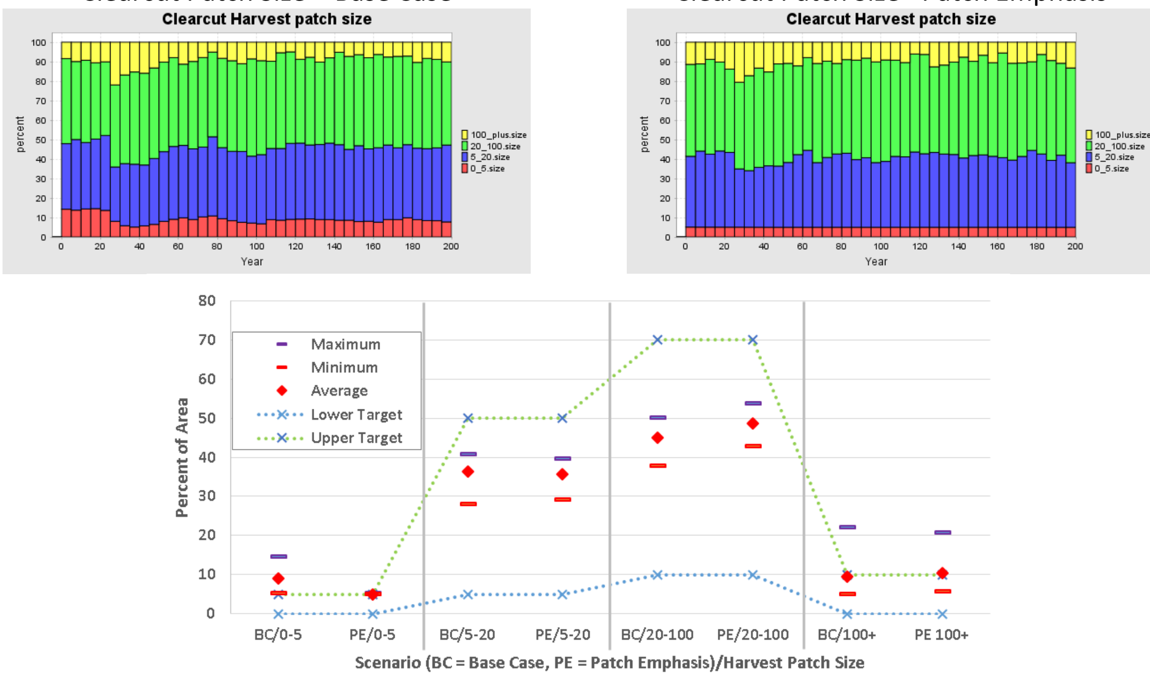


Figure 37 Clearcut Harvest Opening Size Distribution for the Base Case and Patch Emphasis Runs

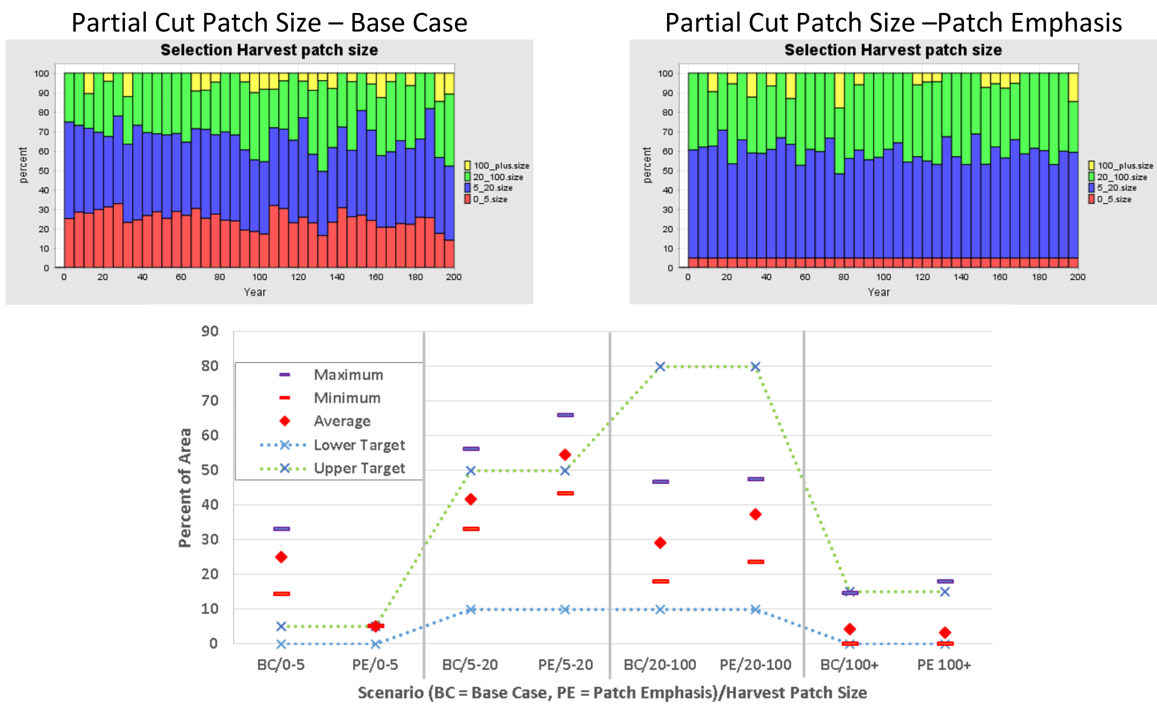


Figure 38 Partial Cut Harvest Opening Size Distribution for the Base Case and Patch Emphasis Runs

3.2.4.3 Adjacency Constraints

Rather than using the patch capabilities of Patchworks to control harvest opening sizes, a sensitivity analysis was completed that applied the standard TSR approach for modelling adjacency. This sensitivity constrained the proportion of THLB area below 3 metres tall within a cumulative effects watershed to a maximum of 33%. Figure 39 show the clearcut harvest opening size distributions for the Base Case and the TSR adjacency sensitivity. The top two graphs in the figure provides the proportion of each patch size by period throughout the planning horizon. The bottom graph provides the average and range for each patch size category relative to the targets. Turning off harvest opening size control and implementing the TSR approach has very little effect on the harvest opening sizes that are created.

Figure 40 illustrates the number of watershed units by their status relative to meeting the TSR adjacency constraints for the Base Case and for the TSR Adjacency scenario, and Figure 41 provides the area by status relative to the TSR adjacency constraints. It can be concluded that the TSR adjacency does not constrain the harvest forecast very much; most units are within the desired threshold even when the constraint is not active (i.e., Base Case).

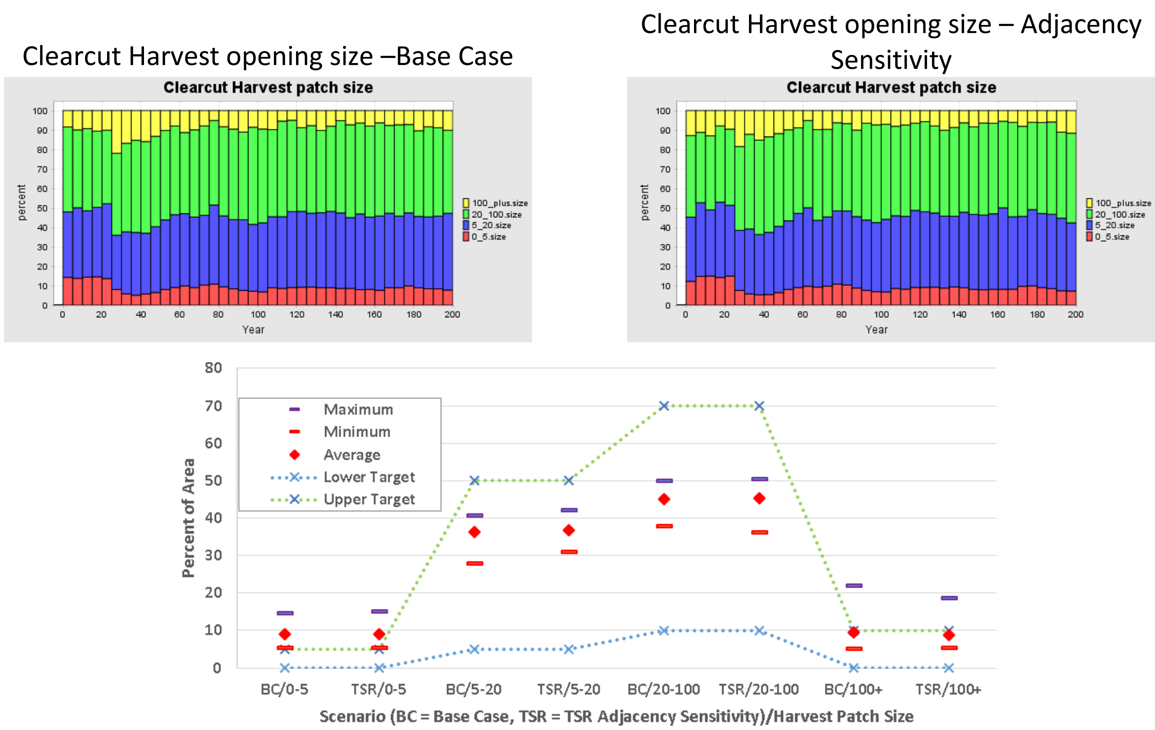


Figure 39 Clearcut Harvest opening size Distribution for the Base Case and TSR Adjacency scenarios

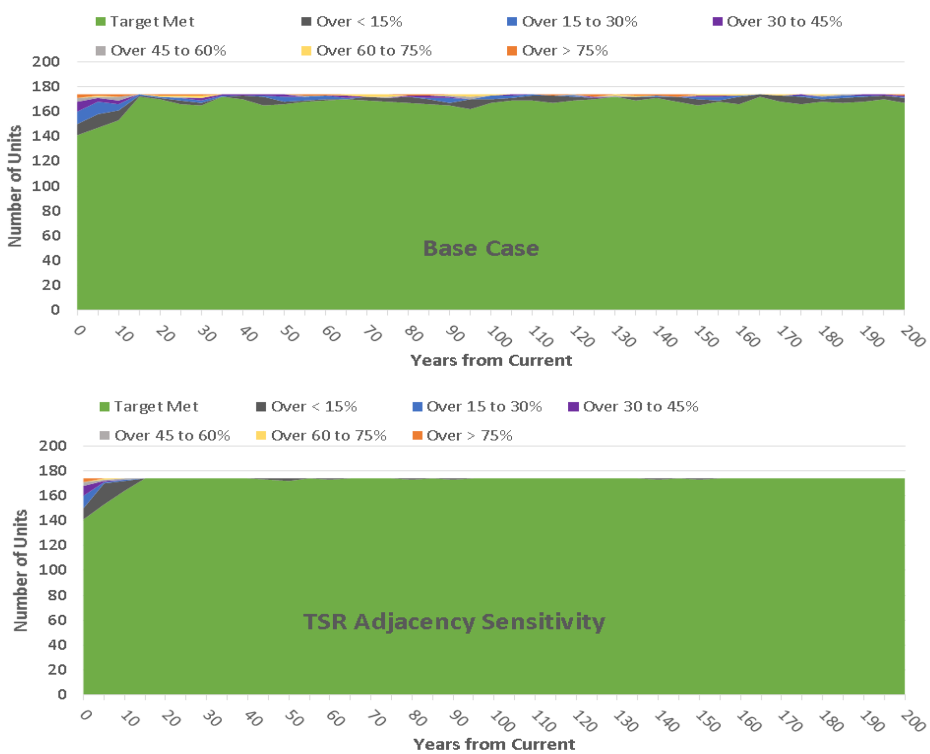


Figure 40 Number of CE Watershed Units by TSR Greenup Status

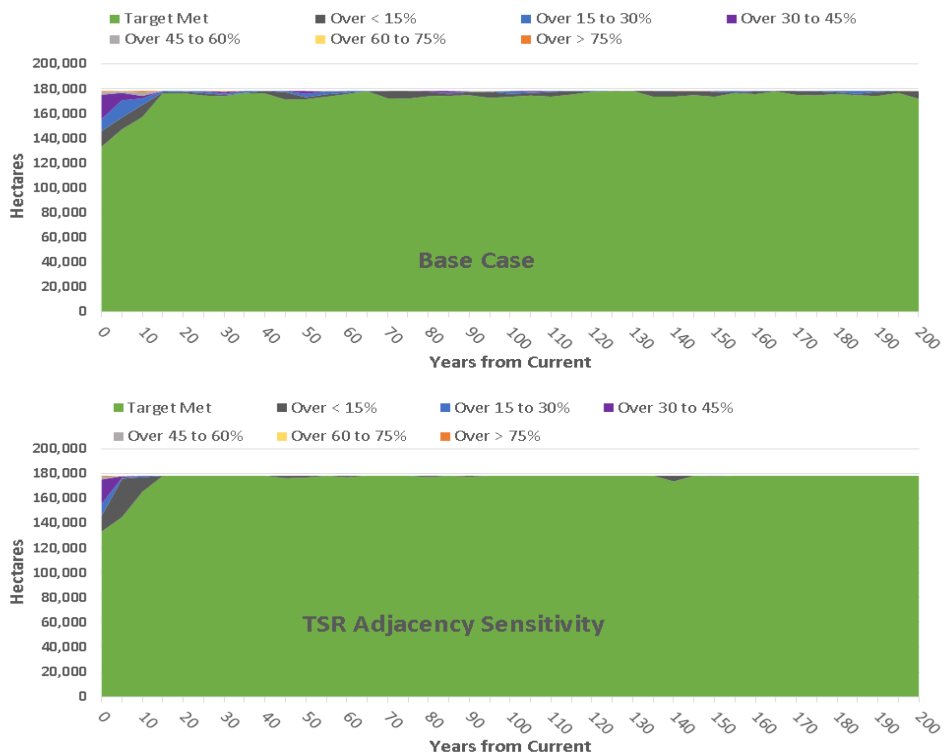


Figure 41 Area of CE Watershed Units by TSR Greenup Status

3.2.4.4 Contiguous Mature Pine

A sensitivity analysis was completed that applied limits on the area of mature-plus-old, pine-leading stands in larger patch sizes for the NDT3a, NDT3b, and NDT4 zones. This resulted in very little impact on timber supply (see Section 3.1), since the target weights for the pine-leading patch size targets were set relatively low. This section compares the patch size distributions of mature-plus-old leading pine for the Base Case with the sensitivity analysis. Figure 42 to Figure 44 show the patch size distributions for the Base Case and the Pine Patch Size sensitivity scenarios for each of NDT3a, NDT3b, and NDT4. The top two graphs in each figure provides the proportion of each patch size by period throughout the planning horizon. The bottom graph provides the average and range for each patch size category relative to the targets.

There is very little difference between the Base Case and the pine-leading patch runs. While it is possible that this could change if the weight for this target was increased, this could result in an undesirable impact on timber supply.

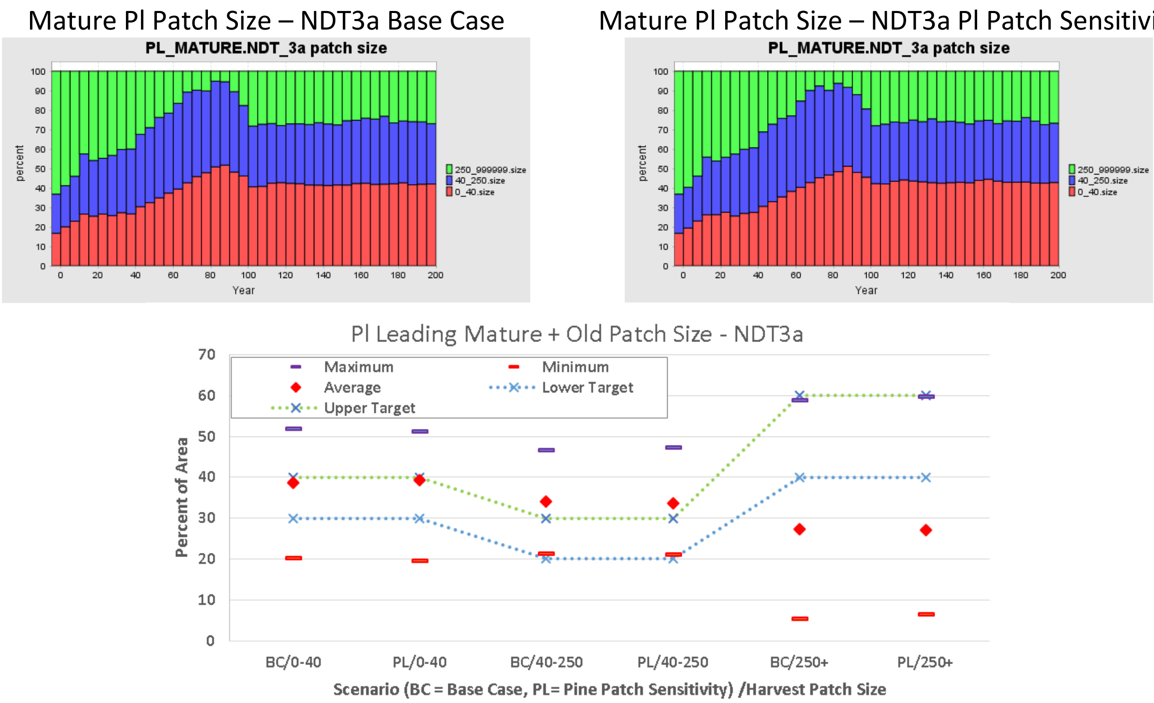


Figure 42 NDT3a - Mature + Old Pine-Leading Patch Size Distributions for the Base Case and Pl Patch Runs

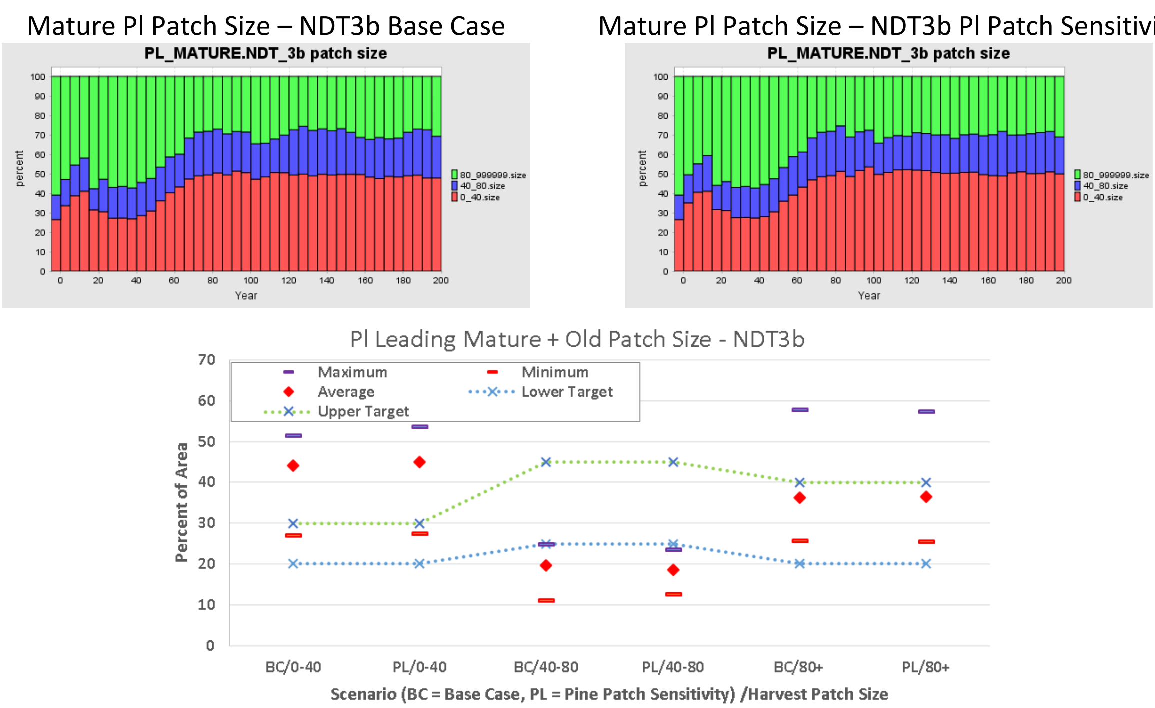


Figure 43 NDT3b - Mature + Old Pine-Leading Patch Size Distributions for the Base Case and Pl Patch Runs

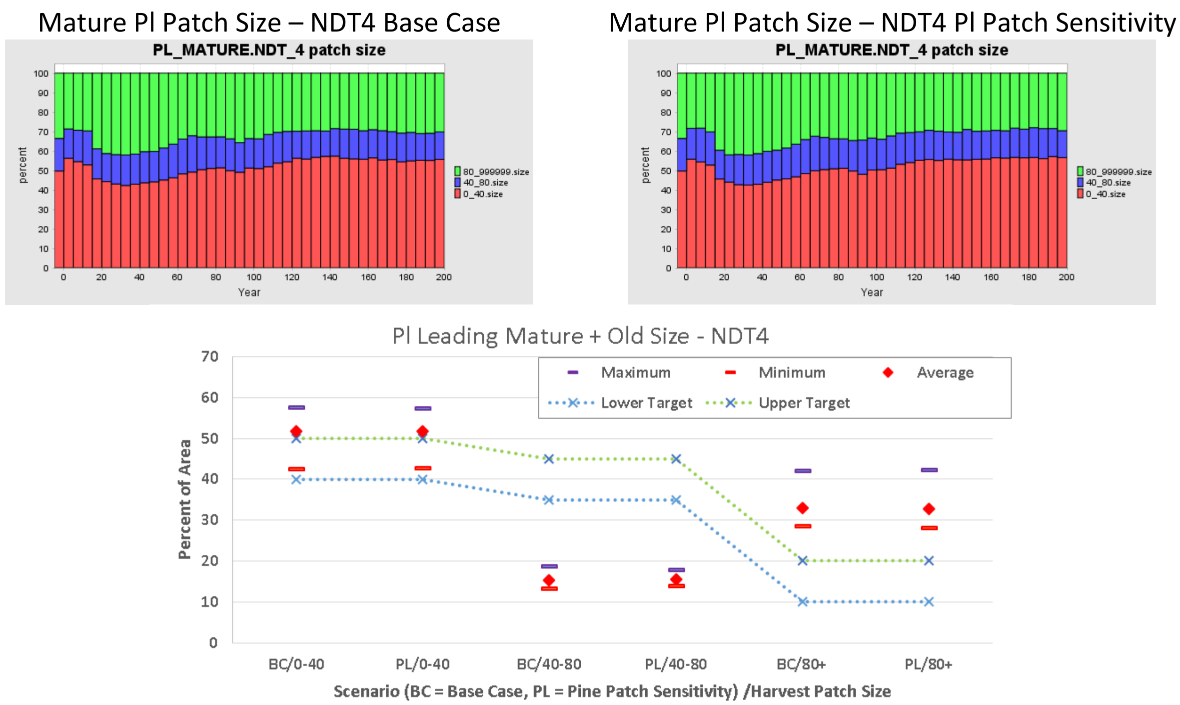


Figure 44 NDT4 - Mature + Old Pine-Leading Patch Size Distributions for the Base Case and Pl Patch Runs

3.3 Base Case Discussion

The ISS Base Case has a THLB area that is approximately 2.5% lower than the TSR Benchmark. This, along with other differences, results in a long-term harvest level that is about 0.9% lower than the TSR Benchmark. The short-term harvest level is about 2.5% higher than the TSR Benchmark, most likely because of the decision to use a different transition to the long-term harvest levels.

Although various sensitivity analyses were completed (Table 5), only three resulted in significant impacts to timber supply:

- Old seral requirements: 4.5% reduction short-term, 1.7% reduction long-term
- Mature-plus-old seral requirements: 2.4% reduction short-term, 1.3% reduction long-term
- Enhanced small stream reserves: 1.3% reduction short-term, 0.7% reduction long-term

Patch size criteria were used to influence both the harvest opening size and very early seral patch size, but the relatively low weights used for these targets did not result in these targets being fully met. A sensitivity analyses investigated the effect of increasing the patch size weights to:

- Significantly reduce the number of very small cutblocks; and
- Slightly increase the emphasis on meeting the very early seral patch size distributions

These adjustments did not result in a significant impact on timber supply, indicating that they may be desirable to include in future scenarios.

Table 5 Sensitivity Analysis Results

Tactic	Description	Result
Old Seral Requirements	Requirement to meet the hectare targets for old seral as per the Non-Spatial Old Growth Order	Significant impact (4.5%) on short-term timber supply, 1.7% impact on long-term timber supply.
Mature-plus-old Seral Requirements	Requirement to meet the mature-plus-old seral targets as per the biodiversity guidebook	2.4% impact on short-term timber supply, 1.3% impact on long-term timber supply
TSR adjacency	Requirement to limit area below 3 metres tall to a maximum of 33% within a cumulative effects watershed, instead of implementing patch size targets	No impact on timber supply. Very little difference in cutblock size distribution.
FSW rate of cut	Implement a sustainable rate of cut within all Fisheries Sensitive Watershed units.	Very little impact on timber supply. Temporal redistribution of harvest within FSW units so that area harvested period to period is more uniform.
Enhanced small stream riparian reserves.	Implement a 10 metre reserve on all small streams.	10,904 hectare reduction to THLB. Would be greater if there weren't already enhanced buffers within the Nicola temperature sensitive stream watershed. 1.3% reduction in short-term timber supply, 0.7% reduction in long-term harvest levels.
Reduce contiguous areas of mature pine-leading stands	Use patch targets to limit the amount of large contiguous mature pine-leading patches.	Very little difference in timber supply or patch size distribution of mature pine-leading stands. Results might change if patch size weights are increased.
Patch Emphasis	Increase the patch size weights to limit the area within small cutblocks, and to encourage creation of very early seral (<20 year) patches consistent with targets.	Very little impact to timber supply. Significant reduction in small cutblocks. Small improvement in early seral patch size relative to targets (weight still relatively low so timber supply won't be unduly impacted.

4 Reserve Scenario

4.1 Description

The Reserves scenario was designed to address the question, “Where and how should we reserve forested stands to address landscape-level biodiversity and non-timber values while, wherever possible, minimizing impacts to the working forest?” The underlying purpose of this scenario was to explore ways to maintain the harvestable area while providing for the full range of values on the landbase. This tactic was approached by maximizing relative scores assigned across the landbase for old forests, patch size, and interior old forest.

Results are not intended to be applied as reserves in an operational sense. Rather, these candidate reserves provide additional information – as starting point – for revising existing reserves or developing recruitment strategies; involving a collaborative planning team to review one landscape unit at a time.

We recognize that we currently do not have full information regarding First Nations values. While tactics to address specific First Nations values may not be directly modelled in this Reserve Scenario, they are considered within other scenarios where appropriate information is available. We will continue to work with First Nations to understand and incorporate their values into the Reserve and other Scenarios as information becomes available.

4.2 Results

4.2.1 Initial Assessment

An initial assessment of the landbase indicated that only three of the twelve landscape units have sufficient NHLB area that meet the old seral forest targets (Figure 45 – Coldwater, Spius, Tulameen). Consequently, to meet the old seral requirements, the model occasionally had to select old seral stands from THLB or mature areas (NHLB or THLB).

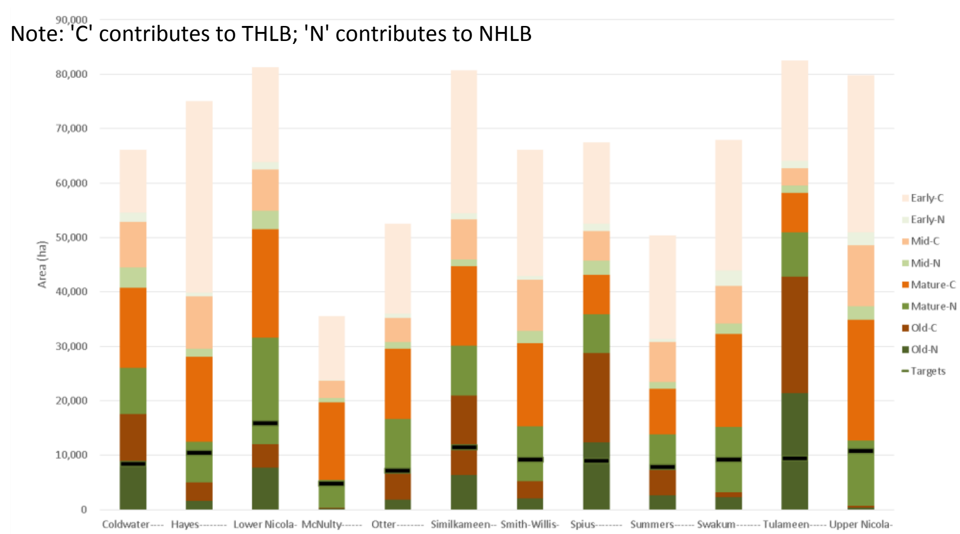


Figure 45 Area of initial seral stage/landbase classification and targets

Charts with the initial condition are provided for each assessment unit (LU/BEC) in Appendix 3. Of the eighty assessment units with targets, only eleven currently have sufficient NHLB area that meet the old seral forest requirements.

4.2.2 Candidate Reserves

Candidate Reserves are presented as a spatial layer that can be displayed on maps (Figure 46) and compared against other spatial data, such as the existing, non-legal OGMAs (section 4.2.2.6). Summaries for patches, interior old forest, and the contribution from anchors were generated from reports created in Patchworks.

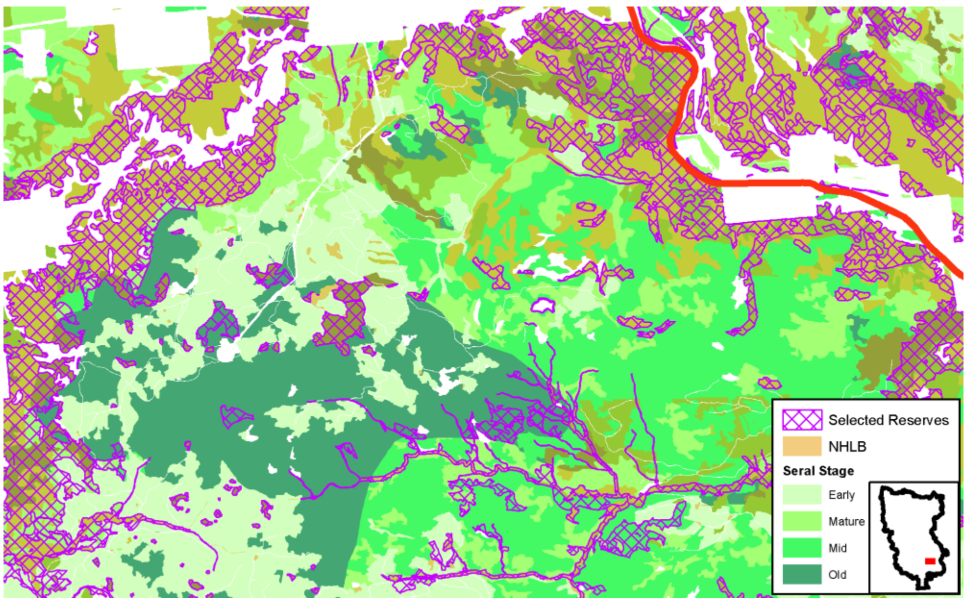


Figure 46 Map example of model-selected candidate reserves

An average of 20% of the Crown Forested Land Base[1] (CFLB) was selected as candidate reserves; varying by LU from 14% to 32% (Figure 47). Appendix 3 includes charts that show the proportion of CFLB selected as candidate reserves for each assessment unit (LU/BEC).

[1] CFLB is described in detail in *Integrated Silviculture Strategy for the Merritt TSA – Data Package*. Version 1.0. August 31, 2017. Prepared by Forsite Consultants Ltd. for the BC Ministry of Forest, Lands and Natural Resource Operations. 62pg.

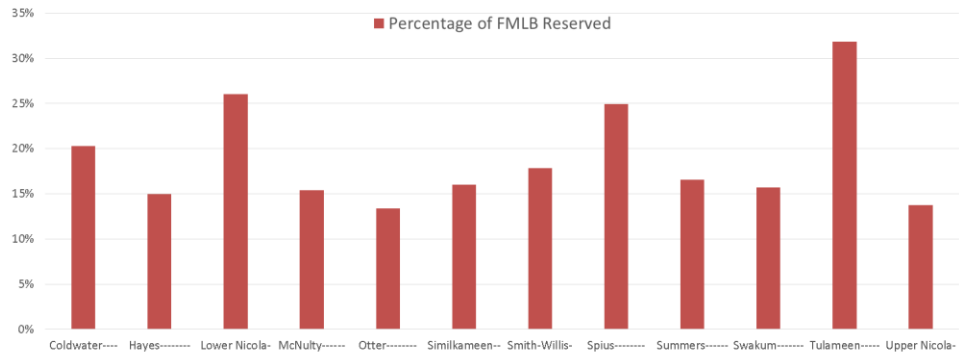


Figure 47 Distribution of CFLB reserved by Landscape Unit

4.2.2.1 Contribution from Anchors and Constraints

Since all anchors within the NHLB were automatically selected as candidate reserves, they played a significant role in the selection of candidate reserves. Figure 48 illustrates the contribution anchors had in selecting reserves. In fact, targets were met entirely within anchors in four of the twelve LUs. Automatically selecting anchors also explains, in part, how younger stands were selected as reserves.

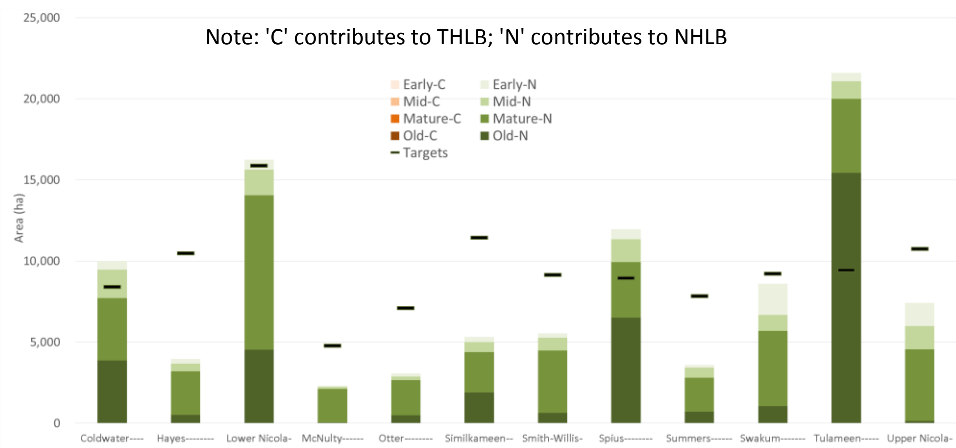


Figure 48 Contribution of anchors selected as reserves

Table 6 shows that overall, two-thirds of the candidate reserves that were selected from anchors compared to areas selected from constraints. This distribution varies considerably between landscape units.

Table 6 Distribution of Reserves Selected from Anchors and Constraints by Landscape Unit

Landscape Units	Area (ha) Selected from Anchors		Area (ha) Selected from Constraints	
Coldwater	10,055	75%	3,368	25%
Hayes	3,968	35%	7,261	65%
Lower Nicola	16,310	77%	4,869	23%
McNulty	2,309	42%	3,160	58%
Otter	3,093	44%	3,947	56%
Similkameen	5,326	41%	7,599	59%
Smith-Willis	5,547	47%	6,266	53%
Spius	12,005	71%	4,819	29%
Summers	3,608	43%	4,736	57%
Swakum	8,629	81%	2,064	19%
Tulameen	21,708	83%	4,583	17%
Upper Nicola	7,455	68%	3,542	32%
	100,014	64%	56,213	36%

4.2.2.2 Landbase Netdown

The distribution of netdown types (Table 7) shows that the candidate reserves are composed of forest removed from the THLB for various physical, economic, and environmental constraints. Significant areas of the candidate reserves coincide with environmentally sensitive areas, physically inoperable lands, and riparian reserves. While these were designed through the selection process, the areas from existing spatial OGMAs were coincidental through stands with higher constraint scores.

Table 7 Summary of candidate reserves ordered by netdown type and LU

Description	Parks	ESA	Inoper	Riparian	Trails	WHA	OGMA	Frog	UWR	WTR	THLB	Total
Coldwater	75	4,444	561	3,956		1,260	569	0	444	13	2,100	13,423
Hayes		1,099	908	2,069			2,142		103	793	4,115	11,229
Lower Nicola	752	9,551	3,165	3,764		93	1,093		698	310	1,752	21,179
McNulty	42	1,893	180	839			741		44	189	1,540	5,469
Otter	40	1,600	554	1,125		170	1,415	1	676	129	1,330	7,040
Similkameen	118	2,246	1,708	1,937	134	31	3,134	2	950	443	2,222	12,925
Smith-Willis	129	1,695	2,507	1,180		280	1,943		485	343	3,251	11,813
Spius		7,065	1,882	3,316		563	669	0	201	20	3,109	16,824
Summers	28	1,094	1,232	1,302		5	1,889		641	203	1,950	8,344
Swakum	54	2,450	342	5,699		119	676		321	29	1,003	10,693
Tulameen	10,492	6,062	2,407	1,577	448	1,589	601	2	193	52	2,867	26,291
Upper Nicola	88	1,587	161	5,597		22	1,208		79	290	1,966	10,997
Netdown Totals	11,818	40,788	15,607	32,361	583	4,130	16,080	6	4,836	2,814	27,204	156,227
% Distribution	7.6%	26.1%	10.0%	20.7%	0.4%	2.6%	10.3%	0.0%	3.1%	1.8%	17.4%	100.0%

These columns are listed according to the netdown order (left to right) and are defined as follows: Parks, Reserves and Protected Areas; Environmentally Sensitive Areas; Physically Inoperable ; Riparian Areas; Heritage Trails; Wildlife Habitat Areas; Old Growth Management Areas; Coastal Tailed Frog; Ungulate Winter Range Snow Interception Cover; Existing Wildlife Tree Patches; Timber Harvesting Land Base (current).

4.2.2.3 Seral Stage

Figure 49 shows that the cumulative area of candidate reserves exceed targets for old forest in some LUs. This typically results from a combination of the existing anchors and patch target requirements within LUs. This figure also reflects the younger stands within candidate reserves resulting from existing anchors plus old forest recruitment required for some assessment units (LU/BEC). These old forest deficits are more pronounced in Appendix 3 where charts show the distribution of candidate reserves for each assessment unit.

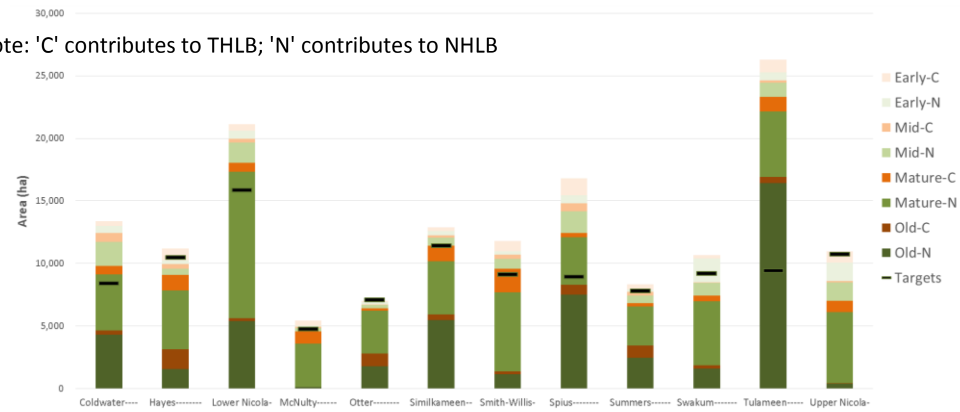


Figure 49 Area selected as candidate reserves by seral stage and landbase type

The selection of younger stands came from two sources of the process. Firstly a number of the existing anchors initially selected as candidate reserves (Figure 48) included stands within all seral stages. Then younger stands were introduced as the model grouped polygons into target patch sizes and evaluated relative scores from various stand attributes and constraints. But overall, suitable age class selection was a much higher priority. Note that while these areas are identified as candidate reserves, only the old forest portion actually contributes towards the landscape-level targets for old seral (~113,000 ha over the TSA).

4.2.2.4 Patches

Patch size targets were included to influence the model in creating larger patch sizes. Downward pressure was applied to stands 0-100 ha in size and upward pressure on stands 1000+ ha. This upward pressure resulted in some over-selection of reserves that included non-old and THLB to fill in and create larger patches.

This reserve selection process identified areas with overlapping values to spatialize the non-spatial old growth targets. This can be used to encourage further discussion and provide planners with a basis for refining old growth reserves with local and on the ground knowledge.

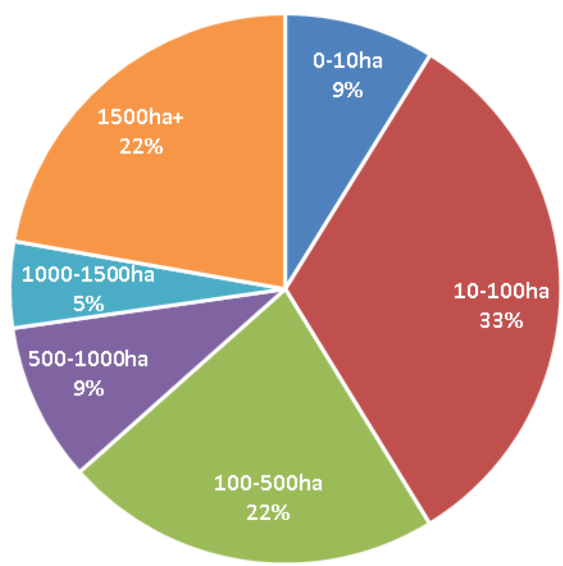


Figure 50 Patch sizes for selected reserves

4.2.2.5 Interior Old Forest

In preparation for the model, interior old forest was identified to contribute towards the selection of candidate reserves through a score for stand features. Additionally, as described above, patch targets were imposed in the model to encourage larger patches, which inherently contains more interior old forest.

Since there are no targets for interior old forest, the model was configured to simply report the proportion of candidate reserves that are made up of interior old forest. Overall, 39,257 ha or 25% of the candidate reserves were identified as interior old forest. Figure 51 shows the distribution of interior old forest is greater than 10% (an ad hoc level for reference) in eight of the twelve landscape units. Charts in Appendix 3 show the proportion of interior old forest within candidate reserves for each assessment unit (LU/BEC).

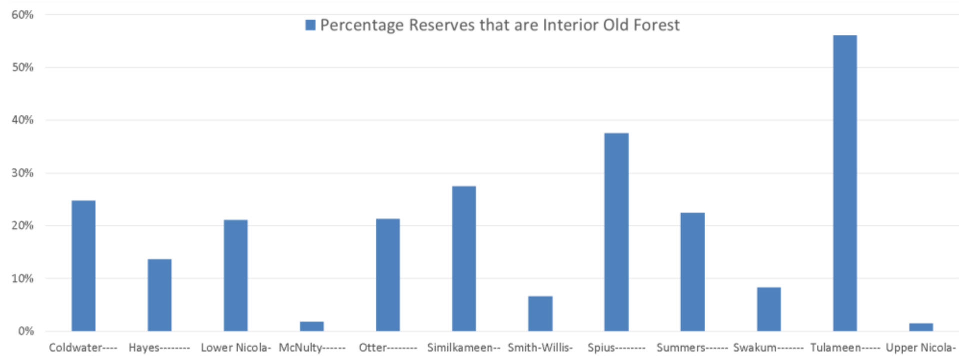


Figure 51 Distribution of interior old forest reserved by Landscape Unit

To remain an interior polygon, accompanying edge polygons were also targeted and selected within the model as candidate reserves. At this time, a post-processing analysis to assess the actual interior old forest from the candidate stands was not undertaken. This exercise is a higher priority where actual targets exist for interior old forest.

4.2.2.6 Riparian Reserves

Applying spatial riparian reserves resulted in some long, narrow reserves with relatively little interior forest. This was mitigated elsewhere by implementing patch size requirements with interior old forest criteria borrowed from the Omineca Region. The larger riparian reserves contributed favorably to connect reserves, while smaller riparian reserves were typically associated with headwaters of watershed sub-basins and are likely not as appropriate as OGMAs.

4.2.3 Comparing Candidate Reserves and Existing Non-Legal, Spatial OGMAs

The non-legal, spatial OGMAs currently managed within the Merritt TSA were developed through a collaborative process involving forest licenses, government, and First Nations, that implemented more detailed local data and issues, applied ecological stand structure rather than age since harvest, and addressed other values besides maintaining biodiversity. While they considered landscape-level thresholds, these OGMAs combined with other NHLB do not actually achieve some required old forest thresholds at this time. In contrast, this Reserve Scenario applied a systematic approach with a priority on achieving landscape-level biodiversity thresholds. It is not surprising, then, that the disparate approaches produced significantly different results (Figure 52). The following paragraphs provide a brief comparison of the non-legal, spatial OGMAs and the candidate reserves selected through this Reserve Scenario.

4.2.3.1 Area Comparisons

Perhaps the key question to answer for this comparison is, "What's the difference?" Overall, this process reserved 48,107 hectares more than the non-legal, spatial OGMAs. The largest increase was in the Tulameen LU (including Manning Park) while one LU (Otter) was reduced in size. These area differences may not provide very good comparisons because in some cases, the spatial OGMAs are adjacent to areas designated as NHLB that were included with the candidate reserves.

Table 8 Comparison of areas identified by LU for non-legal OGMAs and candidate reserves

Landscape Unit	Spatial OGMA Area (ha)	Candidate Reserve Area (ha)	Area Difference (ha)
Coldwater	8,366	13,423	5,057
Hayes	6,764	11,229	4,465
Lower Nicola	18,289	21,179	2,890
McNulty	2,503	5,469	2,967
Otter	7,184	7,040	-144
Similkameen	8,378	12,925	4,547
Smith-Willis	8,569	11,813	3,244
Spius	9,769	16,824	7,055
Summers	6,037	8,344	2,307
Swakum	8,914	10,693	1,779
Tulameen	14,870	26,291	11,421
Upper Nicola	8,476	10,997	2,521
Totals	108,119	156,227	48,107

When spatial OGMAs are considered NHLB (Table 9) the candidate reserves resulted in a net area of 22,596 hectares that would be released back as THLB. As well, the overall score of the candidate reserves was 57% higher than the OGMAs, suggesting that there was an improvement in the quality of areas reserved through this process.

Table 9 Comparison of area changes by LU for non-legal OGMAs and candidate reserves

	Reserves and OGMAs Match	Reserves Added Within NHLB	OGMAs Changed to THLB*	Reserves Added Within THLB	Net Area Released to THLB
Coldwater	3,721	7,601	4,625	2,100	2,525
Hayes	4,278	2,836	2,463	4,112	-1,649
Lower Nicola	10,976	8,451	7,295	1,752	5,543
McNulty	1,191	2,738	1,305	1,540	-235
Otter	3,112	2,598	4,054	1,329	2,726
Similkameen	5,334	5,369	3,025	2,221	804
Smith-Willis	4,886	3,676	3,749	3,249	499
Spius	5,226	8,489	4,962	3,106	1,856
Summers	3,951	2,443	2,247	1,948	299
Swakum	3,245	6,445	5,148	1,003	4,145
Tulameen	9,584	13,841	5,761	2,866	2,895
Upper Nicola	3,314	5,718	5,152	1,965	3,188
Total	58,817	70,205	49,786	27,190	22,596

** estimate approximately 200 ha involve other THLB netdowns*

Table 10 shows an overlap of 58,832 ha or 29% of the combined area for candidate reserves and spatial OGMAs, unique candidate reserves at 97,395 ha (47%), and unique spatial OGMAs at 49,995 ha (24%). This distribution is fairly consistent over all LUs.

Table 10 Overlay summary of candidate reserves and OGMAs

	Unique Reserves		Unique OGMAs		Overlap of Reserves and OGMAs	
Landscape Unit	**Area (ha)**	**% of LU**	**Area (ha)**	**% of LU**	**Area (ha)**	**% of LU**
Coldwater	9,701	54%	4,644	26%	3,722	21%
Hayes	6,948	51%	2,484	18%	4,281	31%
Lower Nicola	10,203	36%	7,313	26%	10,976	39%
McNulty	4,278	63%	1,311	19%	1,191	18%
Otter	3,926	35%	4,071	37%	3,113	28%
Similkameen	7,590	48%	3,043	19%	5,335	33%
Smith-Willis	6,925	44%	3,763	24%	4,888	31%
Spius	11,595	53%	4,978	23%	5,229	24%
Summers	4,391	41%	2,264	21%	3,953	37%
Swakum	7,448	47%	5,174	33%	3,245	20%
Tulameen	16,707	52%	5,776	18%	9,585	30%
Upper Nicola	7,683	48%	5,174	32%	3,315	20%
Totals	97,395	47%	49,995	24%	58,832	29%

4.2.3.2 Landbase Netdown

The summary of candidate reserves by netdown types (Table 7) showed a relatively high contribution to candidate reserves from environmentally sensitive areas and physically inoperable areas removed from the harvestable landbase. The proportion that these netdown areas contribute to both candidate reserves and spatial OGMAs (Table 7) shows that overall, the proportion of area identified as environmentally sensitive and physically inoperable is quite similar (just over 1/3) for both. After previous netdowns were removed, the candidate reserves included 32,361 ha of riparian areas; 4 times more than spatial OGMAs.

Table 11 Percentages of OGMAs and candidate reserves with ESA and inoperable netdown types

LU	Spatial OGMA	Candidate Reserves
Coldwater	50%	37%
Hayes	27%	18%
Lower Nicola	72%	60%
McNulty	36%	38%
Otter	27%	31%
Similkameen	23%	31%
Smith-Willis	43%	36%
Spius	58%	53%
Summers	25%	28%
Swakum	22%	26%
Tulameen	28%	32%
Upper Nicola	12%	16%
Total	39%	36%

4.2.3.3 Spatial Distribution

A few trends can be observed when reviewing spatial criteria of the candidate reserves compared to the OGMAs (note that these examples are referenced in Figure 52):

1) The patch size criteria could still be forced to reduce the number tiny polygons.
2) 'Doughnut holes' suggests a need to explore other criteria to group reserves.
3) Anchors selected from the NHLB play a significant role in developing candidate reserves.
4) Incorporating riparian reserve areas clearly adds to the maintenance of landscape connectivity.

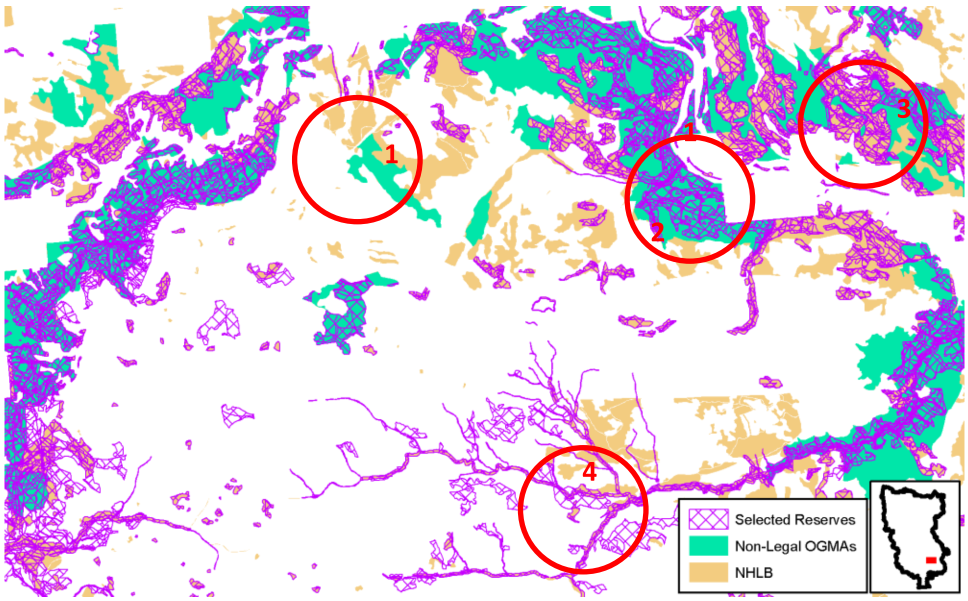


Figure 52 Map example comparing spatial OGMAs to candidate reserves

4.2.3.4 Polygon Sizes

A minimum polygon size requirement was neither applied in the selection process for the candidate reserves, nor the existing spatial OGMAs. Despite the patch size requirements applied, the fragmented spatial dataset (i.e., resultant) used to score, select and group polygons resulted in a higher proportion of small polygons with the candidate reserves than spatial OGMAs (Table 12). This may have been exacerbated by introducing small riparian reserves and constraint scores for small areas, like some wildlife tree reserves.

Table 12 Polygon size distribution comparison for candidate reserves and spatial OGMAs

Polygon Size (Dissolved)	Spatial OGMAs	Candidate Reserves
1. <10 ha	1%	6%
2. 10-100	25%	35%
3. 100-500 ha	32%	21%
4. 500-1000 ha	13%	9%
5. 1000-1500 ha	7%	4%
6. >1500 ha	20%	24%

4.2.3.5 Leading Species

Despite penalizing stand feature scores for pine-leading stands, the candidate reserves included a much higher proportion of these stands than expected. Compared to spatial OGMAs – and generally for the TSA – the proportions for other species appears to be similar.

Table 13 Comparison of areas by leading species for TSA, candidate reserves and OGMAs

Lead_sp	BA	BL	CW	DEC	FD	HW	LW	PA	PL	PW	PY	SE	SX	Total
TSA (ha)	956	67,108	106	9,705	242,258	591	241	440	406,416	35	16,262	11,530	57,427	813,077
Reserves (ha)	332	22,232	23	1,921	55,032	359	69	223	49,774	26	7,566	2,781	15,898	156,236
OGMA (ha)	100	13,184	35	3,591	54,264	156	111	191	16,367	4	7,009	1,914	13,539	110,464
TSA %	0%	8%	0%	1%	30%	0%	0%	0%	50%	0%	2%	1%	7%	100%
Reserves %	0%	14%	0%	1%	35%	0%	0%	0%	32%	0%	5%	2%	10%	100%
OGMA %	0%	12%	0%	3%	49%	0%	0%	0%	15%	0%	6%	2%	12%	100%

4.2.3.6 Area by Seral Stage and Landbase Type

While retention targets for old forest are assessed for LU/BEC combinations, combining results for each LU (Figure 53) provides a reasonable way to compare the seral stages and landbase types reserved for non-legal OGMAs and the candidate reserves. The following observations were made:

- In both cases, insufficient old forest requires recruitment from younger age classes. Existing anchors also contribute to the amount of younger seral stages.
- Non-legal OGMAs were already classified as NHLB areas and do not contribute to THLB.
- Non-legal OGMAs meet the LU-combined targets in 4 of the 12 LUs while candidate reserves meet these targets in all but one LU (i.e., Otter).
- Non-legal OGMAs meet the appropriate LU/BEC targets in 34 of the 80 assessment units while candidate reserves meet these targets in 78 of the 80 assessment units.

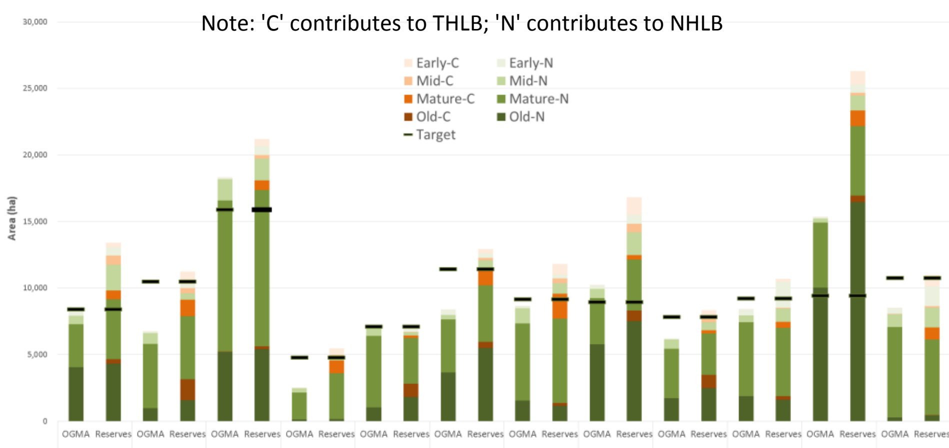


Figure 53 Comparison of non-legal OGMAs to candidate reserves: area by seral stage and landbase type

4.2.3.7 Contribution of Anchors

The contribution of anchors assigned as NHLB (Figure 54) is generally greater with the candidate reserves than the non-legal OGMAs. This suggests that the non-legal OGMAs may have avoided known anchors at the time the OGMAs were developed; as sometimes observed with spatial comparisons (e.g., Figure 52 clearly shows NHLB that are not OGMAs).

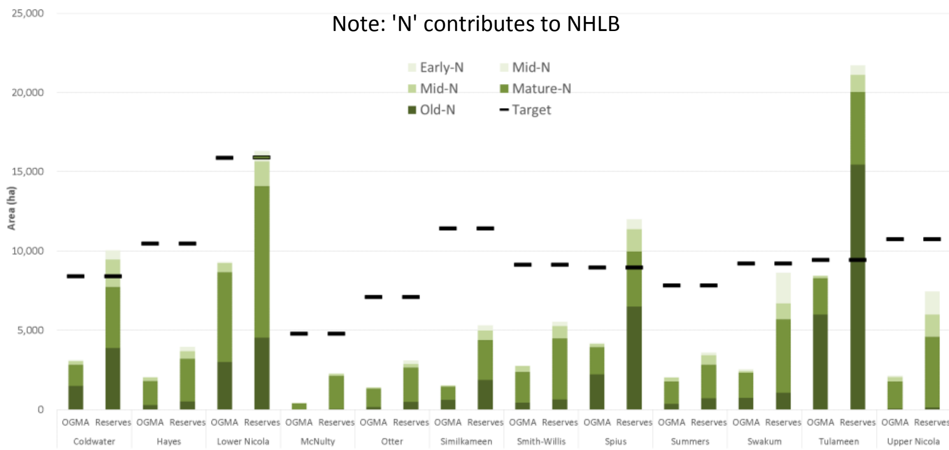
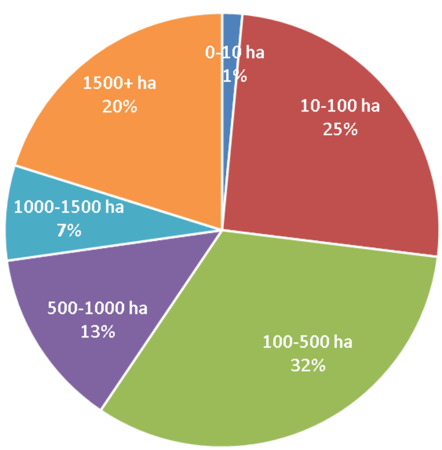


Figure 54 Comparison of non-legal OGMAs to candidate reserves: contribution of anchors

4.2.3.8 Patch Size Distribution

The interim patch size criteria did not attempt to mimic the patch size distribution of the spatial OGMAs. Figure 55 shows that the two approaches produced a fairly similar patch size distribution except for a significant difference in the smallest (0-10 ha) category.

Spatial OGMAs



Candidate Reserves

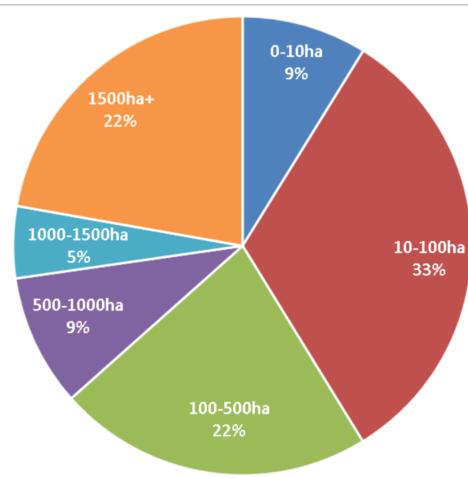


Figure 55 Patch size distribution of non-legal OGMAs and candidate reserves

4.2.3.9 Age Class Distribution

A comparison of age classes (Figure 56) shows that the general distribution is fairly similar. The candidate reserves resulted in more very young stands because they existed within selected anchors, or because they were allowed to contribute as recruitment. At the same time, the candidate reserves identified more mature and old stands to meet the old retention thresholds.

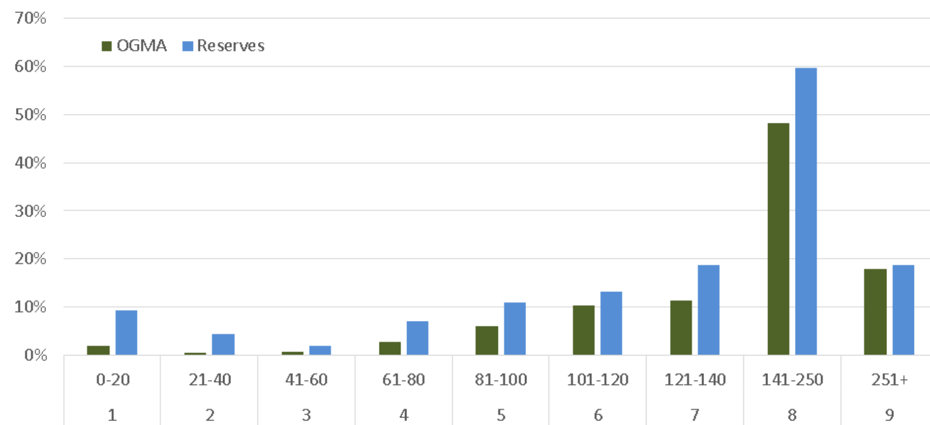


Figure 56 Age class distribution of non-legal OGMAs and candidate reserves

5 Harvest Scenario

5.1 Description

The Harvest scenario aimed to answer the question "Which stands should be prioritized for harvest/salvage in the short term (and what are the mid/long term consequences of not following this strategy)?" The Harvest scenario can also be used to illustrate differences in species profile that may occur if harvest is not distributed well (i.e., volume looks alright in the future, but economics become much more challenging). The underlying purpose of the Harvest scenario was to explore tactics aimed to improve timber harvesting opportunities, and to determine if harvesting could be used as a tool to reduce the impacts from wildfire without unduly impacting timber supply. Three tactics were explored: 1) minimum harvest criteria partitions, 2) harvest feasibility, and 3) priority on wildfire management.

The Merritt ISS explored the effects of applying alternative minimum harvest criteria (MHC) from those used for the ISS Base Case. The Base Case used a minimum volume of 150 m^3/ha for clearcut harvesting, and 120 m^3/ha (60 m^3/ha removal) for partial cutting. For the Harvest Scenario, clearcut harvest volumes were partitioned into the following classes: >200 m^3/ha, 150 to 200 m^3/ha, 100 to 150 m^3/ha, and 75 to 100 m^3/ha. In addition, managed stands needed to achieve 95% of CMAI in addition to being at least 60 years of age. A sensitivity analysis examined the results of not utilizing ponderosa pine.

Ensuring that harvested blocks are operationally feasible was also a key component of the harvest scenario. The "patching" capabilities of the Patchworks model was used to prevent harvest of any blocks less than one hectare. This means that individual stands less than 1 hectare were only harvested if they could be aggregated with adjacent stands. In some cases, small isolated stands might never be harvested. In other cases, they might be retained for longer until an adjacent stand becomes old enough to harvest. In addition to preventing the harvest of blocks less than 1 hectare, blocks between 1 hectare and 5 hectares were limited to 5% of the total harvest area in each period.

Harvest feasibility was also improved by "smoothing" the selection harvesting volume flow from period to period, rather than allowing the significant fluctuations observed in the ISS Base Case.

The wildfire management strategy placed higher harvest priorities in the first 10 years for stands that are located in Wildland Urban Interfaces (THLB Area ~ 79,600 ha) , proposed Fire Breaks (THLB Area ~69,250 ha) , or rated as extreme fire threat according to the 2015 Provincial Strategic Threat Analysis

(PSTA) – wildfire threat component dataset for Merritt TSA (THLB Area ~218,650 ha). After accounting for overlaps, the THLB area where harvest was prioritized for wildfire management was approximately 317,700 hectares.

A sensitivity analysis for fire management was also completed that implemented modified (reduced) stocking to areas harvested within the Wildland Urban Interface areas. This was modelled by changing the regeneration method in TIPSY to "clumped", and reducing the establishment density to 600 stems per hectare.

Table 14 summarizes the four different model runs were completed for the harvest scenario.

Table 14 Criteria Applied in the Harvest Scenario

Scenario	Criteria
Run 1: Minimum 200 m^3/ha	○ Minimum harvest volume of 200 m^3/ha ○ Managed stand minimum harvest ages set to 60 years or 95% of CMAI, whichever is greater ○ Blocks less than 1 hectare not allowed ○ Blocks 1 to 5 hectares in size limited to 5% of total harvest area ○ Increased harvest priority (first 10 years) in WUIs, fire breaks, and stands with extreme PSTA rating ○ "Smoothing" of partial harvest cut volumes period to period
Run 2: Minimum 75 m^3/ha	Similar assumptions to Run 1, except: ○ Minimum harvest volume of 75 m^3/ha ○ Harvested volume from stands >= 200 m^3/ha must be at least as much as that reported in Run 1 ○ Harvest volumes reported in the following partitions: 75 to 100 m^3/ha, 100 to 150 m^3/ha, 150 to 200 m^3/ha, >= 200 m^3/ha
Run 3: Exclude Py volume (sensitivity)	Sensitivity analysis based on Run 2, and includes the following additional criteria: ○ Ponderosa pine volumes do not contribute to harvest flows ○ Minimum harvest criteria (75 m^3/ha) based on non-Py volumes only
Run 4: Reduced yields in WUI (sensitivity)	Sensitivity analysis based on Run 2, and includes the following additional criteria: ○ All planted stands within WUIs are regenerated using TIPSY yields generated with "clumped" regen method and initial density of 600 stems per hectare

5.2 Results

5.2.1 Harvest Flows

There were significant differences in harvest flows for the harvest scenario when compared to the ISS Base Case. Figure 57 and Table 15 compare the four Harvest Scenario runs with the ISS Base Case run.

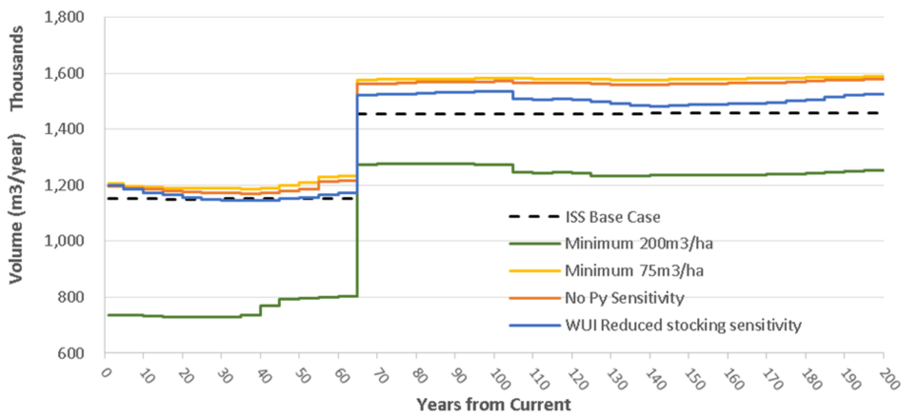


Figure 57 Harvest Flows for the Harvest Scenario Runs

Table 15 Comparison of Harvest Scenario Flows to the ISS Base Case

Scenario	Short-/mid-term Average (m^3/yr)	Short-/mid-term Compared to Base Case (%)	Long-term Average (m^3/yr)	Long-term Compared to Base Case (%)
ISS Base Case	1,150,990	100.00	1,455,628	100.00
Run 1: Minimum 200 m^3/ha	755,689	65.66	1,249,826	85.86
Run 2: Minimum 75 m^3/ha	1,199,312	104.20	1,579,694	108.52
Run 3: Exclude Py volume Sensitivity	1,184,392	102.90	1,565,431	107.54
Run 4: Reduced yields in WUI Sensitivity	1,161,946	100.95	1,507,382	103.56

5.2.1.1 Run 1 (MHC 200 m^3/ha)

There is a significant drop (~34.3%) in the short-/mid-term harvest levels when increasing the minimum harvest volume to 200 m^3/ha. In the long-term, the reduction in harvest level is improved, but still significant (~14.1%).

Due to the way the harvest scenario was formulated, it is not possible to determine with certainty how much of this impact is due to increased restrictions on small block size, and how much is due to increased minimum harvest ages for managed stands. However, based on other similar projects and some initial exploratory runs with the Harvest Scenario, it is believed the impact of block size is relatively small, whereas the effect of increasing minimum harvest ages could be significant. Figure 58 illustrates the difference in weighted minimum harvest ages for the harvest scenario (95% CMAI, minimum 60 years) and the ISS Base Case Scenario (minimum 150 m^3/ha). It can be seen that there is roughly a 13 year increase in minimum harvest age when requiring 95% of CMAI and minimum 60 years. This difference can significantly affect short to mid-term harvest levels as it influences the length of time that natural stands must last before managed stands become available.

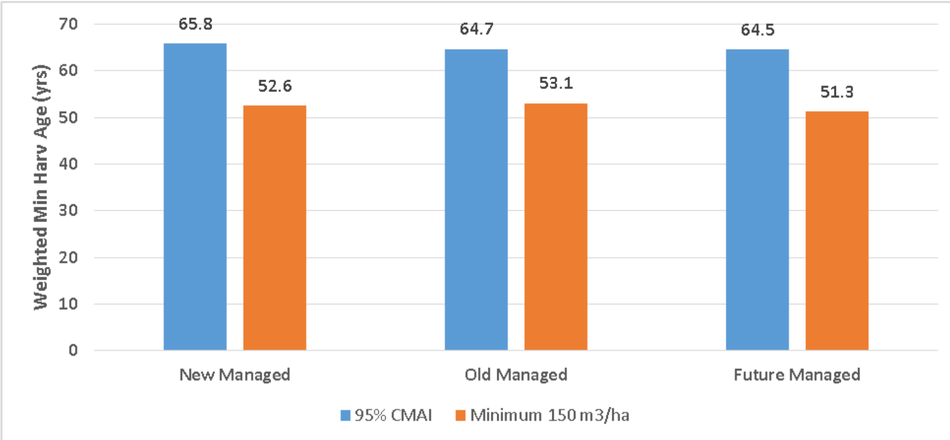


Figure 58 Comparison of Minimum Harvest Age for the Harvest Scenario and ISS Base Case Scenario

5.2.1.2 Run 2 (MHC 75 m³/ha)

Figure 59 illustrates the distribution of harvest by volume class for Run 2 compared to the harvest flow results of the ISS Base Case and Run 1 (MHC 200 m³/ha). Reducing the minimum harvest criteria to 75 m³/ha improved short-/mid-term harvest levels by approximately 4%, and long-term harvest levels by approximately 8.5% when compared to the ISS Base Case.

Although the ISS Base Case excluded harvest from stands below 150 m³/ha, Run 2 includes a significant proportion of the volume from stands less than 150 m³/hectare over the first 50 years; much of this volume is required to achieve the harvest volume of the Base Case. This is likely the result of the increased minimum harvest ages for managed stands (i.e. 95% CMAI, 60 years) limiting the availability of eligible stands for harvest during the transition from mid to long term.

Almost none of the proportionately larger increase in long-term harvest levels is from stands less than 150 m³/ha. This is due to the effective increase in THLB (i.e., previously non-merchantable stands that are now available for harvest) combined with the higher yields realized when these stands are regenerated to managed stand yield tables.

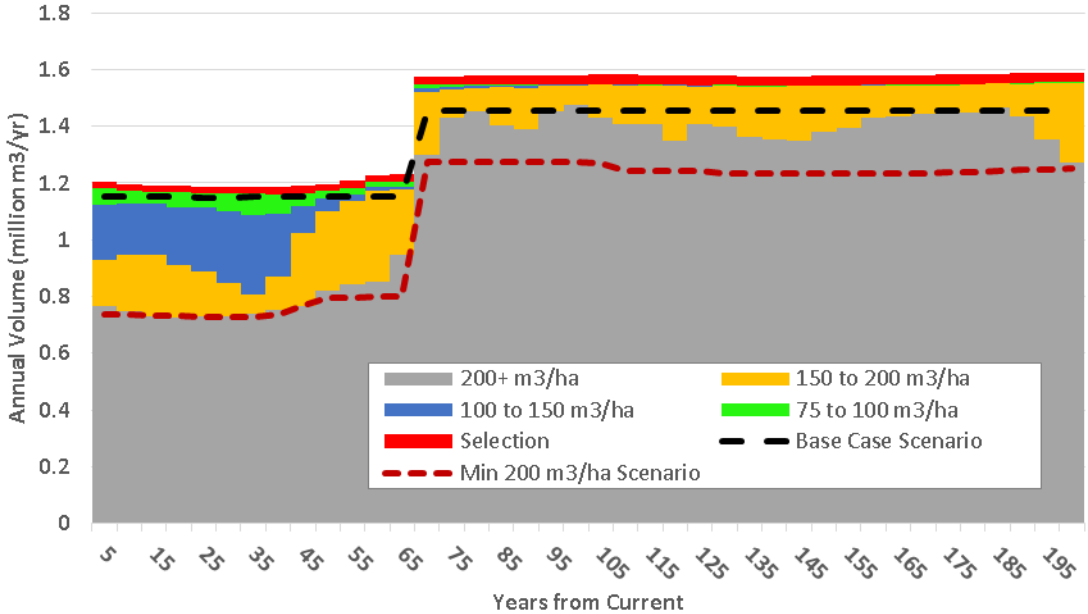


Figure 59 Harvest Volume Distribution for Run 2 - MHC 75m³/ha

5.2.1.3 Run 3 – Ponderosa pine volume excluded (sensitivity)

Excluding ponderosa pine from the harvest flow and updating stand merchantability accordingly resulted in a 1.2 % reduction in short-/mid-term harvest flow and 0.9% reduction in long-term harvest flow when compared to Run 2.

5.2.1.4 Run 4 – Reduced Stocking in Wildland Urban Interface Areas

Figure 60 shows the harvest flow for Run 4 compared with Run 2 (MHC 75 m³/ha) and the ISS Base Case. Despite initial harvest levels being similar to those from Run 2, harvest declines through time as a result of reduced yields for future managed stands to reflect fire management stocking standards within wildland urban interface areas. Overall, the average short-/mid-term is approximately 3.1% less while the average long-term is approximately 4.6% less when compared to Run 2. However, harvest levels are still higher than those of the ISS Base Case.

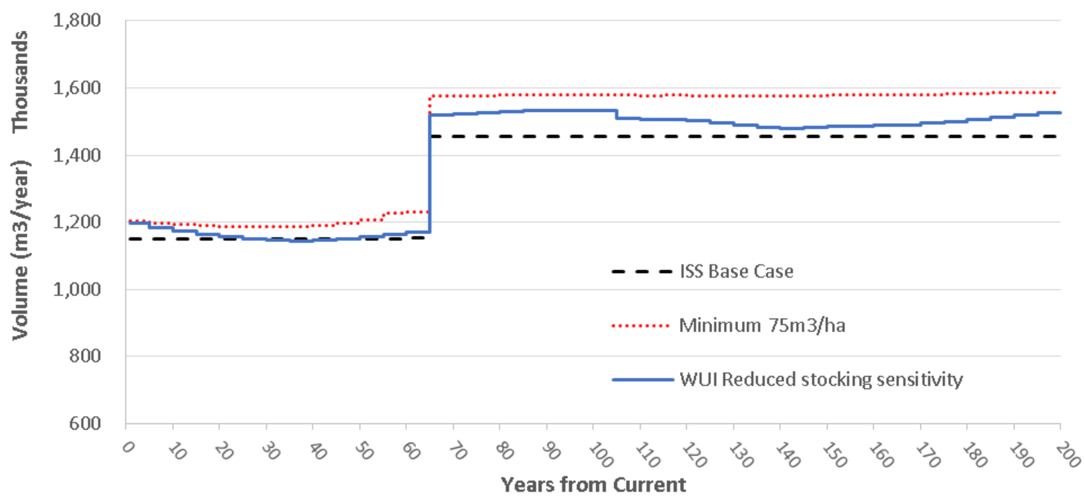


Figure 60 Run 4 – Reduced Stocking in WUI Sensitivity Analysis Harvest Flow

5.2.2 Harvest Ages

Figure 61 shows the distribution of harvest ages for the ISS Base Case, Run 1(MHC 200 m³/ha), and Run 2 (MHC 75 m³/ha) model runs. These graphs show the ISS Base Case Scenario relies heavily on harvesting younger (< 60 yrs) managed stands, starting about 35 years from now. In contrast, the Harvest Scenarios runs required managed stands to be at least 60 years of age and attain 95% CMAI before they are eligible for harvest. There is a noticeable difference in the length of time that natural stands contribute to harvest flows between Run 1 (MHC 200 m³/ha) and Run 2 (MHC 75 m³/ha). For Run 2, there is virtually no contribution from natural stands after 50 years, while Run 1 is harvesting natural stands well into the future. This is likely the result of younger natural stands being available for harvest sooner because of the lower minimum harvest criteria.

ISS Base Case

Harvest Scenario Run 1 – Minimum 200 m³/ha

Harvest Scenario Run 2 – Minimum 75 m³/ha

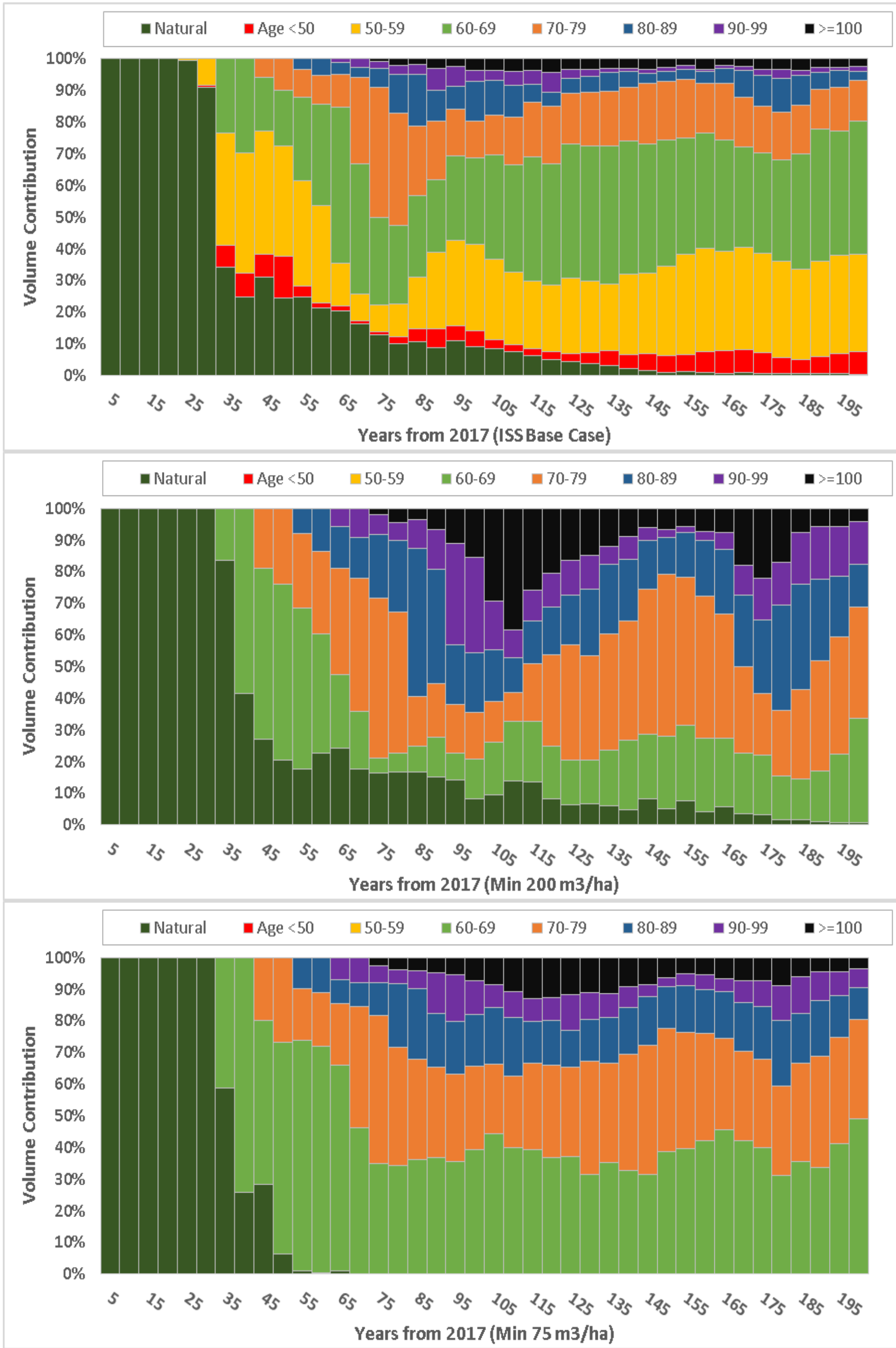


Figure 61 Harvest Ages for the ISS Base, Harvest Run 1, and Harvest Run 2 Scenarios

5.2.3 Growing Stock

Figure 62 shows the total THLB volume for each of the Harvest Scenario runs compared with the ISS Base Case. In all cases, the long-term growing stock is higher for the Harvest Scenario runs. As expected, the growing stock for Run 1 (MHC 200 m³/ha) is higher than the other three Harvest Scenario runs with a minimum harvest criteria of 75 m³/ha.

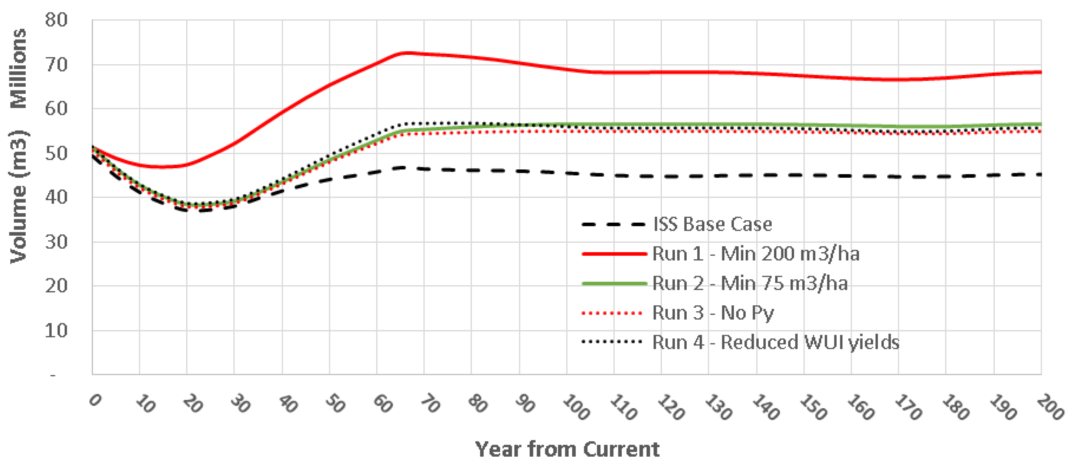


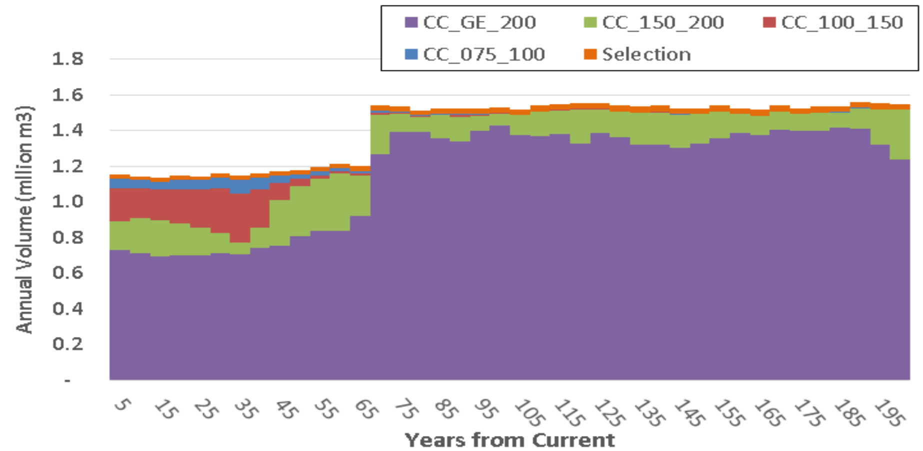
Figure 62 THLB Growing Stock for the Harvest Scenario Runs

5.2.4 Harvest Profile by Slope and Volume Class

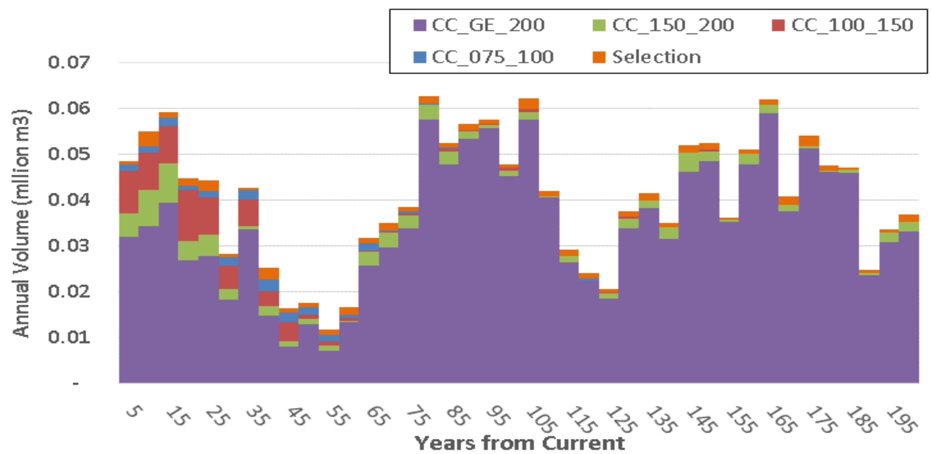
Figure 63 summarizes the harvest profile for Run 2 (MHC 75 m³/ha) by volume category and slope class. Overall, volumes from steep slopes average ~3.2% of the total harvest volume in the short-/mid-term and ~2.6% of the total harvest volume in the long-term. However, there is significant fluctuation in the harvest flow contribution from steep slopes over the planning horizon, ranging between approximately 1% and 5% of the total harvest volume.

In the short-/mid-term, roughly 1/3 of the volume harvested on steep slopes is from clearcut stands less than 200 m³/ha or from selection harvesting. This changes in the long-term as harvest transitions to managed stands, with only 7% of the volume harvested from lower volume stands or selection harvesting.

Slope < 45%



Slope >= 45%



Total Landbase

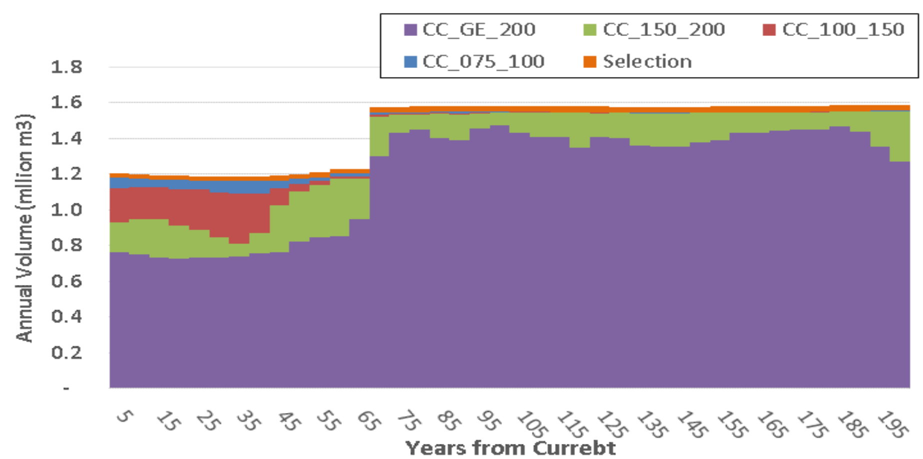


Figure 63 Run 2 (MHC 75 m³/ha) Harvest Profile by Slope and Volume Class

5.2.5 Harvest Profile by Species and Product

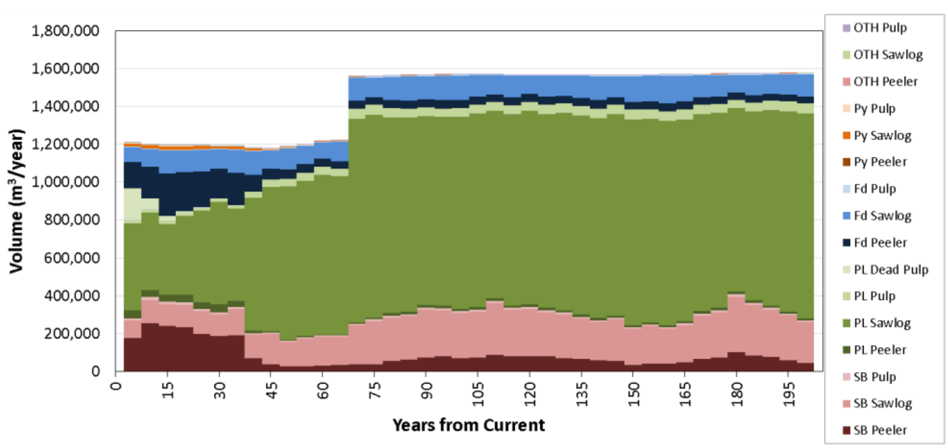
The analysis was configured to produce a set of reports that summarize the harvest flow by species group and age classes. A spreadsheet was subsequently built to illustrate species and product profile (Figure 64), according to an estimated species and product distribution by age class (Table 16). Note that the information presented here is one example of user-input estimates to illustrate the product distributions by age class. The intent is for a user knowledgeable with the local timber characteristics to update the information in the spreadsheet to produce a better estimate of products.

Table 16 User-Defined Estimates of Species and Product Distribution by Age Class

	Spruce/Balsam			Lodgepole pine Live			Lodgepole Pine Dead		
Age Class	**Peeler**	**Saw**	**Pulp**	**Peeler**	**Saw**	**Pulp**	**Peeler**	**Saw**	**Pulp**
0 to <40			100%			100%			100%
40 to <60		93%	7%		92%	8%			100%
60 to <80		89%	4%		95%	5%			100%
80 to <120	35%	63%	2%	4%	93%	3%		5%	95%
120 to <200	62%	39%	3%	8%	89%	3%		5%	95%
200+	69%	26%	5%	10%	85%	5%		5%	95%
Selection									

	Douglas-fir			Ponderosa Pine			Other		
Age Class	**Peeler**	**Saw**	**Pulp**	**Peeler**	**Saw**	**Pulp**	**Peeler**	**Saw**	**Pulp**
0 to <40			100%			100%			100%
40 to <60		93%	7%		85%	15%		80%	20%
60 to <80	7%	89%	4%		90%	10%		90%	10%
80 to <120	35%	63%	2%		95%	5%		85%	15%
120 to <200	62%	37%	1%		95%	5%		85%	15%
200+	69%	30%	1%		95%	5%		80%	20%
Selection	69%	30%	1%						

Product Volume:
Run 2 (MHC 75 m³/ha)



Product Percentage:
Run2 – MHC 75 m³/ha

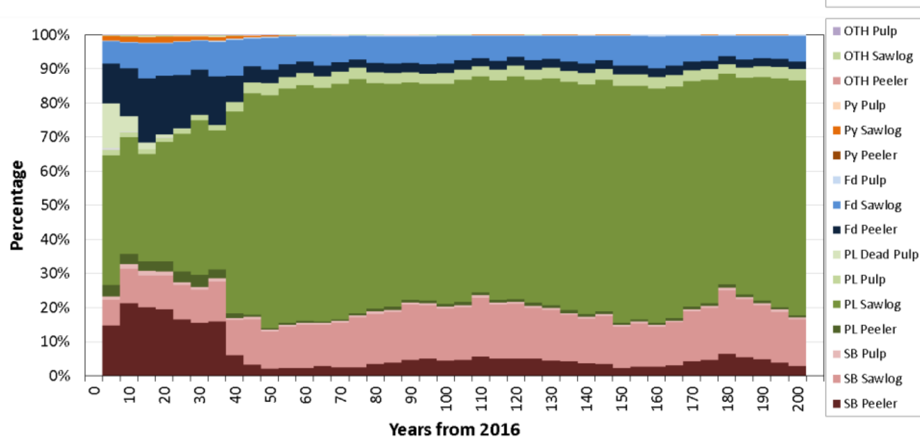
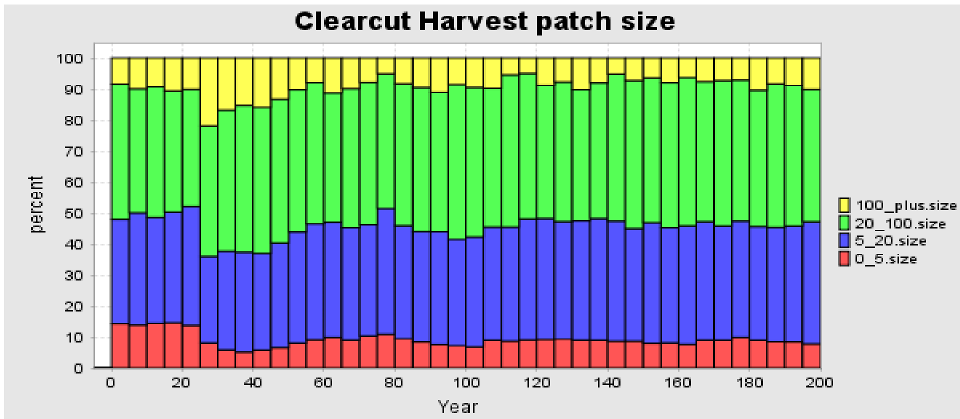


Figure 64 Species and Grade Profile for Run 2 (MHC 75 m³/ha) (Harvest Flow and Percentages)

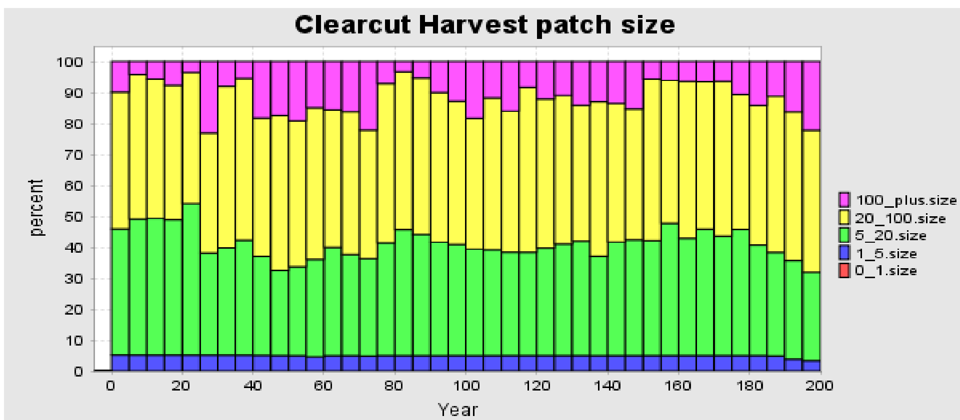
5.2.6 Harvest Opening Size

Figure 65 compares harvest cutblock size distributions for the ISS Base Case and Harvest Scenario Run 1 (MHC 200 m³/ha) and Run 2 (MHC 75 m³/ha) model runs. The Harvest Scenario runs result in less area harvested as small cutblocks relative to the ISS Base Case. Although there are slight differences in the distribution of larger blocks between Run 1 and Run 2 of the Harvest Scenario, the area occupied by small blocks is similar.

ISS Base Case



Run 1 (MHC 200 m³/ha)



Run 2 (MHC 75 m³/ha)

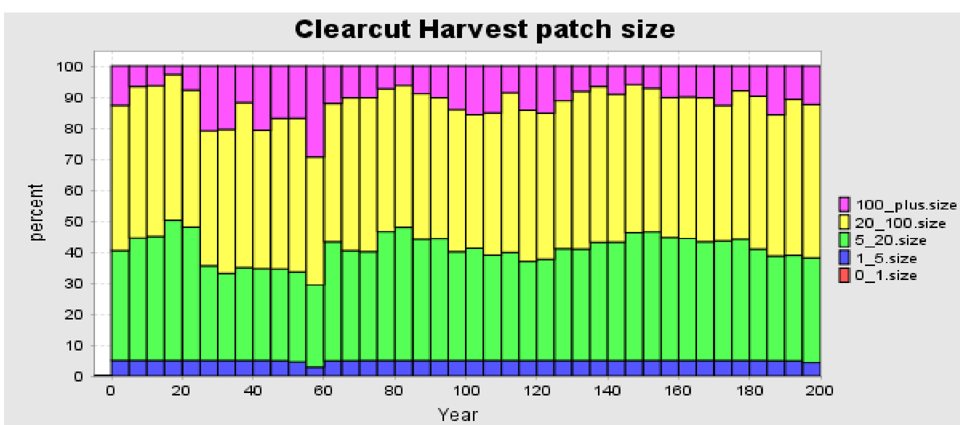
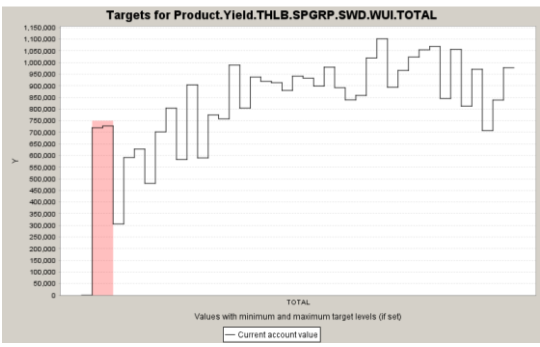


Figure 65 Harvest Cutblock Size for ISS Base Case, Run1 – MHC 200 m^3/ha and Run 2 (MHC 75 m^3/ha)

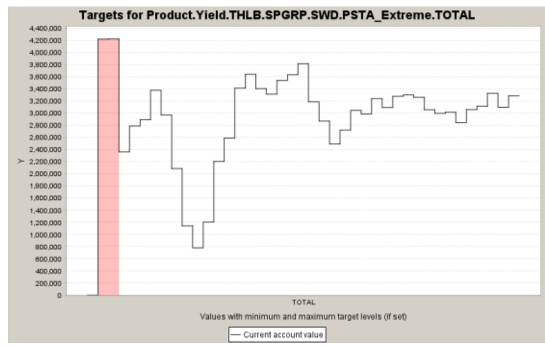
5.2.7 Fire Management Harvest Priority

Figure 66 shows the results from focusing more harvest within fire management priority areas during the first 10 years for the Run 2 (MHC 75 m^3/ha) model run. The targets set for the fire management priority areas were selected after completing exploratory runs, and were chosen to be higher than the volumes achieved without prioritizing harvest from these areas. These charts show the model was successful in achieving the target set for harvest volume from all of the priority areas.

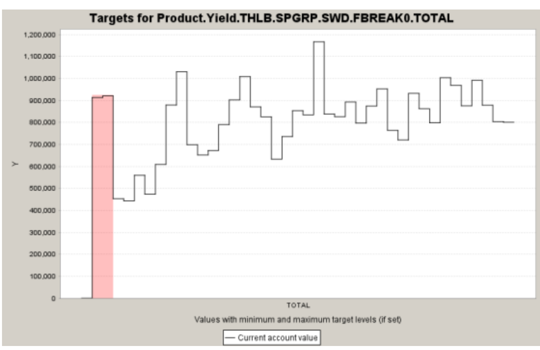
Wildland Urban Interface



PSTA Extreme



Fire Break Priority "0"



Fire Break Priority "1"

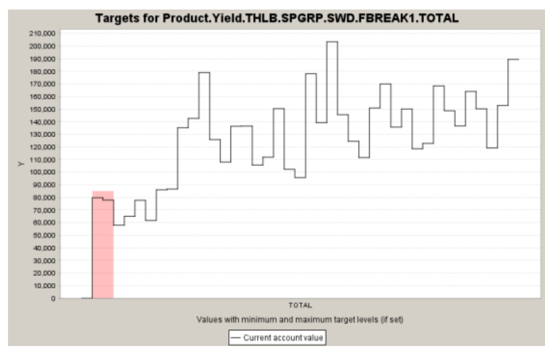


Figure 66 Harvest Volume from Fire Management Priority Stands for Run2 – MHC 75 m^3/ha

6 Silviculture Scenario

6.1 Description

The goal of the Silviculture Scenario was to explore tactics aimed to enhance quantity and quality over the mid- and long-term, as well as, improve biodiversity, wildlife habitat, and cultural interests. In doing so, the Silviculture Scenario introduced investments that would best serve the TSA's future harvest given an expected funding level of $3 million per year over the first 20 years of the planning horizon. Three tactics were explored: 1) fertilization, 2) enhanced basic Silviculture, and 3) rehabilitating MPB impacted stands.

Table 17 summarizes the three different model run completed for the Silviculture Scenario.

Table 17 Criteria Applied in the Silviculture Scenario

Scenario	Criteria
Run 1: Proportionate Flow Priority	○ The harvest request was increased proportionately throughout the planning horizon ○ Volumes from MPB rehab contribute to harvest flows
Run 2: Short-/mid-term Flow Priority	○ The harvest request was only increased for the short-/mid-term periods of the planning horizon ○ Volumes from MPB rehab contribute to harvest flows
Run 3: Rehab Volume Excluded (Sensitivity)	Sensitivity analysis based on Run 2, and included the following elements: ○ The harvest request was only increased for the short-/mid-term periods of the planning horizon ○ Volumes from MPB rehab do not contribute to harvest flows

6.2 Results

6.2.1 Harvest Flows

Figure 67 and Table 18 compare the three Silviculture Scenario runs with the ISS Base Case. Applying a proportionate increase in harvest request (Run 1) resulted in very little increase (0.4%) in the short-/mid-term harvest but a much larger increase (2.43%) in the long-term harvest, relative to the Base Case. However, it is possible to increase the short-/mid-term flow if no additional volume is requested in the long-term (Run 2).

Excluding MPB rehab volume from the harvest flow (Run 3) resulted in a very small (0.4%) reduction in short-/mid-term harvest levels, and a negligible reduction in long-term harvest levels.

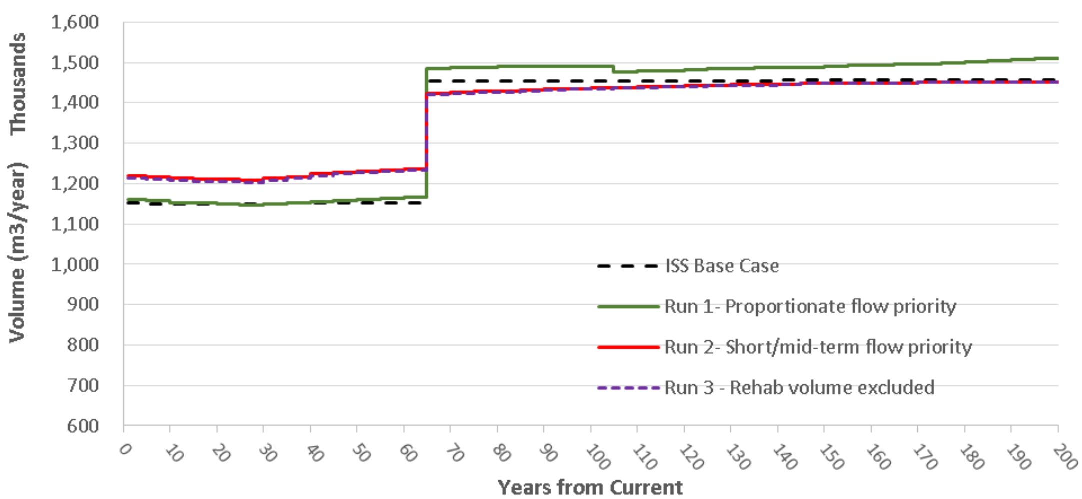


Figure 67 Harvest Flows for the Silviculture Scenario Runs

Table 18 Comparison of Silviculture Scenario Flows to the ISS Base Case

Scenario	Short-/mid-term Average (m^3/yr)	Short-/mid-term Compared to Base Case (%)	Long-term Average (m^3/yr)	Long-term Compared to Base Case (%)
ISS Base Case	1,150,990	100.00	1,455,628	100.00
Run 1: Proportionate Flow Priority	1,155,537	100.40	1,491,042	102.43
Run 2: Short-/mid-term Flow Priority	1,220,345	106.03	1,442,352	99.09
Run 3: Rehab Volume Excluded Sensitivity	1,215,436	105.60	1,441,299	99.02

6.2.2 Growing Stock

Figure 68 shows the total THLB volume for each of the Silviculture Scenario runs compared with the ISS Base Case. The long-term growing stock levels are slightly higher than the Base Case when there is a proportionate increase in harvest request (Run 1), while the levels are slightly lower when harvest flows in the short-/mid-term are prioritized (Run 2 and Run 3).

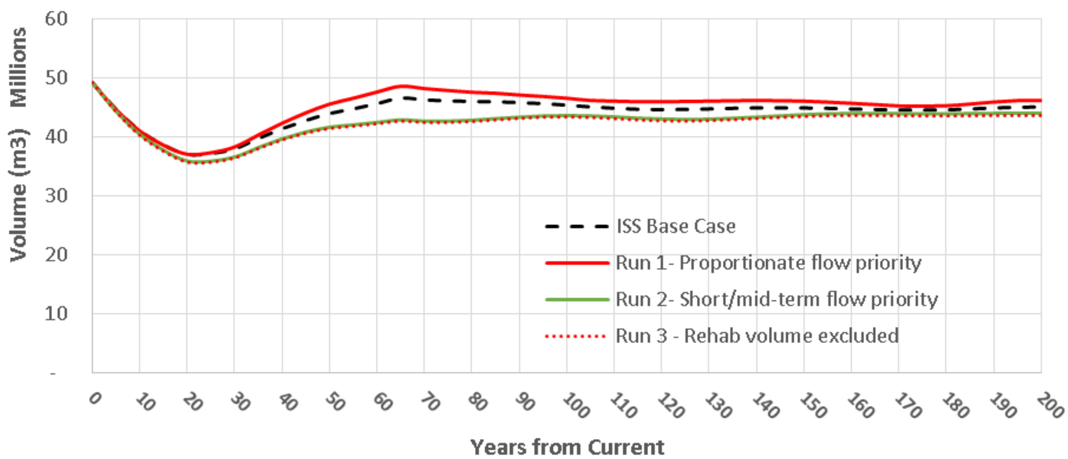


Figure 68 THLB Growing Stock for the Silviculture Scenario Runs

6.2.3 Treatments

The model applied the full annual budget of $3 million per year over the first 20 years. Figure 69 shows the area treated in each 5-year period along with the corresponding area harvested in the future for the Run 2 (Short-/mid-term flow priority) model run. Enhanced basic silviculture is the predominant treatment, with harvest of these stands first occurring in 45 years (note that the minimum harvest criteria for the Silviculture Scenario was set to 150 m^3/ha, similar to the ISS Base Case). Fertilization of young natural stands is the next most common treatment selected, with these stands being harvested earlier than those undergoing enhanced basic silviculture.

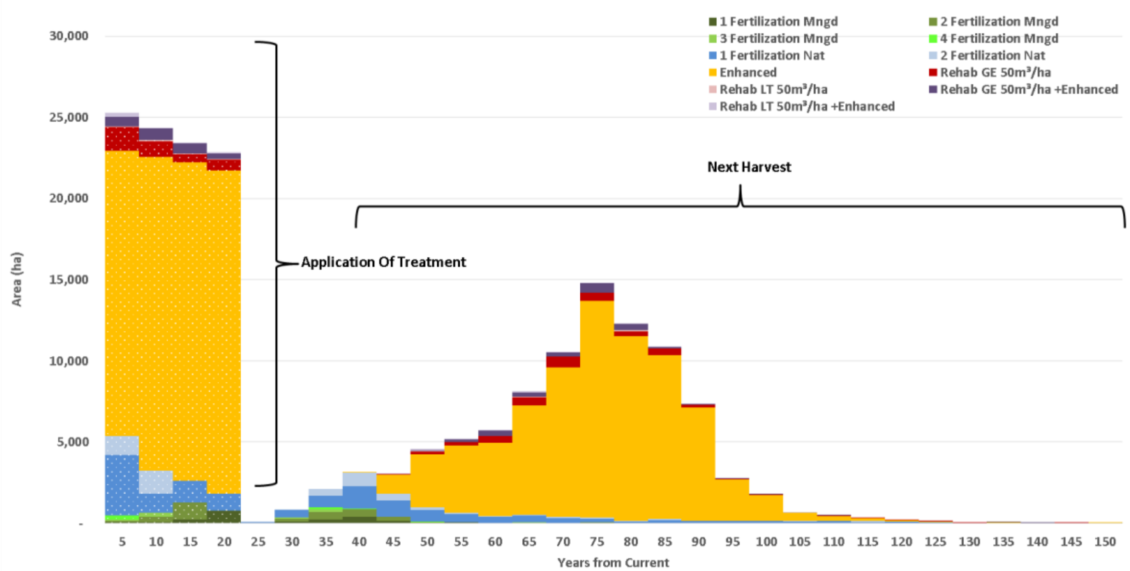


Figure 69 Treatments and Subsequent Harvest by for Run 2- Short-/mid-term Flow Priority

Areas treated in the model depend on the availability of eligible stands for each treatment over the first 20 years combined with the best overall balance of realizing the volume gains through harvest. Figure 70 shows the candidate areas and resulting treatments for fertilization and rehabilitation for Run 2 (Short-/mid-term Flow Priority). It is apparent that the availability of candidate areas did not limit the selection of these treatments.

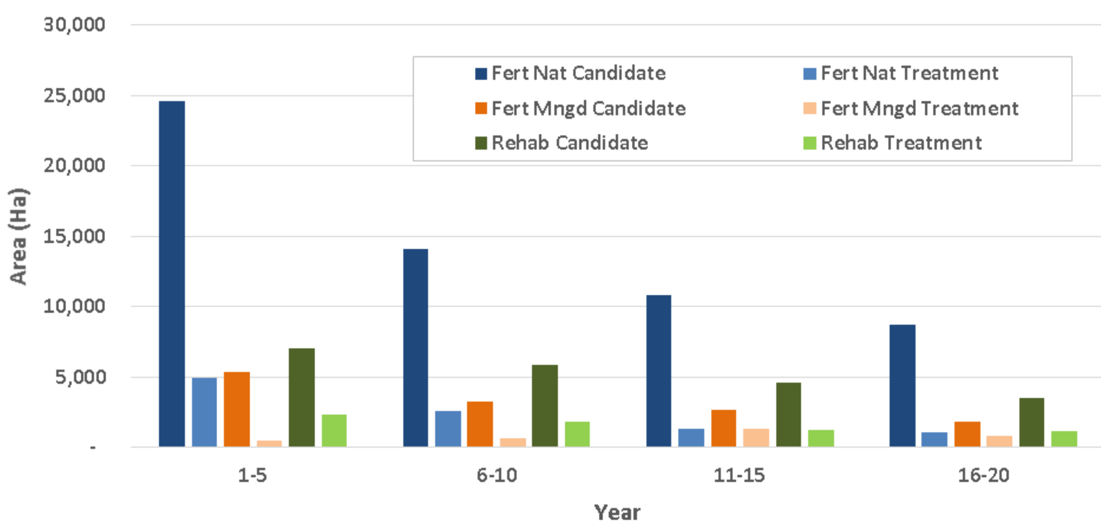


Figure 70 Candidate Area and Subsequent Treatment for Run 2 – Short-/mid-term Flow Priority

7 Combined Scenario

7.1 Description

The Combined Scenario aimed to guide the development and monitoring of tactical plans over the first 20 years of the planning horizon. Key elements from all four scenarios (Base Case, Reserves, Harvest, and Silviculture) were included to provide an integrated strategy to this first iteration of the ISS process.

Table 19 summarizes the three different model run completed for the Combined Scenario.

Table 19 Criteria Applied in the Combined Scenario

Scenario	Criteria
Run 1 – Combined (Spatial OGMAs)	o Removed OGMAs from the THLB as a spatial netdown (i.e., did not incorporate candidate reserves developed in the Reserve Scenario)
Run 2 - Candidate Reserves	o Prevented harvesting within candidate reserves developed in the Reserve Scenario for the first 40 years; after which time they became eligible for harvest. o Implemented old seral targets over the duration of the planning horizon. o Permitted harvesting of spatial OGMAs that did not overlap with Candidate Reserves.
Run 3 - Increased Fertilization Opportunity	Sensitivity analysis based on Run 1, and included the following elements: o Slope restrictions were relaxed on stands eligible for fertilization. Specifically, stands were considered eligible if no more than 50% of their area has slopes greater than 45%.

Key elements from each of the Base Case, Reserve, Harvest, and Silviculture Scenarios are summarized below.

ISS Base Case

- THLB definition from ISS Base Case (included reduction for coastal tailed frog point buffers)
- Active targets from base case (Early seral patch size with low weight, community watershed ECA, Fisheries Sensitive Watershed ECA, Moose forage, visuals)
- Addition of the IRM adjacency constraint (maximum 33% of a cumulative effects watershed to be below 3 metres in height) that was modelled as a sensitivity analysis

Reserve Scenario (modelled as Run 2)

- Spatial OGMAs from the ISS Base Case added back into the THLB (22,596 hectares)
- Harvest prevented in the reserves from the reserve scenario for the first 40 years
- Old seral targets from the Non-Spatial Old Growth order implemented

Harvest Scenario

- Four minimum harvest criteria classes (75 to 100 m^3/ha, 100 to 150 m^3/ha, 150 to 200 m^3/ha, and >= 200 m^3/ha), with implementation of a minimum flow from stands with >= 200 m^3/ha.
- “Smoothing” of the selection harvest flow over time
- Managed stands must reach 95% of CMAI, and at least 60 years of age to be eligible for harvest

- 0 to 1 hectare harvest “patches” not allowed, and 1 to 5 hectare patches limited to 5% of the harvest area
- Minimum harvest criteria on slopes > 45% set to 150 m^3/ha
- Selection harvest not allowed on slopes > 45%
- Increased priority in the first 10 years for harvest from Wildland Urban Interfaces, Fire breaks, and stands with a Provincial Strategic Threat Analysis “Extreme” fire hazard rating
- Reforestation of all harvest stands within Wildland Urban Interfaces using reduced stocking standards (“clumped” regeneration method, 600 stems per hectare)

Silviculture Scenario

- Eligible treatments include MPB rehabilitation, Fertilization, and Enhanced Basic Silviculture
- Total budget of $3 million annually for 20 years
- Enhanced Basic Silviculture limited to 50% of the clearcut area
- Minimum harvest criteria for “Enhanced” stands relaxed to allow harvest below 60 years of age provided 95% of CMAI is reached.

7.2 Results

7.2.1 Harvest Flows

Figure 71 and Table 20 compare the three Combined Scenario runs with the ISS Base Case. The Run 1 harvest flow is very close to the ISS Base case for the first 50 years, after which it can be increased for 15 years before stabilizing on a long-term value that is 1.4% higher than the ISS Base Case. Increasing the opportunities for fertilization by relaxing the slope constraint (Run 3) does not result in a significantly different harvest flow.

Implementing the candidate reserves developed in the reserve scenario for 40 years and allowing harvest within the spatial OGMAs (Run 2) reduced the harvest flow by 5.5% over the first 50 years, primarily because this run also implemented the old seral requirements from the Non-Spatial Old Growth Order. This reduction is similar to the “Old Seral Sensitivity” run observed in the ISS Base Case Scenario (Section 3.1). With the higher THLB in this scenario, the long-term harvest level for Run 2 is approximately 1.7% higher than Run 1.

Based on these results, Run 1 using the existing spatial OGMAS was selected for developing the tactical plan and for reporting the more detailed metrics for the Combined Scenario.

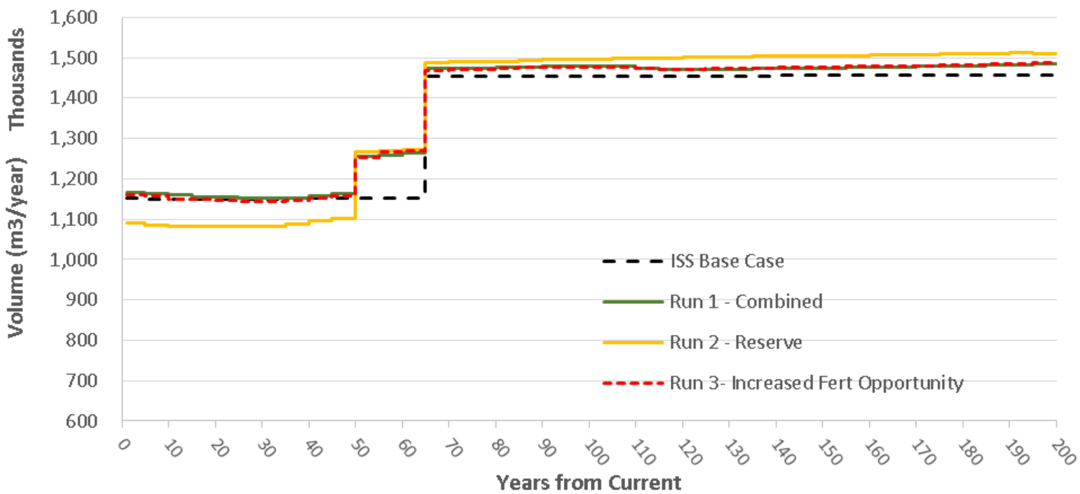


Figure 71 Harvest Flows for the Combined Scenario Runs

Table 20 Comparison of Combined Scenario Flows to the ISS Base Case

Scenario	Years 1-50 Average (m^3/yr)	Years 1-50 Compared to Base Case (%)	Years 51-65 Average (m^3/yr)	Years 51-65 Compared to Base Case (%)	Long-term Average (m^3/yr)	Long-term Compared to Base Case (%)
ISS Base Case	1,150,691	100.00	1,151,986	100.00	1,455,628	100.00
Run 1: Combined	1,158,060	100.64	1,259,003	109.29	1,476,304	101.42
Run 2: Reserve	1,087,612	94.52	1,269,151	110.17	1,501,600	103.16
Run 3: Increased Fert. Opportunity	1,150,881	100.02	1,263,338	109.67	1,476,749	101.45

7.2.2 Harvest Ages

The distribution of harvest ages over time for Run 1 of the Combined Scenario is shown in Figure 72. Most of the managed stands harvested are at least 60 years of age. There is a small amount of volume harvested from stands less than 60 years of age, which reflects harvest of stands that were regenerated using enhanced basic silviculture. These stands are eligible for harvest once they reach 95% of CMAI, even if they are less than 60 years old.

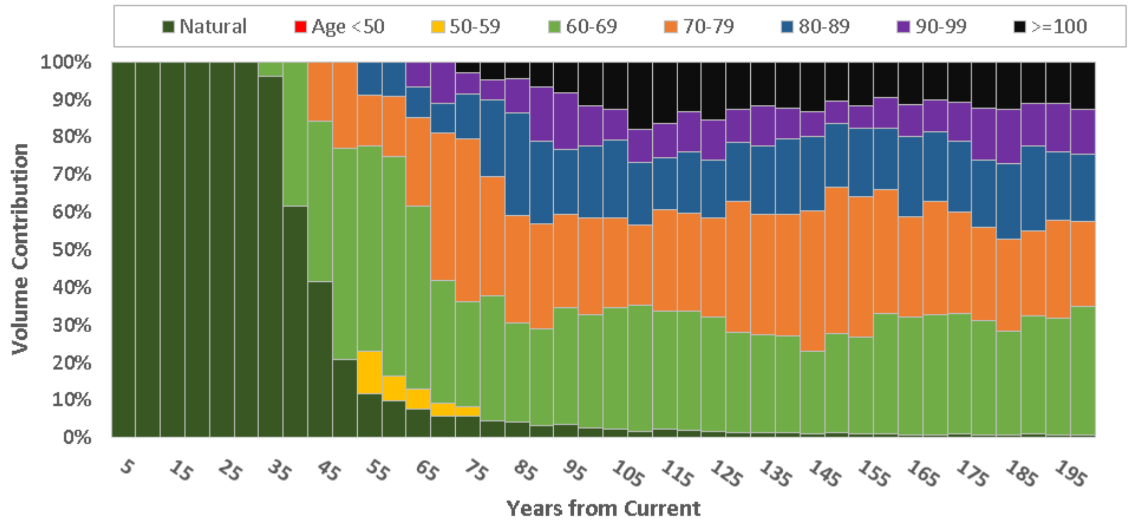


Figure 72 Harvest Ages for the Combined Scenario Run 1

7.2.3 Growing Stock

Figure 73 shows the total THLB volume for each of the Combined Scenario runs compared with the ISS Base Case. In all cases, the long-term growing stock is higher for the Combined Scenario runs. The long-term growing stock for Run 2 due to the increased THLB for this scenario.

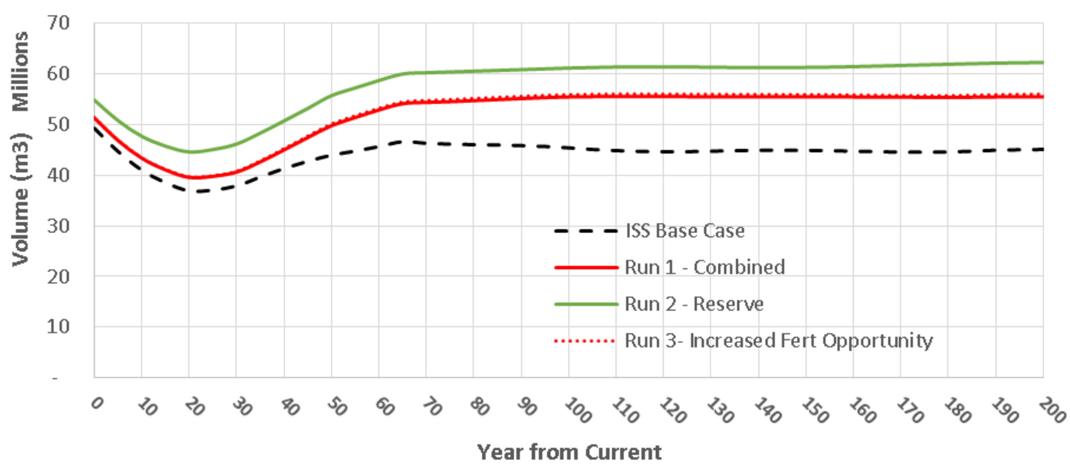
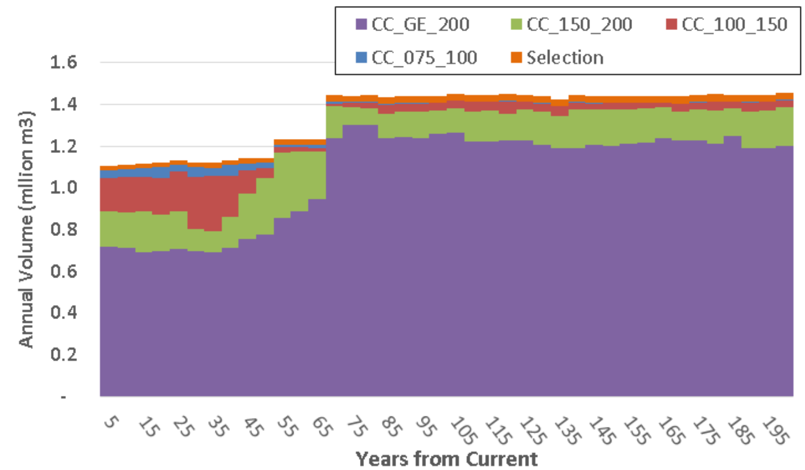


Figure 73 THLB Growing Stock for the Combined Scenario Runs

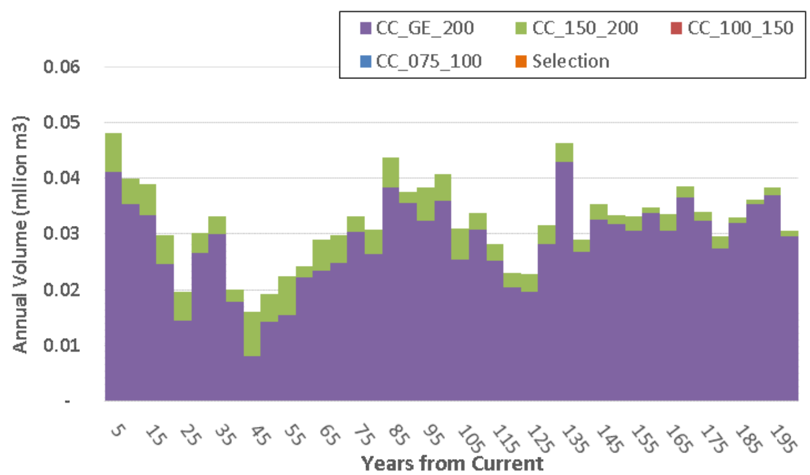
7.2.4 Harvest Profile by Slope

Figure 74 shows the harvest profile by slope and volume class for Run 1 of the Combined Scenario. In the first 50 years a significant proportion (~18.4%) of the volume is harvested in stands with less than 150 m³/ha. However, all of this is from stands on slopes less than 45%. There is no selection harvesting on slopes >= 45%, and most of the volume (~83.3% in the first 50 years) on the steeper slopes is from stands with at least 200 m³/ha.

Slope < 45%



Slope >= 45%



Total Landbase

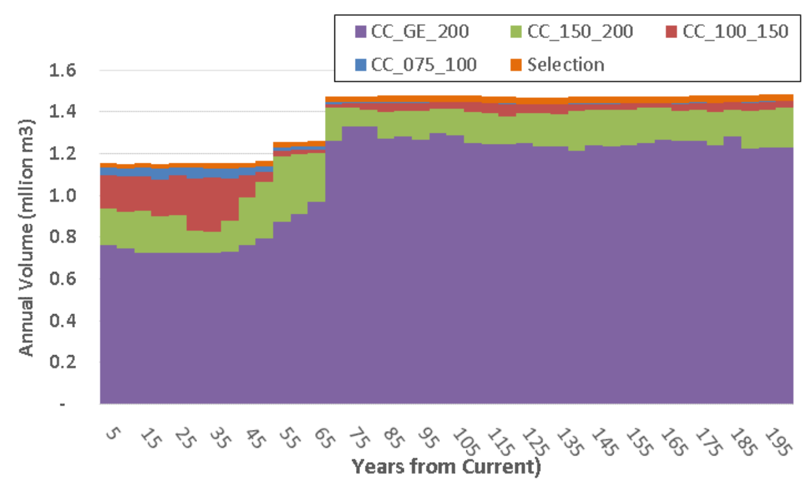
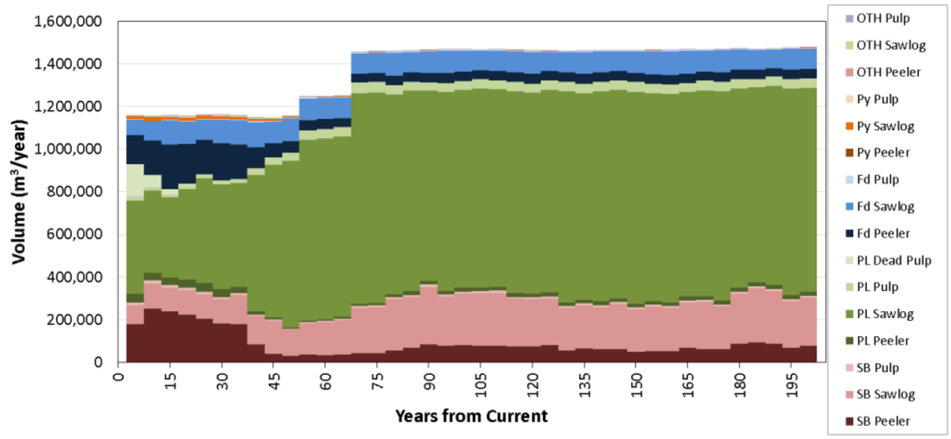


Figure 74 Harvest Profile by Slope and Volume Class for Combined Scenario Run 1

7.2.5 Harvest Profile by Species

Figure 75 shows the species and harvest profile for Run 1 using the assumptions outlined in Section 5.2.5. Note that the information presented here is one example of user-input estimates to illustrate the product distributions by age class. The intent is for a user knowledgeable with the local timber characteristics to update the information in the spreadsheet to produce a better estimate of products.

Product Volume: Combined Scenario Run 1



Product Percentage: Combined Scenario Run 1

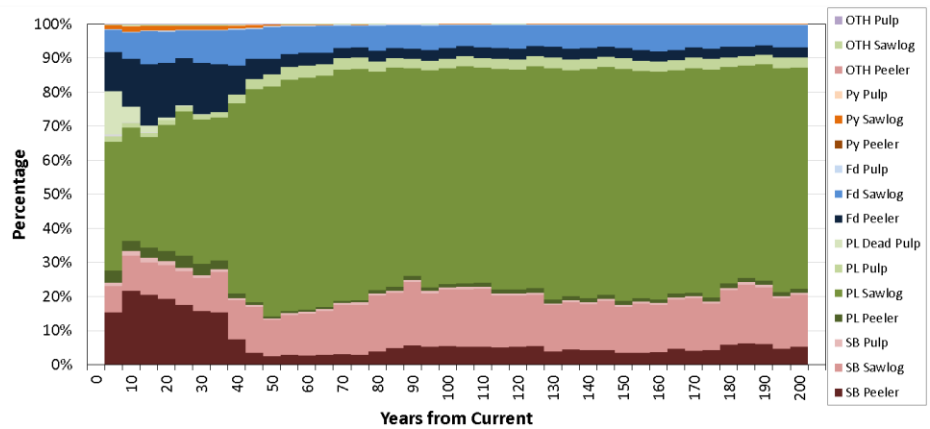


Figure 75 Species and Grade Profile for the Combined Scenario Run 1 (Harvest Flow and Percentages)

7.2.6 Harvest Opening Size

Figure 76 summarizes the harvest opening size distributions for Combined Scenario Run 1 for both clearcut and selection silviculture systems. The proportion of larger block sizes is less for selection systems than clearcut.

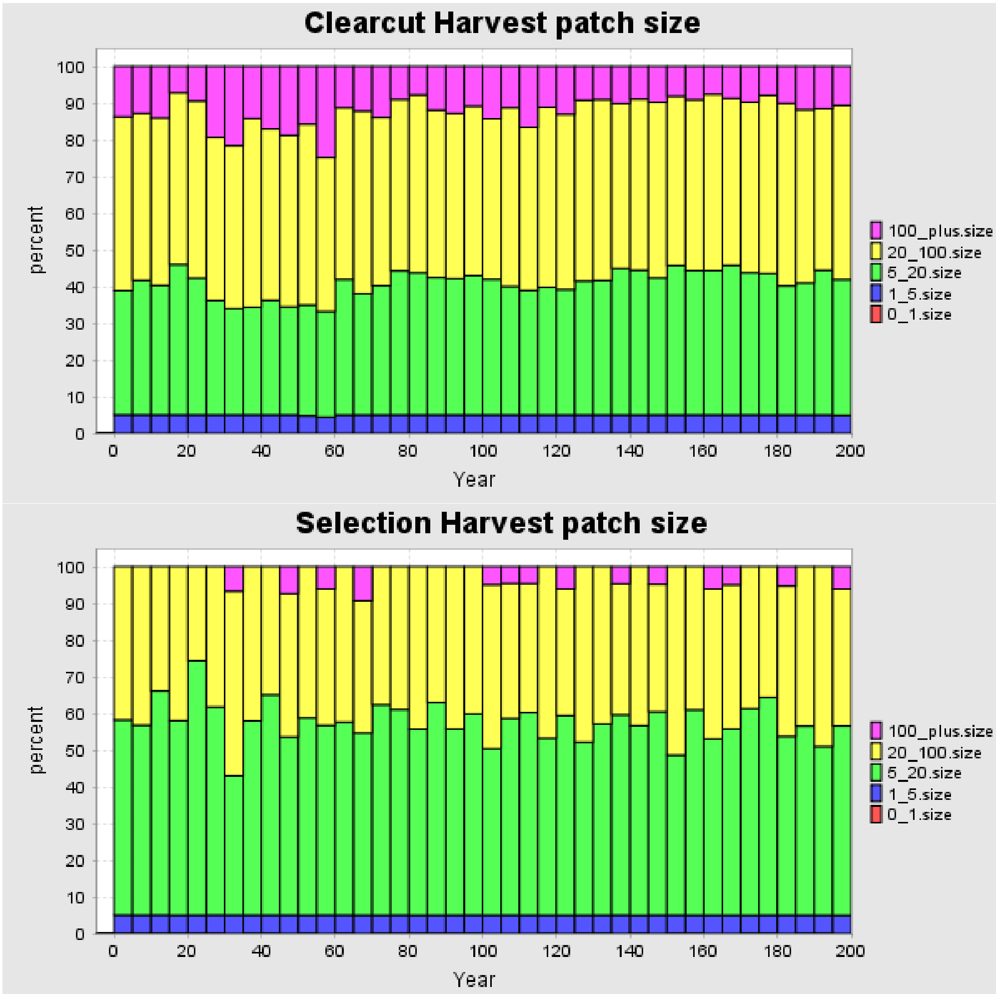


Figure 76 Clearcut and Selection Harvest Cutblock Sizes for Combined Scenario Run 1

7.2.7 Fire Management Harvest Priority

Figure 77 shows the harvest levels from within fire management priority areas for Run 1. The model successfully achieved the increased target set for the first 10 years of the planning horizon. Figure 78 summarizes the area planted in each period within Wildland Urban Interface areas, as well as, the cumulative area being managed with reduced stocking through time. The cumulative area increases quite rapidly for the first 75 years, then reduces as stands with reduced stocking are harvested and regenerated again with reduced stocking.

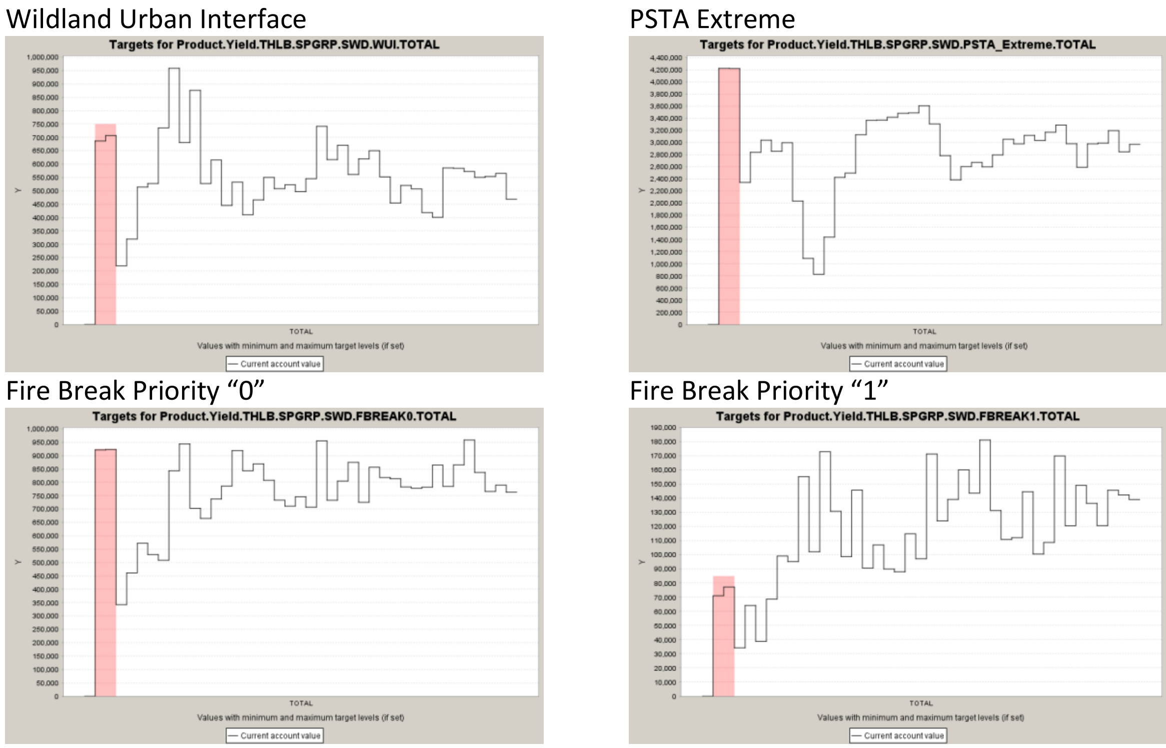


Figure 77 Harvest Volume from Fire Management Priority Stands for Combined Scenario Run 1

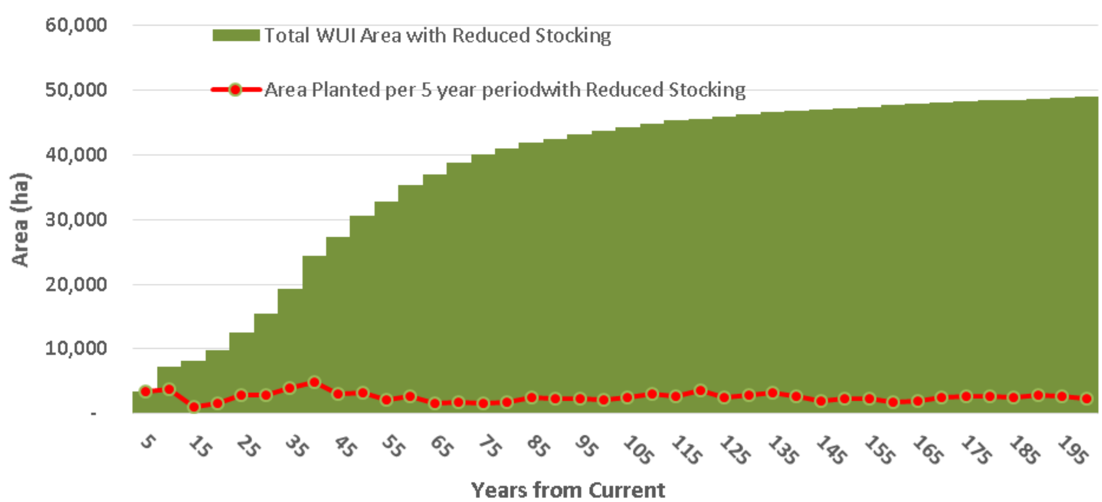
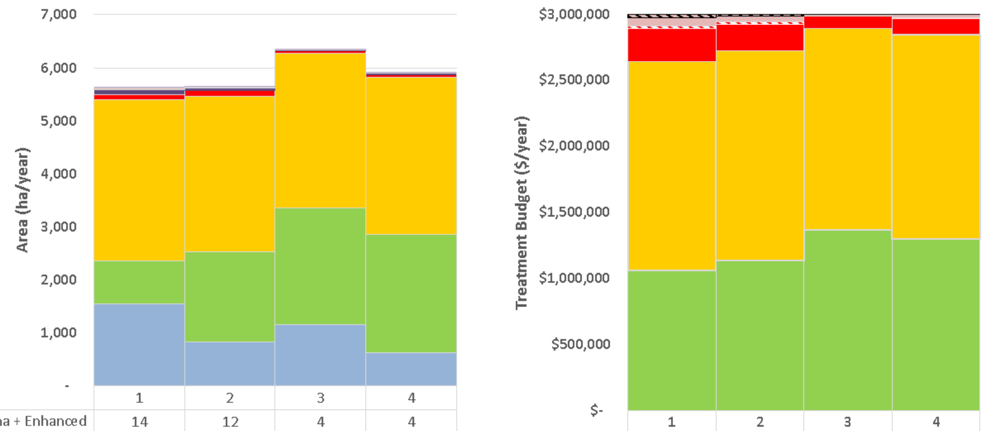


Figure 78 Wildland Urban Interface areas Planted with Reduced Stocking for Combined Scenario Run 1

7.2.8 Silviculture Treatments

Like the Silviculture Scenario, the $3 million budget was spent mostly on enhanced basic silviculture and rehabilitation tactics (Figure 79). Relatively little area – and budget – was identified with rehabilitation treatments. Note that in this chart, areas fertilized multiple times were accounted for multiple times.



	1	2	3	4
Rehab LT 50m³/ha + Enhanced	14	12	4	4
Rehab LT 50m³/ha	35	19	3	13
Rehab GE 50m³/ha + Enhanced	86	54	21	36
Rehab GE 50m³/ha	100	99	40	47
Enhanced	3,042	2,945	2,928	2,954
Mngd Fert (All Treatments)	819	1,692	2,200	2,232
Nat Fert (All Treatments)	1,540	830	1,151	630

	1	2	3	4
Rehab_LT_50 in WUI	$28,657	$12,524	$47	$3,574
Rehab_LT50	$59,493	$45,280	$16,145	$27,387
Rehab_GE50_in_WUI	$18,164	$20,248	$2,404	$4,465
Rehab_GE50	$251,886	$199,425	$88,630	$118,019
Enhanced	$1,580,460	$1,587,530	$1,524,646	$1,549,189
Fertilization	$1,061,321	$1,134,983	$1,368,072	$1,297,314

Figure 79 Treatment Budget and Area over first 20 years – Combined Scenario

Figure 80 shows the area treated in each 5-year period and the corresponding area harvested in the future for the Combined Scenario Run1. During the first 20 years, the model applied the full annual budget of $3 million per year. There is a reduced proportion of enhanced basic silviculture treatments compared to the Silviculture Scenario because the Combined Scenario limited enhanced basic silviculture to 50% of the clearcut harvest area. This results in a greater proportion of fertilization treatments that become an important component of the harvest between 30 and 50 years in the future, whereas stands treated with enhanced basic silviculture begin to contribute to harvest after about 50 years. Note that in this chart, areas fertilized multiple times were identified but not accounted for multiple times.

A sensitivity run (Run 3) was completed to determine if increasing the eligible area for fertilization resulted in an increase in the actual area fertilized. In this run, stands were considered eligible for fertilization if under 50% of the stand was >= 45% in slope, compared with Run 1 where any stands with slope >= 45% were ineligible. Figure 81 provides a comparison of the candidate areas and actual treatments for these two runs. Although the area eligible for fertilization increased significantly (12,200 hectares, or 33.7% in the first period), the total area fertilized during the first 20 years only increased by 2,360 hectares, or 8.1%). Furthermore, this reallocation of treatments did not result in a significantly different harvest flow (Section 7.2.1).

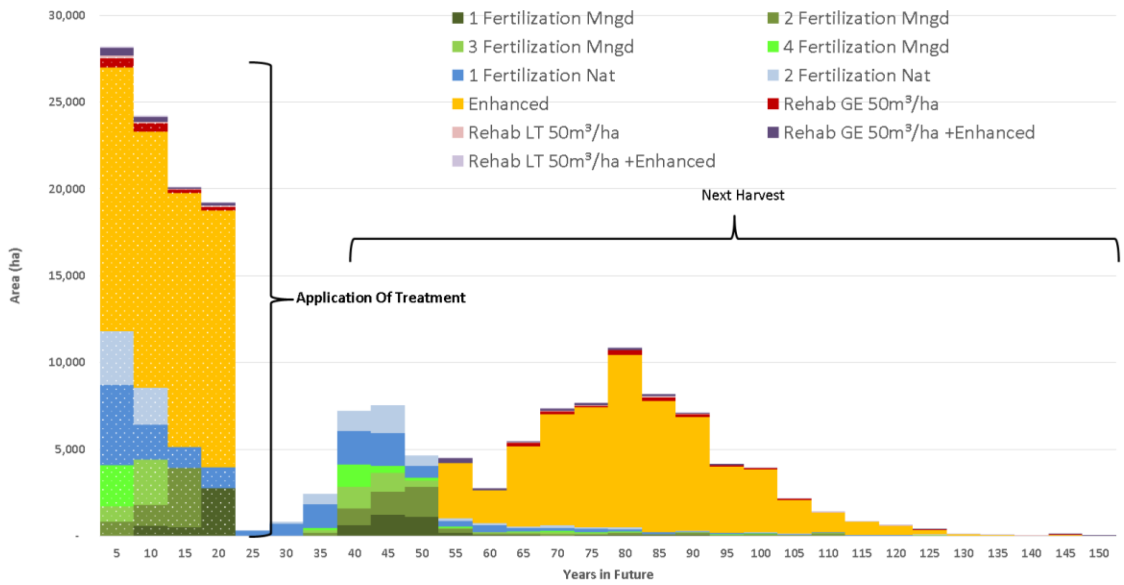
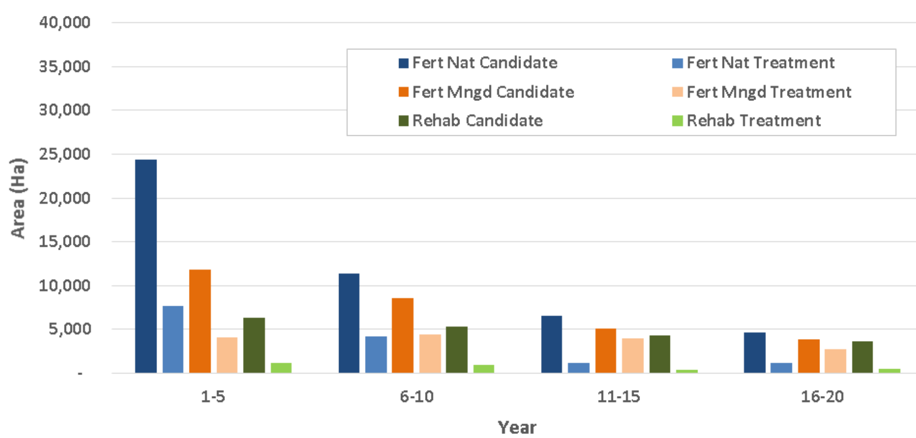


Figure 80 Treatments and Subsequent Harvest for the Combined Scenario Run 1

Run 1



Run3 – Increase Fertilization Opportunity

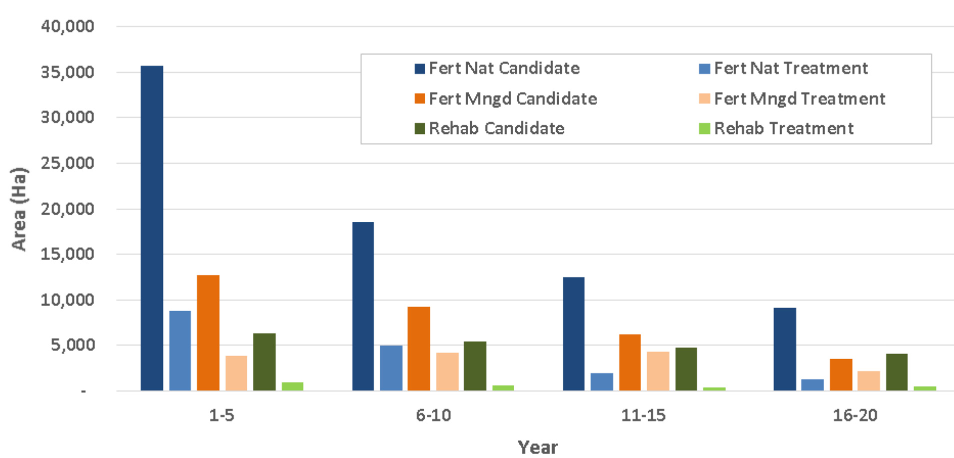


Figure 81 Candidate Area and Subsequent Treatment for Combined Scenario Run 1 and Run3

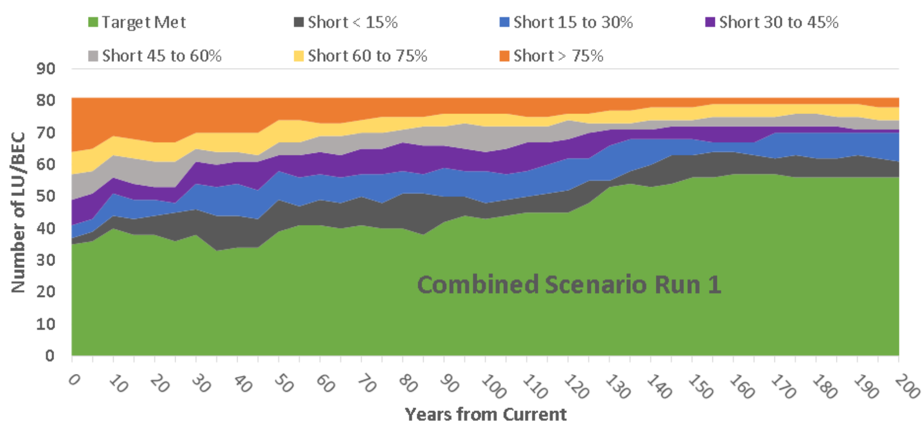
7.2.9 Non-Timber Objectives

Reporting was completed for the status of several non-timber objectives that did not have explicit targets set. The following subsections summarize these results for Run 1 of the Combined Scenario.

7.2.9.1 Old Seral

Figure 82 summarizes the old seral status over time for the Combined Scenario Run 1. As identified in the ISS Base Case, the non-legal, spatial OGMAs do not currently contain enough old seral to meet the requirements of the Non-Spatial Old Growth Order. Recruitment occurs over time, with the area of old seral relative to targets steadily increasing before reaching a steady state approximately 140 years from now.

Old Seral Target Status by Number of LU/BEC Combinations



Old Seral Target Status by Area

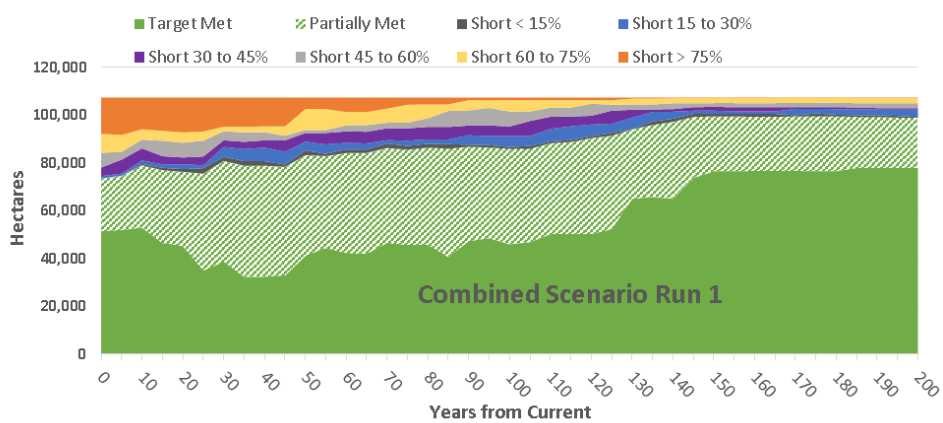
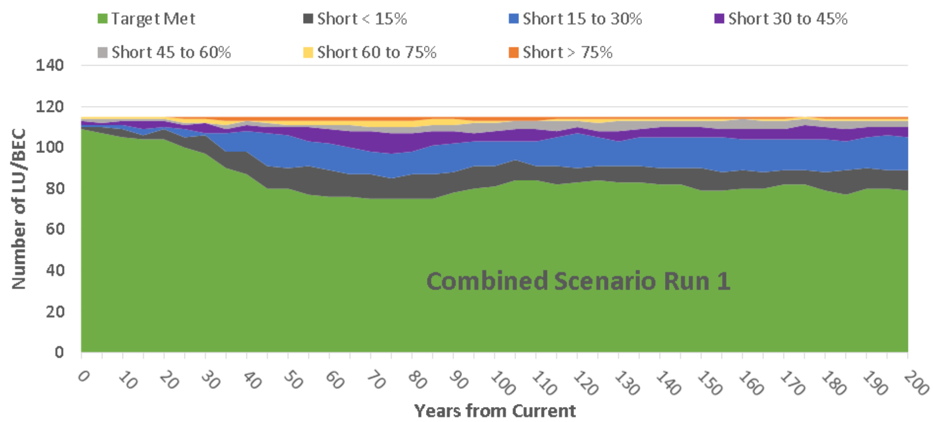


Figure 82 Old Seral Target Status for Combined Scenario Run 1

7.2.9.2 Mature-Plus-Old-Seral

Figure 83 summarizes the mature-plus-old seral status relative to the targets outlined in the Biodiversity Guidebook. Similar to the results from the ISS Base Case (Section 3.2.1.2), there is an overall reduction in the amount of mature-plus-old seral on the landscape over time.

Mature-Plus-Old Seral Target Status by Number of LU/BEC Combinations



Mature-Plus-Old Seral Target Status by Area

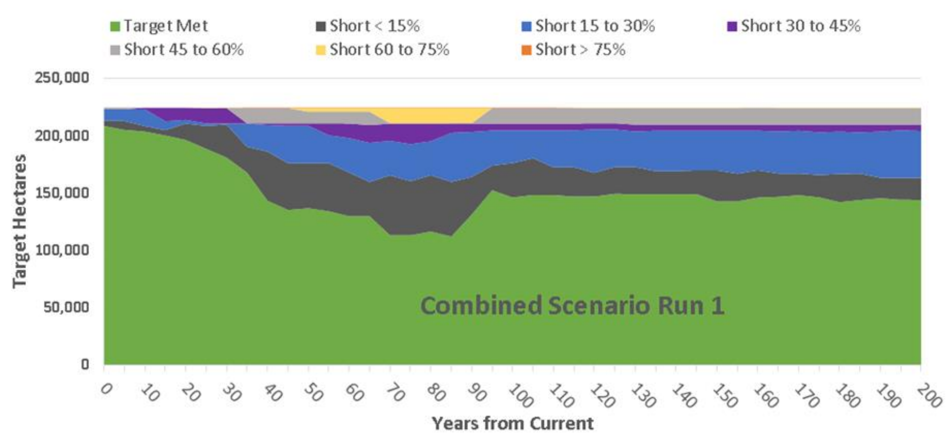
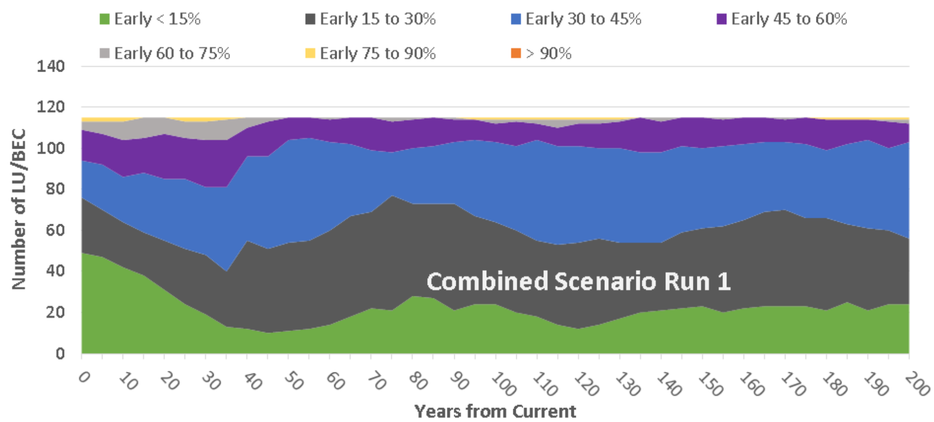


Figure 83 Mature-Plus-Old Seral Target Status for the Combined Scenario Run 1

7.2.9.3 Early Seral

Figure 84 summarizes the distribution of early seral on the landbase. Note that there were no reference targets established; these early seral distributions are intended for information purposes only. The area of early seral climbs for the first 25 years before dropping to a stable long-term amount.

Early Seral Target Status by Number of LU/BEC Combinations



Early Seral Target Status by Area

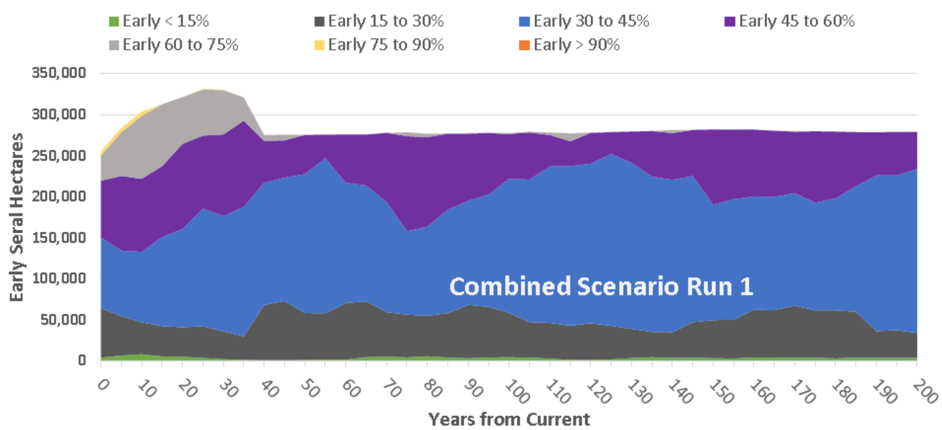


Figure 84 Early Seral Target Status for the Combined Scenario Run 1

7.2.9.4 Very Early Patch Size

Figure 85 shows the very early seral (<20 years) patch size distributions for the Combined Scenario Run 1. The top graph for each NDT provides the proportion of each patch size by period throughout the planning horizon. The bottom graph provides the average and range for each patch size category relative to the targets. The desired distributions are not achieved due to the relatively low weight set for this target.

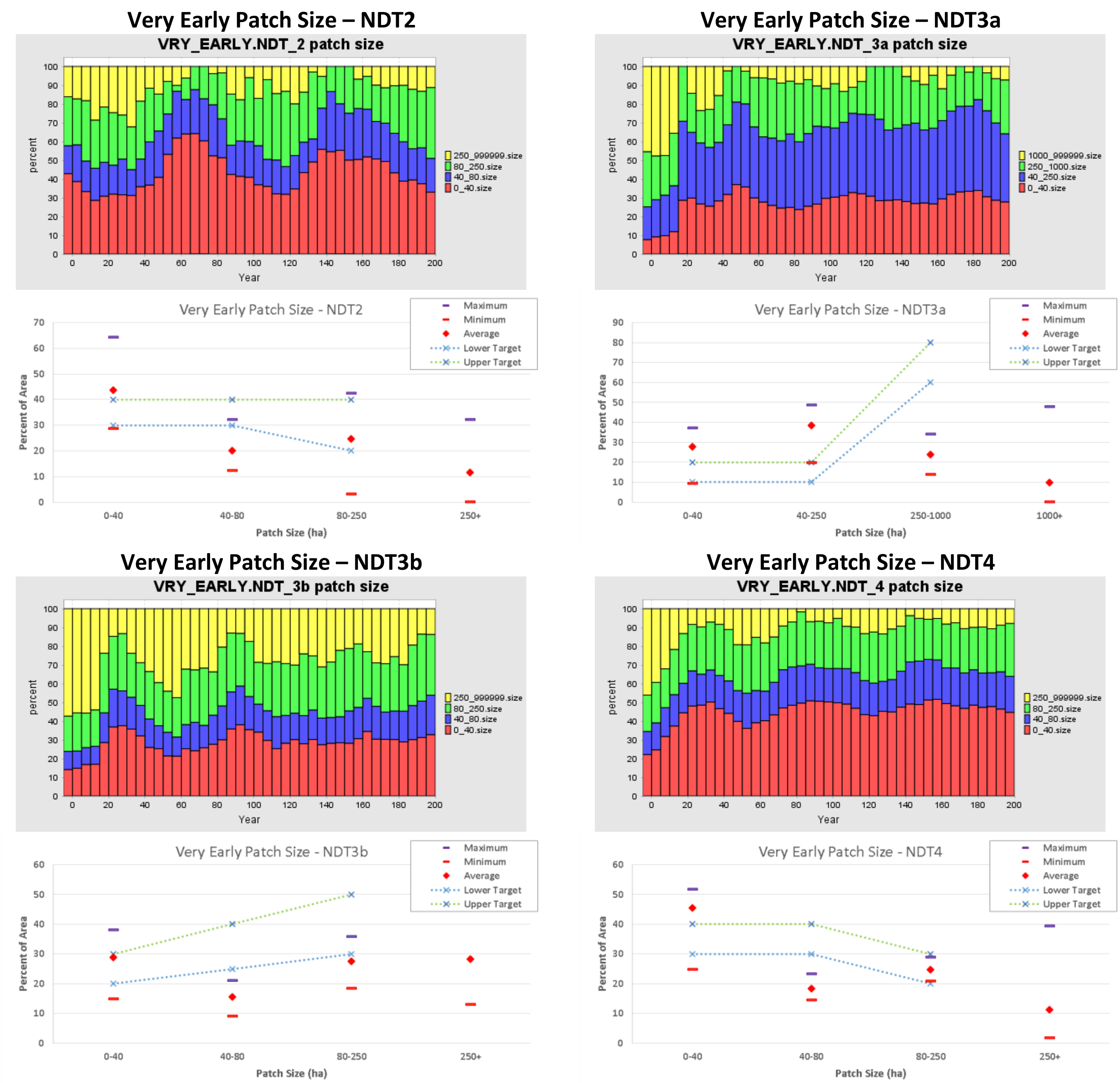


Figure 85 Very Early Seral Patch Size Distributions for the Combined Scenario Run 1

7.2.9.5 Mature-Plus-Old Patch Size

Figure 86 shows the mature-plus-old seral patch size distributions for the Combined Scenario Run 1. Similar to the ISS Base Case, both NDT2 and NDT4 have patch size distributions that are not well aligned with the targets in the Biodiversity Guidebook. There is too much in large patches and not enough in small patches. In comparison, NDT3a has more area in small patches than desired, at the expense of larger patches. NDT3b has the best overall alignment of patch size distribution with the desired targets.

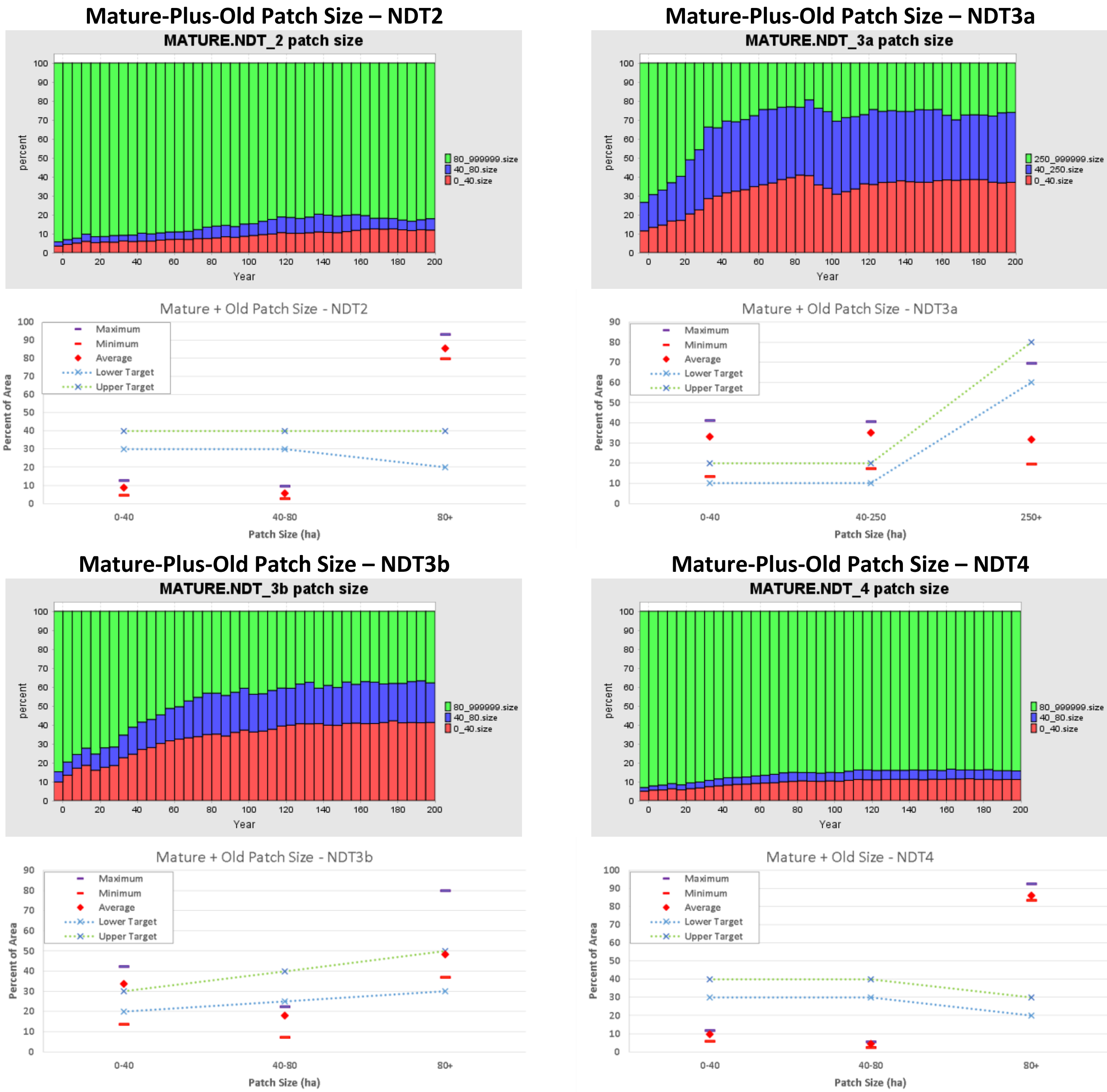


Figure 86 Mature-Plus-Old Seral Patch Size Distributions for the Combined Scenario Run 1

7.2.9.6 Moose Winter Range

The Combined Scenario implemented a minimum threshold of 15% of early seral (<25 years of IDF/ICH and <35 years for MS/ESSF). Figure 87 shows the status of this constraint for Run 1, which was easily met throughout the planning horizon. In addition, the status of cover (stands >= 16 metres in height) was monitored as follows:

- Area of cover within the moose polygon
- Area of cover within 200 metres of riparian features within the moose polygon
- Amount of cover in patches greater >= 20 hectares.

Figure 88 provides an overview of the cover status within the moose polygon.

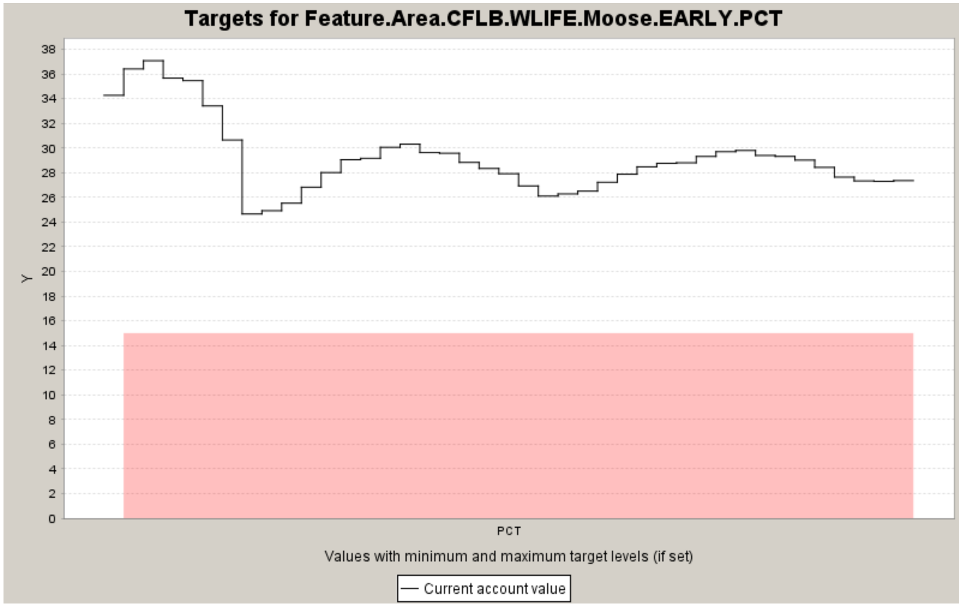
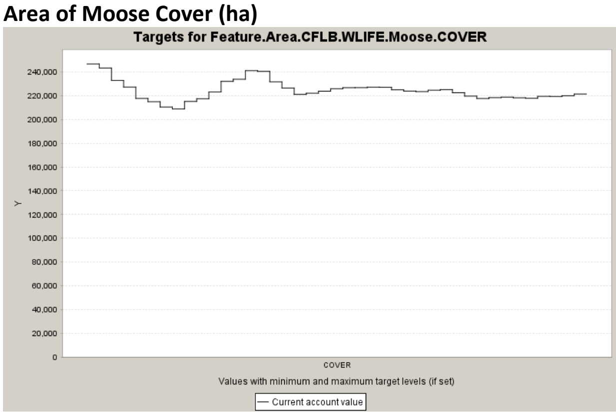
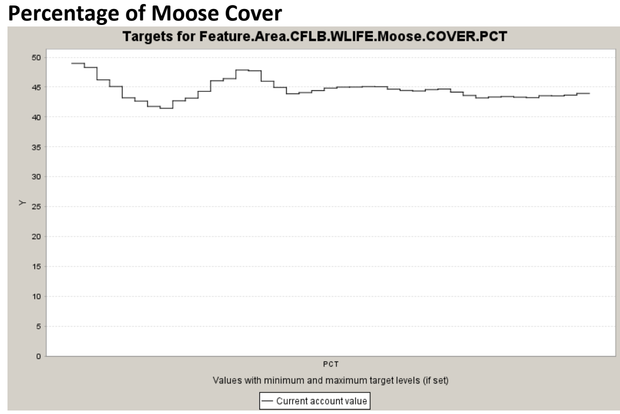


Figure 87 Moose Early Seral Status for Combined Scenario Run 1

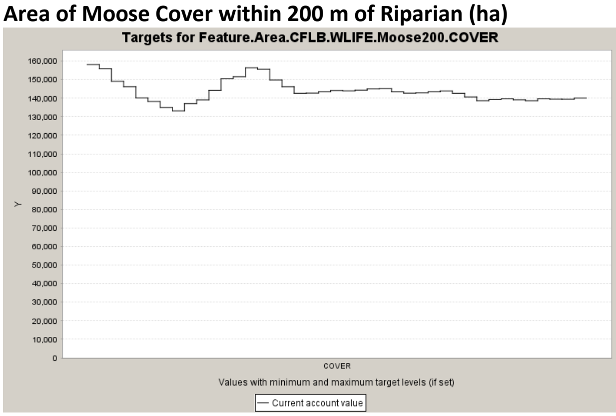
Area of Moose Cover (ha)



Percentage of Moose Cover



Area of Moose Cover within 200 m of Riparian (ha)



Moose Cover Patch Size

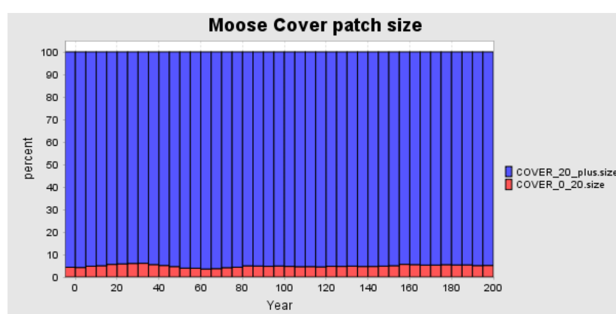


Figure 88 Moose Cover Status for Combined Scenario Run1

7.2.9.7 Marten Habitat

To provide insight into marten habitat over time, Run 1 of the Combined Scenario reported the amount of seral in the MS and ESSF zones, as well as, the amount of mature-plus-old seral in the CWHms, ESSFdc, ESSFdcw, ESSFxc, ESSFmw, and ESSFmww subzones. No target thresholds were set for these indicators. Figure 89 illustrates the status of early seral, and Figure 90 shows the status of mature-plus-old seral for the selected BEC zones/subzones. The results are very similar to those for the ISS Base Case (Section 3.2.3.3).

Early Seral in the MS (%) **Early Seral in the ESSF (%)**

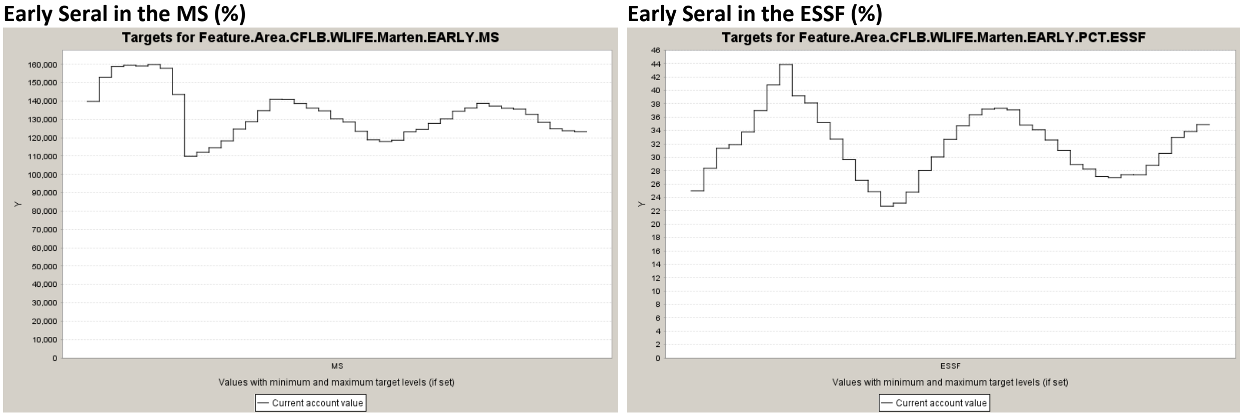
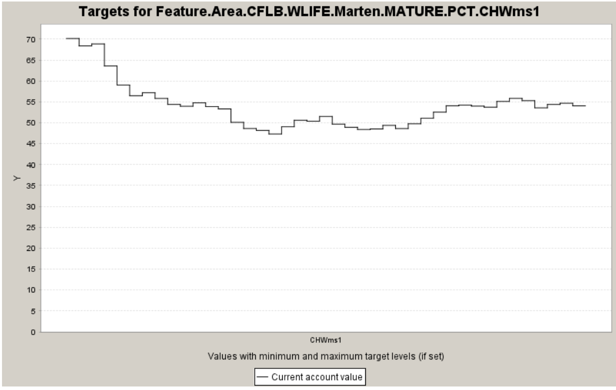
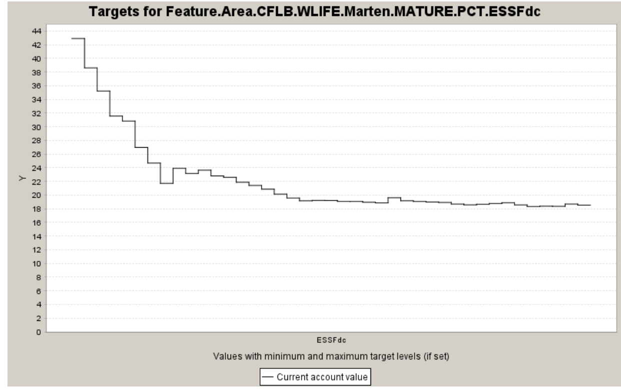


Figure 89 Marten Habitat – Early Seral Status by BEC Zone for the Combined Scenario Run1

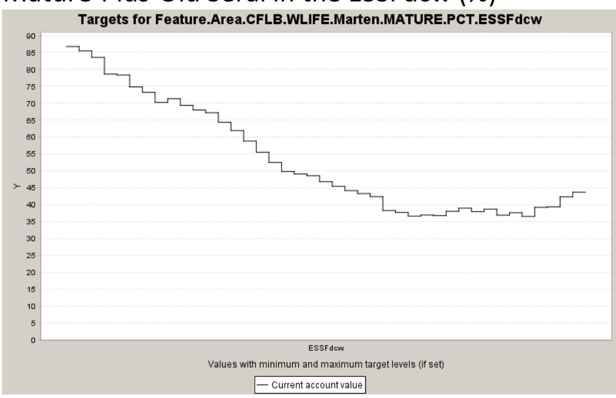
Mature-Plus-Old Seral in the CWHms1 (%)



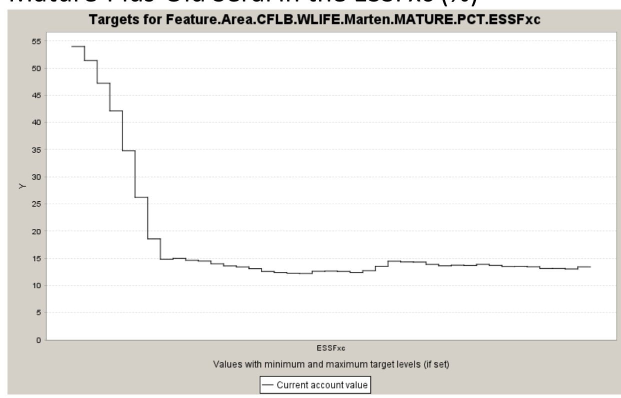
Mature-Plus-Old Seral in the ESSFdc (%)



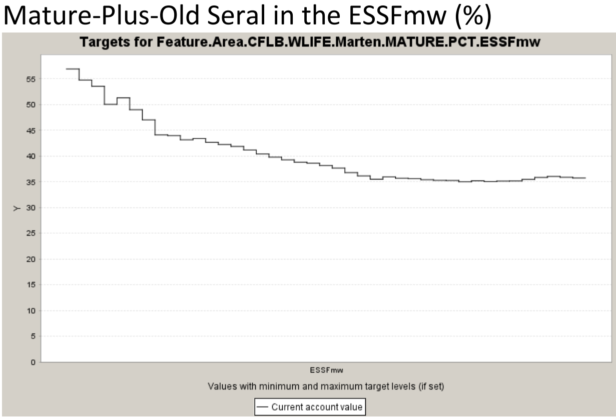
Mature-Plus-Old Seral in the ESSFdcw (%)



Mature-Plus-Old Seral in the ESSFxc (%)



Mature-Plus-Old Seral in the ESSFmw (%)



Mature-Plus-Old Seral in the ESSFmww (%)

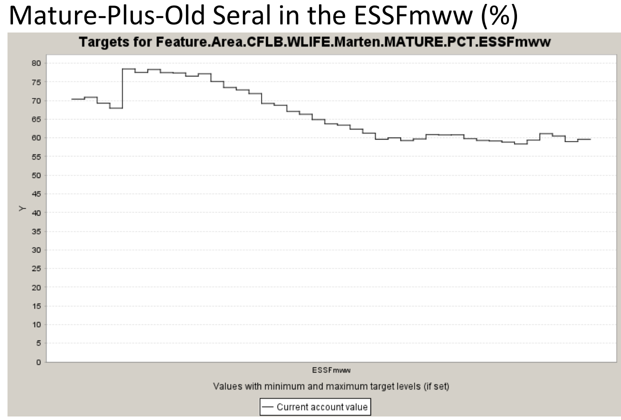
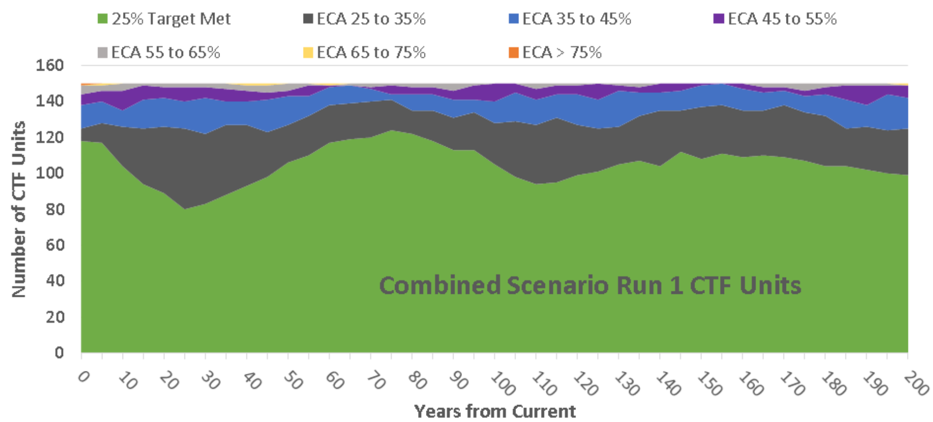


Figure 90 Marten Habitat – Mature-Plus-Old Seral Status by BEC Variant for Combined Scenario Run1

7.2.9.8 Coastal Tailed Frog

ECAs on 152 watershed units identified as sensitive for CTF (large watersheds, watersheds, basins, sub-basins and residuals) were monitored relative to a non-legal threshold of 25%. Figure 91 shows both the number of units and the area relative to this threshold for Run 1 of the Combined Scenario. Similar to the results for the ISS Base Case (Section 3.2.3.1), a significant number and area of CTF watershed units exceeded 25% ECA.

Number of Coastal Tailed Frog Watershed Units by ECA Status



Area of Coastal Tailed Frog Watershed Units by ECA Status

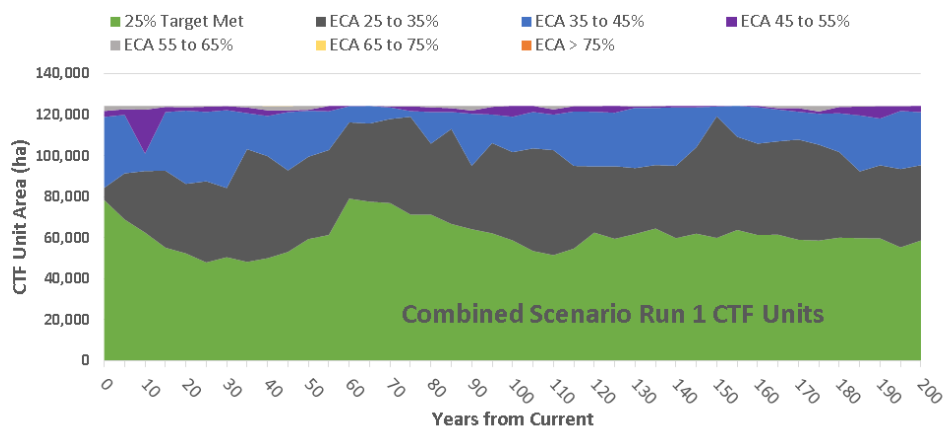


Figure 91 Coastal Tailed Frog Watershed Unit ECA Status for Combined Scenario Run 1

8 Discussion

8.1 Key Observations

These ISS analyses generated numerous reports and spatial outputs associated with the modelling tactics implemented. The key observations for all scenarios completed so far (i.e., ISS Base Case, Reserve, Harvest, and Silviculture) are briefly summarized in Table 21.

Table 21 Summary of Key Observations

Topic	Key Observations
Old Seral	The intent of the OGMA order is met by following a process that was developed by multiple stakeholders and First Nations over several years and approved by government. These OGMAs do not currently contain enough old seral to meet the requirements and further recruitment of new OGMAs over the next century will not meet these old seral requirements in all units. Implementing old seral requirements significantly reduced the harvest levels in both the short- and long-terms. See sections 3.1, 3.2.1.1 and 7.2.9.1.
Mature-Plus-Old Seral	Implementing mature-plus-old seral requirements reduced the harvest levels in both the short- and long-terms by 2.4% and 1.3%, respectively. See sections 3.1, 3.2.1.2 and 7.2.9.2.

Topic	Key Observations
Early Seral	The early seral (<40 years) status was reported (only) for each LU/BEC combination. With no constraint in place, approximately 80% of these units exceeded the non-legal threshold of 15%. See sections 3.2.1.3 and 7.2.9.3.
Very Early Patch Size	All scenarios implemented target ranges for very early seral stage (age <20 years) by NDT with low weights to avoid affecting harvest levels. While increasing weights of the patch size targets improved the results, the desired distributions were still not achieved for all categories and periods. These adjustments did not result in a significant impact on timber supply. See sections 3.2.1.4 and 7.2.9.4
Mature-Plus-Old Patch Size	To demonstrate the effect of implementing very early patch size, the Combined Scenario reported (only) mature-plus-old seral patch size distributions. While they vary by NDT, the results over time clearly trended towards the desired patch size distribution. See section 7.2.9.5.
Adjacency	There was no significant difference in harvest flows when the TSR adjacency constraints (i.e. maximum 33% area less than 3 metres tall) were applied rather than patch size targets. See sections 3.1 and 3.2.4.3.
Contiguous Mature Pine	There is very little difference between the Base Case and the pine-leading patch runs. While it is possible that this could change if the weight for this target was increased, this could result in an undesirable impact on timber supply. See sections 3.1 and 3.2.4.4.
Community Watersheds	A maximum ECA threshold of 30% was applied to nine community watersheds. Three of these initially exceeded this threshold but all recovered within two decades. See section 3.2.2.1.
Fisheries Sensitive Watersheds	The proposed FSW GAR order limits ECA to 25% above the snowline for sixteen watershed units. Two of these initially exceeded this threshold but they recovered within two decades. See section 3.2.2.2. The proposed FSW GAR order also includes the requirement for a sustainable rate of cut within each watershed unit so a sensitivity analysis limited the area harvested per period in each unit within a specified range of the expected (based on average rotation age) area that could be harvested sustainably. When the rate of cut constraint is implemented, the number of watersheds that exceed the maximum clearcut area each period is reduced substantially; reducing the area harvested greater than the maximum (averaging 0.6 hectares per year). Ultimately, this constraint had very little impact on harvest flows. See sections 3.1 and 3.2.2.3.
Cumulative Effects Watersheds	The ECA above the H40 and H60 snowlines was reported (only) for 136 cumulative effects assessment watersheds relative to non-legal thresholds of 35% and 25% for units with a High and Low/Moderate hazard rating, respectively. With no constraint in place, approximately 1/3 and more than half of the Low/Moderate and High hazard watersheds, respectfully, exceed these thresholds. See section 3.2.2.4.
Coastal Tailed Frog	The THLB was reduced for and ECAs were monitored on 152 watershed units relative to a non-legal threshold of 25%. In the Base Case Scenario, a significant number and area of CTF watershed units exceeded the 25% ECA. See sections 3.2.3.1 and 7.2.9.8.
Moose Winter Range	The minimum threshold of 15% of early seral is easily met throughout the planning horizon. The area of moose cover at least 16 meters in height averages 47% for the first 70 years, before declining to a long-term level of about 37%. A significant proportion (> 75%) of the cover is located within 200 metres of riparian features and the majority (>90%) is in patches >= 20 hectares. See sections 3.2.3.2 and 7.2.9.6.
Marten	To provide some insight into marten habitat, the status of both early and mature-plus-old seral was reported in identified BEC units. Over time, the early seral status developed into a dampened, cyclical pattern With a few exceptions, the amount of mature-plus-old falls through time with most subzones remaining above 35% over all periods. See sections 3.2.3.3 and 7.2.9.7.

Topic	Key Observations
Visual Quality	Disturbance limits were applied to individual visual polygons according to their recommended visual quality objective. Due to past harvesting and/or natural disturbance, some VQO requirements are initially exceeded; otherwise the limits for vast majority of units are maintained, and are often constraining, over the entire planning horizon. See section 3.2.4.1.
Small Streams	Increasing the buffers on small streams (S4, S5, and S6) to 10 metres reduced the THLB by 10,904 hectares, or approximately 1.9%, which reduced harvest levels by 1.3% in the short-term and 0.7% in the long-term. See sections 3.1 and 3.3.
Candidate Reserves	The candidate reserves developed in the Reserve Scenario resulted in a net area of 22,596 hectares that would be released back as THLB. As well, the overall score of the candidate reserves was 57% higher than the non-legal, spatial OGMAs; suggesting that there was an improvement in the quality of areas reserved through this process. See section 4.2.3.1.
	Implementing the candidate reserves developed in the reserve scenario for 40 years and allowing harvest within the spatial OGMAs reduced the harvest flow by 5.5% over the first 50 years - primarily because this run also implemented the old seral requirements from the Non-Spatial Old Growth Order. Due to the significance of this impact, the candidate reserves were not used for developing the tactical plan. See section 7.2.
Minimum Harvest Criteria	An initial harvest flow established using minimum harvest criteria set to 200 m³/ha was maintained as a target harvest profile in subsequent analyses. Including stands with lower minimum harvest criteria increased short-/mid-term harvest levels by ~34% to ~39% (section 5.2.1).
	Reducing the minimum harvest criteria to 75 m³/ha improved harvest levels; significant proportion of the volume from stands less than 150 m³/hectare over the first 50 years. In the long-term, very few stands less than 150 m³/ha are harvested because of the higher yields realized when these stands are regenerated to managed stand yield tables (section 5.2.1.2).
	Setting the minimum harvest criteria to 60 years and 95% CMAI produced a more desirable harvest age distributions and resulting product profile (section 5.2.2).
Py contribution	Excluding ponderosa pine from the harvest flow and updating stand merchantability accordingly reduced harvest flows only slightly (section 5.2.1.3).
Steep slopes	In the Harvest Scenario, roughly 1/3 of the volume harvested on steep slopes over short-/mid-term is from clearcut stands less than 200 m³/ha or from selection harvesting (Sec 5.2.4). A similar trend was observed in the Combined Scenario where harvest on steep slopes was controlled (i.e., ~18.4% of the clearcut harvest from stands less than 150 m³/ha; all from slopes less than 45%) – section 7.2.4.
Product Profile	A spreadsheet was built to illustrate species and grade profile according to user-defined estimates of species and grade distribution by age class (sections 5.2.5 and 7.2.5)
Small Harvest Openings	Each scenario incorporated patch targets and weights for grouping areas into several harvest opening size categories. This tactic aimed to limit the area harvested in the model as small openings (i.e., none less than 1 ha and up to 5% between 1 ha and 5 ha). It is likely that the weights applied in the Combined Scenario negatively impacted harvest levels. See sections 3.2.4.2, 5.2.6, and 7.2.6.
Partial Cutting	Harvest feasibility was improved in both the Harvest and Combine Scenarios by “smoothing” the selection harvesting volume flow from period to period, rather than allowing the significant fluctuations observed in the ISS Base Case. The model was encouraged to achieve selection volumes between 34,000 m³/year and 37,600 m³/year. See sections 5.1 and 7.1.
Wildfire Management	Over the first 10 years, the model was encouraged to harvest stands located within Wildland Urban Interfaces (THLB Area ~ 79,600 ha), proposed Fire Breaks (THLB Area ~69,250 ha), and areas rated as extreme fire threat (THLB Area ~218,650 ha). After accounting for overlaps, the THLB area where harvest was prioritized for wildfire management was approximately 317,700 hectares. See sections 5.2.7 and 7.2.7.

Topic	Key Observations
	Implementing fire management stocking standards within wildland urban interface areas reduced harvest flows by ~3% over the short-/mid-term. The cumulative area applied with fire management stocking standards increases quite rapidly for the first 75 years, then reduces as stands with reduced stocking are harvested and regenerated again with reduced stocking. See sections 5.2.1.4 and 7.2.7.
Silviculture Tactics	The model applied all of the annual budget of $3 million per year over the first 20 years; mostly on enhanced basic silviculture and rehabilitation tactics. These tactics contributed directly to the harvest over the next 30 to 120 years. To provide a more appropriate distribution, the Combined Scenario limited enhanced basic silviculture to 50% of the clearcut harvest area. See sections 6.2.3 and 7.2.8.
Large Datasets	These forest estate models were extremely complex as modelling details and approaches were addressed as accurately as possible (e.g., large number of non-timber objectives and silviculture treatment options). The exponential growth of these models caused much longer times needed to develop, build, run, and report modelling results. These are important considerations when planning analyses of this magnitude.

8.2 Recommendations

Opportunities to improve future analyses or explore new tactics were identified through these analyses. Specific recommendations are briefly summarized in Table 22.

Table 22 Summary of Recommendations

Topic	Recommendation
Harvest Flow	Implement different rules to prepare a more comprehensive harvest flow. To facilitate easier comparisons between subsequent scenarios, the ISS Base Case scenario applied a single-step transition between the mid- and long-term harvest levels than the multiple steps transition used in the TSR Benchmark scenario. A modified harvest flow could be developed for the Combined Scenario.
Harvest opening size	Continue to explore trade-offs between creating operationally-feasible harvest opening sizes and acceptable impacts to timber supply. This could be done to ensure that harvested blocks are operationally feasible.
Patch Size	Continue to explore target patch size distributions. This will result in trade-offs between influencing the model to create these distributions and acceptable impacts to timber supply.
Fire Management Stocking Standards	Refine assumptions related to implementing fire management stocking standards. The sensitivity developed in the Harvest Scenario implemented modified (reduced) stocking to all harvested stands within WUI areas. These assumptions may be refined based on actual operational experience.
Minimum Harvest Criteria	Confirm that implementing a biological criterion for determining minimum harvest age is generally supported. The recent TSR had included an assumption that stands must be at least 60 years of age before they are eligible for harvest in the model. Including the 95% CMAI criterion increased the weighted minimum harvest age by approximately 13 years. While this new criterion constrains harvest levels, it demonstrated an improved harvest profile (age and product).
Low Volume	Introduce a low volume partition that encourages licensees to continue to salvage MPB-impacted stands. Both Harvest and Combined Scenarios included much lower minimum harvest criteria than in TSR, to identify an opportunity to harvest a new profile. Note that the lower volume criterion effectively applies to existing natural stands only as the managed stand requirements to achieve 95% CMAI and minimum stand age of 60 years promote much higher stand volume thresholds.

Topic	Recommendation
Steep slopes	Confirm that stand volume limits for harvesting on slopes greater than 45% are appropriate. In the Harvest Scenario, we observed that ~67% of the volume harvested on steep slopes came from clearcut stands greater than 200 m^3/ha or from selection harvesting. In the Combined Scenario, we arbitrarily assigned a minimum harvest volume of 150 m^3/ha and dropped selection harvest from steeper slopes which increased the proportion of volume harvested (~83%) from steep slope stands greater than 200 m^3/ha.
Candidate Reserves	Revise approach for selecting candidate reserves in reserve scenario, specifically: o Refine key elements of stand scoring, criteria, and thresholds. o Revise the order that candidate reserves are selected. o Include other key information to use as potential anchors or constraints. o Revise patch size criteria to reflect a biologically-appropriate condition. o Implement controls on interior old forest. o Undertake a post-processing exercise to assess the interior old forest selected. o Apply a minimum size threshold to wildlife tree retention areas applied as constraints (these were not anchors/default OGMAs). o Adjust weights on patch sizes. o Apply a harsher penalty in the constraints to avoid pine-leading stands. o Include spatial data layers to compare candidate reserves and identify replacement reserves (e.g., slope, elevation, slope position, aspect, soil moisture). o group small riparian reserves with adjacent stands and delete others as required. o Explore ways to measure and monitor landscape connectivity.
Silviculture Tactics	Explore different funding levels to identify trends associated with different silviculture tactics. Treatments in both the Silviculture and Combined Scenarios were limited to a total annual budget of $3 million over the first 20 years of the planning horizon. Decreasing and increasing this limit could identify specific trade-offs between tactics.
	Determine the most cost-effective treatment schedule to achieve most of the potential harvest gains. This might be done by calculating and comparing the net present value for the incremental volume realized over the planning horizon and under increasingly higher funding levels (i.e., multiple runs).
Enhanced Basic Silviculture	Develop and incorporate more precise definitions of eligible stands and treatment responses. In both the Silviculture and Combined Scenarios, all future clearcut stands were deemed eligible for enhanced basic silviculture treatments, which maximizes the opportunities for this tactic. We recommend further exploration of eligible stands as enhanced basic stocking standards must be developed and approved before an operational cost allowance will be considered.
Watershed Reporting Units	Identify the key watersheds and h-lines to monitor and constrain in the model. ECA targets were monitored and implemented on over 500 watershed reporting units including community watersheds, proposed FSWs, coastal tailed frog watersheds, and cumulative effects watersheds. This was done primarily for district and regional FLNRO staff to review and provide further guidance on the key watershed reporting units for future analyses.

Appendix 1 Criteria for Scoring Anchors

Anchors	Order / Units	Criteria (Based on Timber Impact)	Modelling
WHA: Coastal Tailed Frog	3-004, 3-005, 3-014 to 3-017, 3-148, 3-150, 8-011 to 8-013, 8-077 to 8-082	No harvest in core area – no salvage – do not construct stream crossing or roads within 33 m of streams and within 100 m of a known point location.	No harvest
http://www.env.gov.bc.ca/wld/documents/wha/ASTR-8-077_ord.pdf http://www.env.gov.bc.ca/wld/documents/wha/ASTR-8-078_ord.pdf http://www.env.gov.bc.ca/wld/documents/wha/ASTR-8-079_ord.pdf http://www.env.gov.bc.ca/wld/documents/wha/ASTR-8-080_ord.pdf http://www.env.gov.bc.ca/wld/documents/wha/ASTR-8-081_ord.pdf http://www.env.gov.bc.ca/wld/documents/wha/ASTR-8-082_ord.pdf			
WHA: Data Sensitive	3-008, 3-009, 3-046 to 3-048, 3-140	No harvest in data sensitive areas	No harvest
http://www.env.gov.bc.ca/cgi-bin/apps/faw/wharesult.cgi?search=forest_region&forest=Cascades&submit2=Search			
WHA: Great Basin Spadefoot	3-126	No harvest – do not construct roads or landings	No harvest
http://www.env.gov.bc.ca/wld/documents/wha/SPIN_3-126_ord.pdf			
WHA: Grizzly Bear	8-083 to 8-089 2-105, 2-195, 2-203, 3-026 to 3-028	No forestry practices to be carried out – do not construct roads, trails or landings	No harvest
http://www.env.gov.bc.ca/wld/documents/wha/URAR_8-083to89_Cascades_ord.pdf http://www.env.gov.bc.ca/wld/documents/wha/URAR_2-097varto380_Order.pdf http://www.env.gov.bc.ca/wld/documents/wha/URAR_13-Cascades_ord.pdf http://www.env.gov.bc.ca/wld/documents/wha/URAR_3-026to028_ord.pdf			
WHA: Lewis's Woodpecker	3-082, 3-083	Do not harvest or salvage mature timber	No harvest
	3-103, 3-104	Do not construct roads – no timber harvesting	
http://www.env.gov.bc.ca/wld/documents/wha/LEWO_3-080to089_ord.pdf http://www.env.gov.bc.ca/wld/documents/wha/LEWO_3-103_104_ord.pdf			
WHA: Western Screech Owl	3-068	Do not construct roads or stream crossings – do not harvest or salvage – do not construct trails within 50 m of known nest site	No harvest
	8-125, 8-260	Do not construct new roads or stream crossings within core area – do not harvest or salvage during breeding season (March 1 to Aug 15) – do not harvest or salvage – do not construct trails within 50 m of known nest site	
http://www.env.gov.bc.ca/wld/documents/wha/WSOW-3-032,068_ord.pdf http://www.env.gov.bc.ca/wld/documents/wha/WSOW_8-125_ord.pdf http://www.env.gov.bc.ca/wld/documents/wha/WSOW_8-260_ord.pdf			
WHA: Williamson's Sapsucker	3-090 to 3-095, 3-129 to 3-135,	Do not construct roads – No timber harvesting	No harvest

<table>
<tr><td></td><td>3-137, 3-139, 3-142, 3-143, 8-096 to 8-098, 8-100</td><td></td><td></td></tr>
<tr><td colspan="4">http://www.env.gov.bc.ca/wld/documents/wha/WISA_3-090_095,129_130_ord.pdf
http://www.env.gov.bc.ca/wld/documents/wha/WISA_3_131varto143_order.pdf
http://www.env.gov.bc.ca/wld/documents/wha/WISA-8-096_098,100_ord.pdf</td></tr>
<tr><td rowspan="2">UWR: Mountain Goat</td><td>U-2-001</td><td>No harvest within winter ranges – GWM applies to 500m buffer around UWR – forest activities (incl. salvage) will retain all forest cover (100% retention)</td><td rowspan="2">No harvest</td></tr>
<tr><td>U-3-006</td><td>Do not construct roads – no permanent roads within 500m adjacent to UWR – no forestry activities between Nov 1 to June 30 (including no heli-logging/blasting within 2km of UWR, no ground-based or cable logging within 500m adjacent to UWR)</td></tr>
<tr><td colspan="4">http://www.env.gov.bc.ca/wld/documents/uwr/uwr_u2_001.pdf
http://www.env.gov.bc.ca/wld/documents/uwr/u-3-006_ORAM_Order.pdf</td></tr>
<tr><td>Parks and Protected Areas</td><td>Multiple Statutes</td><td>No harvest within parks.</td><td>No harvest</td></tr>
<tr><td>Environmentally Sensitive Areas</td><td>Non-Legal</td><td>FLNRO Cascades District inventory (1994-1996):
<table>
<tr><th>Code Description</th><th>CD</th><th>Area (ha)</th></tr>
<tr><td>Unknown</td><td></td><td>975</td></tr>
<tr><td>Snow chute and avalanche.</td><td>A</td><td>362</td></tr>
<tr><td>Snow chute and avalanche, regen problems.</td><td>AP</td><td>335</td></tr>
<tr><td>High water values/harvesting sensitivity.</td><td>H</td><td>108</td></tr>
<tr><td>Regen problems.</td><td>P</td><td>40,493</td></tr>
<tr><td>Regen problems, high recreational.</td><td>PR</td><td>145</td></tr>
<tr><td>High recreational.</td><td>R</td><td>1,309</td></tr>
<tr><td>Fragile or unstable soils.</td><td>S</td><td>6,972</td></tr>
<tr><td>Fragile or unstable soils, snow chute and avalanche.</td><td>SA</td><td>6</td></tr>
<tr><td>Fragile or unstable soils, regen problems.</td><td>SP</td><td>16,574</td></tr>
<tr><td>Fragile or unstable soils, regen problems, high recreational.</td><td>SPR</td><td>547</td></tr>
<tr><td>Fragile or unstable soils, importance to wildlife.</td><td>SW</td><td>50</td></tr>
<tr><td>Importance to wildlife.</td><td>W</td><td>153</td></tr>
<tr><td></td><td></td><td>68,029</td></tr>
</table></td><td>No harvest</td></tr>
<tr><td>Cultural Survival Areas</td><td></td><td>Data not available at this time</td><td></td></tr>
<tr><td>Cultural Heritage Resources</td><td></td><td>Data not available at this time</td><td></td></tr>
<tr><td>Archaeological Sites</td><td>Arch. Sites, heritage features, traditional use sites, etc.</td><td>Protected and/or conserved areas under the Heritage Conservation Act or through consultation with First Nations

Not permitted to use data at this time.</td><td>No harvest</td></tr>
<tr><td>Physically Inoperable</td><td></td><td>Slopes > 65% or Terrain Stability Class 5</td><td>No harvest</td></tr>
<tr><td>Legally Established Heritage Trails</td><td></td><td>No harvesting within 100m each side of established trail.</td><td>No harvest</td></tr>
<tr><td>Research Sites (i.e. PSP)</td><td></td><td>Permanent Sample Plot (PSP) with 50 m buffer</td><td>No harvest</td></tr>
<tr><td>Effective Riparian Reserve Zones</td><td></td><td>FPPR buffer widths (each side):
- S1 (except large rivers) 100m, S2 30m, S3 20m
- Lakeshore Management Zones (Class A 200m), L1/L2 10m
- W1/W2/W5 10m</td><td>No harvest</td></tr>
<tr><td>Temperature Sensitive Streams</td><td></td><td>Enhanced riparian buffers (10m each side) for S4, S5, and S6 streams within the Nicola Watershed.</td><td>No harvest</td></tr>
<tr><td>Whitebark Pine</td><td></td><td>Where Pa exists within any species code of the forest inventory.</td><td>No harvest</td></tr>
</table>

Wetlands		Forest Inventory where BCLCS_LEVEL_3 = 'W'	No harvest

Appendix 2 Criteria for Scoring Constraints

Constraints	Order / Units	Criteria (Based on Timber Impact)	Modelling
OGMA	Provincial Non-Spatial Old Growth Objectives	Non-legal spatial layer developed based on target areas assigned by LU and BEC (v6) variant (Table 2 of Appendix 2 of the order); updated by licensees from time-to-time to track minor changes and replacements.	No harvest
WHA: Coastal Tailed Frog	3-004, 3-005, 3-014 to 3-017, 3-148, 3-150, 8-011 to 8-013, 8-077 to 8-082	Minimize length of road in WHA – partial harvest in buffer areas that maintain 80% basal area – no salvage	Partial harvest max 20% basal area
	3-148, 3-150	Minimum 70% basal area retention within buffer areas – all high value wildlife trees retained – no salvage	Partial harvest max 30% basal area
http://www.env.gov.bc.ca/wld/documents/wha/ASTR-8-077_ord.pdf http://www.env.gov.bc.ca/wld/documents/wha/ASTR-8-078_ord.pdf http://www.env.gov.bc.ca/wld/documents/wha/ASTR-8-079_ord.pdf http://www.env.gov.bc.ca/wld/documents/wha/ASTR-8-080_ord.pdf http://www.env.gov.bc.ca/wld/documents/wha/ASTR-8-081_ord.pdf http://www.env.gov.bc.ca/wld/documents/wha/ASTR-8-082_ord.pdf			
WHA: Lewis's Woodpecker	3-082, 3-083	If harvesting is approved: protect and retain all PP and ACT live and dead ≥ 30 cm dbh – maintain >= 6 standing dead trees per ha (≥ 45 cm dbh) – partial harvest to maintain widely spaced late seral PP and FD	Partial harvest; maintain widely spaced late seral PP/FD; retain all PP/ACT
http://www.env.gov.bc.ca/wld/documents/wha/LEWO_3-080to089_ord.pdf			
WHA: Western Screech Owl	8-125, 8-260	Avoid constructing roads or stream crossings – in PP/IDF select harvest ≤ 20% basal area provided no suitable wildlife trees are removed – retain deciduous species – within RMZs retain >60% trees including all suitable wildlife trees – do not construct trails within 50 m of known nest site Suitable wildlife trees (WTP): ≥ 2.5 ha; PPxh/ PPdh/ IDFxh/ IDFxw/ IDFdk/ IDFmw/ riparian areas; cavities; deciduous preferred (AT, ACT, EW, FD, PP, LW); deciduous ≥34 cm dbh, conifer ≥ 74cm dbh (≥30 cm dbh recruit)	Partial harvest max 20% basal area; retain deciduous; in RMZs retain > 60% trees
http://www.env.gov.bc.ca/wld/documents/wha/WSOW_8-125_ord.pdf http://www.env.gov.bc.ca/wld/documents/wha/WSOW_8-260_ord.pdf			
UWR: Mule Deer, Bighorn Sheep, Elk	U-3-003	1. Forestry activities must retain min amount of snow interception cover (SIC) targets: a. Shallow (SIC 15%)– BG, PP, IDFxh1, IDFxh1a, IDFxh2, IDFxh2a – Fd > 70%, ≥ 121 years b. Moderate (SIC 33%) – IDFdk1, IDFdk1a, IDFdk2, IDFdk3, IDFunk, MS– Fd > 70%, ≥ 121 years, ≥ 36% canopy closure c. Deep (SIC 40%) – ESSF, ICH, CWH – Fd > 70%, ≥ 121 years, ≥ 46% canopy closure 2. In Moderate SZ with insufficient forest cover, activities must retain forest cover with SIC attributes (rank order from A (high) to D (low)): a. Fd 70%, ≥ 81 years, ≥ 36% crown closure b. Fd 50%, ≥ 81 years, ≥ 36% crown closure c. Fd 50%, ≥ 81 years, ≥ 16% crown closure	Partial harvest to maintain SIC targets/attributes Min patch size: Shallow = 1 ha Moderate = 10 ha Deep = 20 ha

		d. Fd 30%, ≥ 81 years, ≥ 16% crown closure Area of roads and right of ways under permit is not included in area used to calculate percent of SIC *SIC: mature conifer with high % Fd, ≥ 140 years, ≥ 46% CC* *Deep SZ: 40% in SIC, patches no less than 20ha* *Moderate SZ: 33% in SIC, patches no less than 10ha* *Shallow SZ: 15% in SIC, patches no less than 1 ha* *Security Cover: stands ≥ 2 m height in patches ≥ 5 ha*	
	U-8-001	SIC requirements: a. Shallow – BG/ PP/ IDFxh; Fd ≥ 50%; ≥ 140 years b. Moderate – IDFdk/ IDFdm/ IDFmw/ MS/ ICHdw; Fd ≥ 50%; IDFmw ≥ 140 years, all others ≥ 175 years; CC ≥ 36% c. Deep – ICH (except ICHdw); Fd ≥ 50%; ≥ 100 years; CC ≥ 46% - WTPs are Fd ≥ 140 years - Moderate (except IDFmw) ≤ 50% SIC by pcell can be NTHLB provided ≥ 50% Fd, ≥ 120 years and CC ≥ 36% - IDFmw no restrictions to % in NTHLB as long as CC ≥ 50% and age/species conditions are met - Moderate – in 67% available for harvest to be uneven aged silv. System as long as ≤ 20% of stems removed every 40 years - Moderate SIC stands on slopes < 80% - Moderate ≤ 30% of pcell can be ≤ 20 years	Partial harvest to maintain SIC targets/attribute s Moderate: partial harvest uneven-aged system with ≤20% removed 40 year rotation; retained stands on slopes <80%; ≤30% pcell ≤20 years
http://www.env.gov.bc.ca/wld/documents/uwr/uwr_u3_003.pdf http://www.env.gov.bc.ca/wld/documents/uwr/u-8-001_ord.pdf http://www.env.gov.bc.ca/esd/distdata/ecosystems/frpa/Approved_FRPR_sec7_WLPPR_sec9_Notices_and_Supporting_Info/UWR/Timber_Supply_Areas/Merritt_TSA/Supporting_Info/Docs/Supporting_info_Merritt%20TSA_UWR.pdf			
UWR: Mountain Goat	U-3-006	Harvesting must result in: uneven aged stands with ≥ 50% pre-harvest basal area in mature stems (> 100 years) retained; cutblocks ≤ 5ha or 200m in one dimension; ≤ 33% forested area < 33 years; maintain SIC/thermal cover by retaining Fd leading stands ≥ height class 2 and ≥ crown closure class 8 *Escape terrain: slopes > 30^o and < 60^o* *Forage: high snow interception characteristics, warm southerly aspects in coastal/transition areas and/or high-exposure/windswept slopes* *Termal/Security Cover: ≤ 33% of forested habitat within 200 m of escape terrain in early seral (< 40 years) over one rotation and ≥ 50% basal area of mature and old stems retained at all times* *Snow Interception/ Thermal Cover:Fd leading stands ≥ 12m height with large, well developed crowns, ≥ 70% CC*	Maintain SIC/ thermal cover with stands > 50% Fd, ≥ 10.5m, ≥ 76% Partial harvest max 50% basal area, retain stands > 100 years; cutblocks ≤ 5ha; ≤ 33% < 33 years
http://www.env.gov.bc.ca/wld/documents/uwr/u-3-006_ORAM_Order.pdf http://www.env.gov.bc.ca/esd/distdata/ecosystems/frpa/Approved_FRPR_sec7_WLPPR_sec9_Notices_and_Supporting_Info/UWR/Timber_Supply_Areas/Merritt_TSA/Notice/Merritt%20TSA_UWR.pdf			
UWR: Moose	FPPR Sec 7 Notice	*Forage: maintain min 15% forested landbase in early seral stands: IDF/ICH < 25 years, MS/ESSF < 35 years*	Forage: retain 15% in early seral

		Cover: conifer stands ≥ 16 m height with relatively high CC; ≥ 50% cover in patches ≥ 20 ha; where possible cover close to riparian features	Cover: conifer stands ≥ 16m with high CC, ≥ 50% in patches ≥ 20 ha
http://www.env.gov.bc.ca/esd/distdata/ecosystems/frpa/Approved_FRPR_sec7_WLPPR_sec9_Notices_and_Supporting_Info/UWR/Timber_Supply_Areas/Merritt_TSA/Notice/Merritt%20TSA_UWR.pdf			
DRAFT: Fisheries Sensitive Watersheds	Spius, Prospect, Maka, Upper Spius, Juliet, Upper Coldwater	TBD	TBD
Community Watersheds	Anderson, Bell, Brook, Dillard, Hackett, Kwinshatin, Lee, Skuagam, Thomas	maximum allowable ECA as per licensee's FSPs – young seral limit of 30% under 6.6 m height with 100 m buffer reserve upstream of water intakes	Max 30% of young seral stands (by CWS) < 6.6 m
Riparian Management Zones		Modified FPPR buffer widths (each side) and basal area (BA) retention based on licensee FSPs: - S1-A 100m 20% BA - S1-B/S2/S3 20m 20% BA - S4 fish/S5 30m 10% BA - S4 no fish 30m 0% BA - S6 20m 10% BA - L1 25% BA - L2 20m 10% BA - L3/L4 30m 10% BA - LMZ 200m – Class B 50% BA, Class C 25% BA, Class D 10% BA, Class E 5% BA - W1/W5 40m 10% BA - W2 20m 10% BA - W3 30m - W4 30m 10% BA	Minimum basal area retention by riparian class and applicable management zone (buffer width)
Recreation	Heritage Trails: Dewdney, Hope Pass, Hudson's Bay Brigade, Whatcom	200 m right of way – requires permit for any alterations – must meet VQO Retention (activities not visually evident – perspective view below Visually Effective Green-up)	Max 4%
Visual Quality Objectives	Preservation (P)	No visible activities – percent alteration per VQO 0.17-0.83% – perspective view below Visually Effective Green-up (VEG) (based on slope)	Max 0.83%
	Retention (R)	Activities not visually evident – percent alteration per VQO 2-4% – perspective view below VEG	Max 4%
	Partial Retention (PR)	Activities visible but minimal – percent alteration per VQO 6.7-13.3% – perspective view below VEG	Max 13.3%
Landscape Level Fuel Breaks	N/A	FLNRO Cascades Natural Resource District – Fire Management Plan	No thresholds.

<table>
<tr><td>Wildland Urban Interface</td><td>N/A</td><td>Provincial Strategic Threat Analysis</td><td>No thresholds.</td></tr>
<tr><td>Wildlife Tree Retention</td><td>N/A</td><td>RESULTS reserves; WTR already removed from depletion areas (blocks)</td><td>No thresholds.</td></tr>
<tr><td>Operability</td><td>N/A</td><td>Adopt the following relative scores to distinguish timber harvesting preference:
<table>
<tr><td></td><td colspan="4">Site Index</td></tr>
<tr><td>Slope</td><td>≤9</td><td>≥9&<12</td><td>≥12&<16</td><td>≥16</td></tr>
<tr><td>0-45</td><td>8</td><td>2</td><td>0</td><td>0</td></tr>
<tr><td>45-65</td><td>9</td><td>6</td><td>3</td><td>0</td></tr>
<tr><td>>65</td><td colspan="4">Already considered as anchors</td></tr>
</table>
</td><td>No thresholds.</td></tr>
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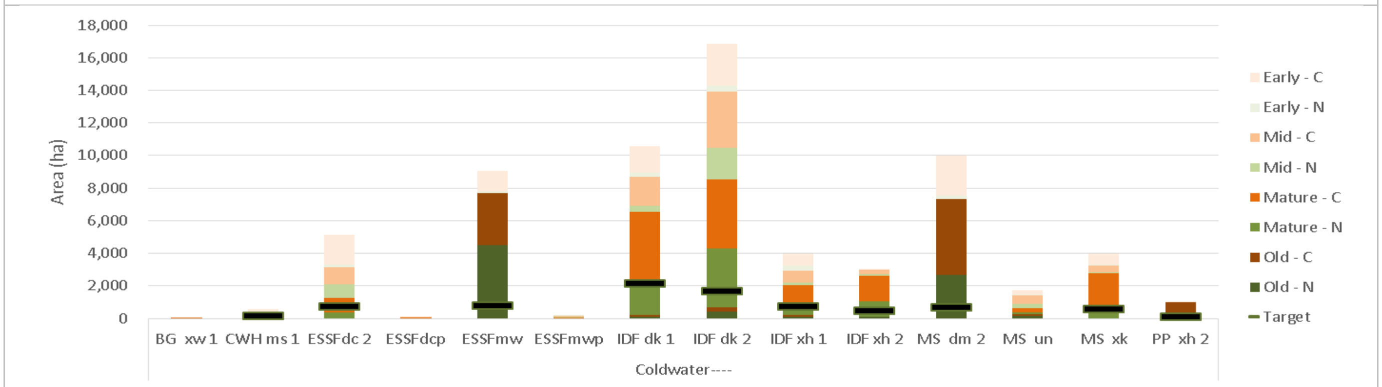
Appendix 3 Reserve Summary by Landscape Unit

The following pages provide charts that summarize candidate reserves for each LU/BEC assessment unit.

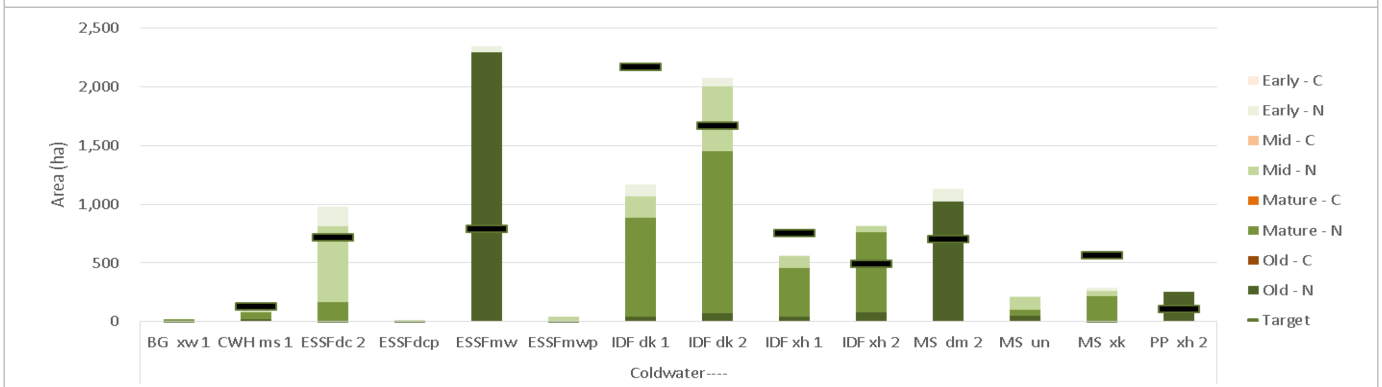
Coldwater

Note: 'C' contributes to THLB; 'N' contributes to NHLB

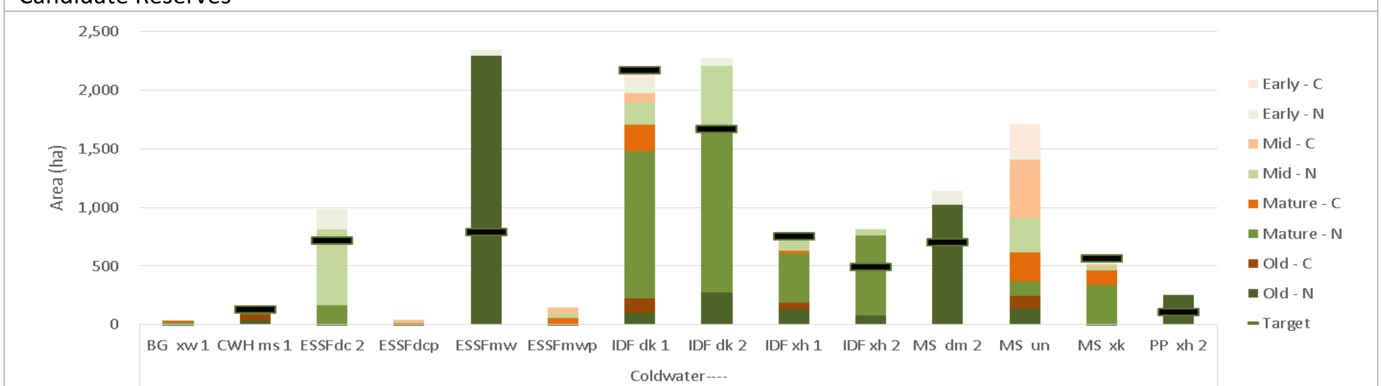
Initial Condition



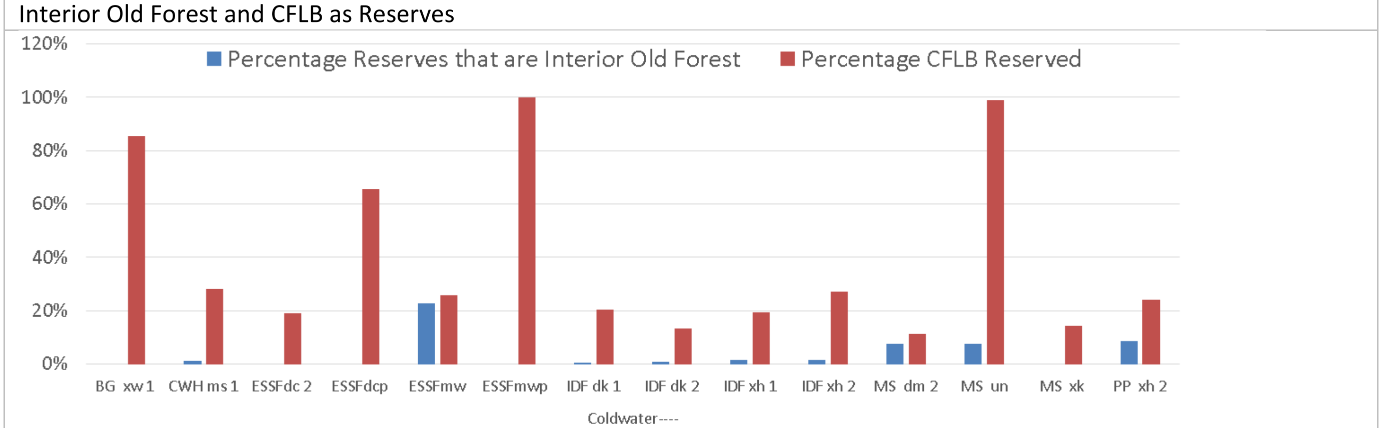
Selected Anchors



Candidate Reserves



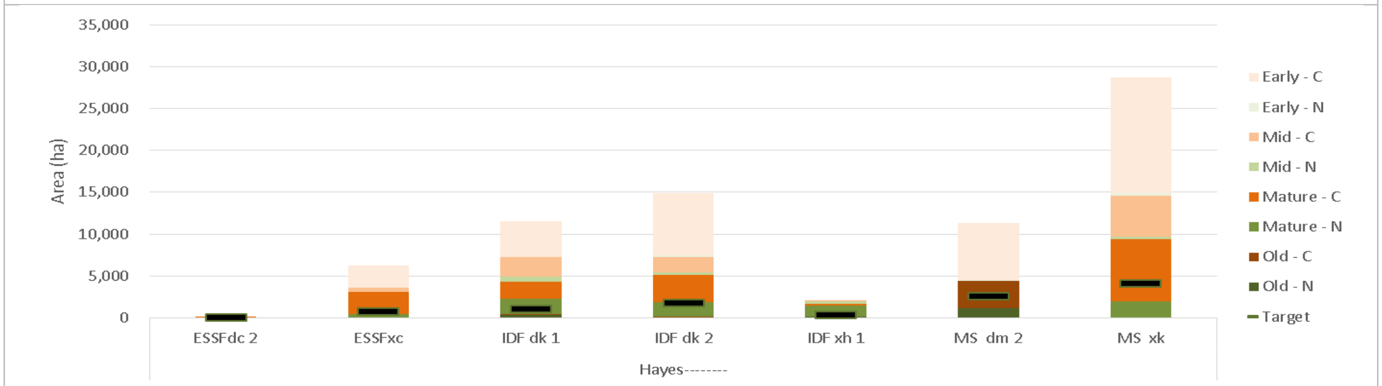
Interior Old Forest and CFLB as Reserves



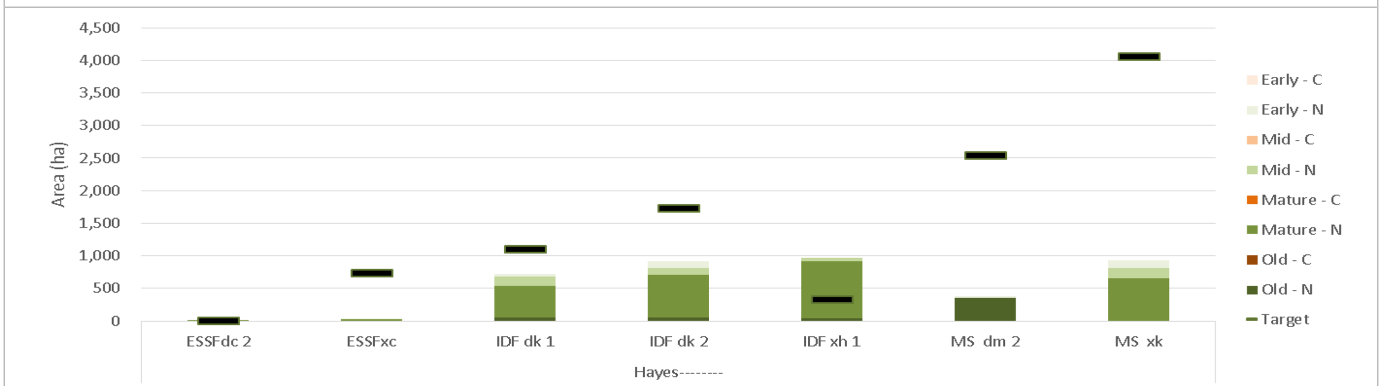
Hayes

Note: 'C' contributes to THLB; 'N' contributes to NHLB

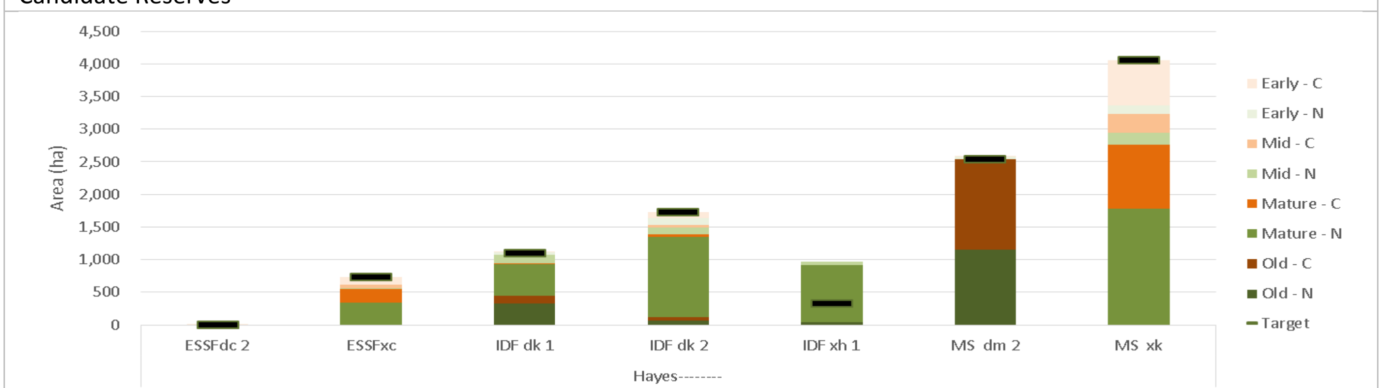
Initial Condition



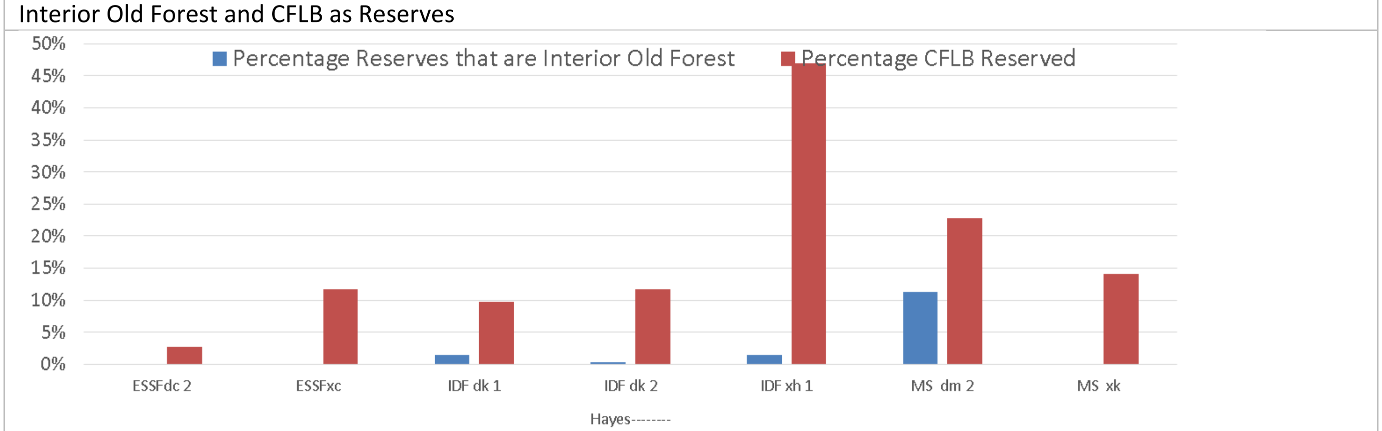
Selected Anchors



Candidate Reserves



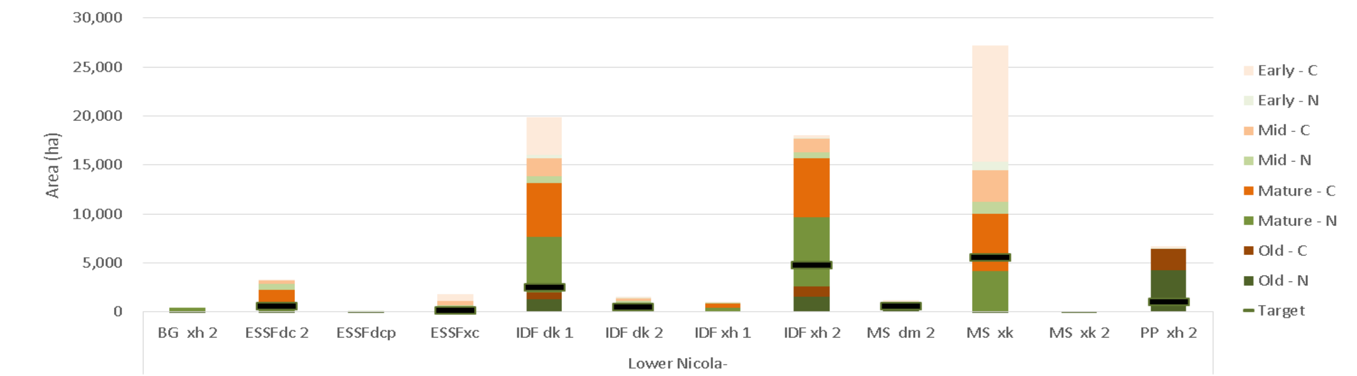
Interior Old Forest and CFLB as Reserves



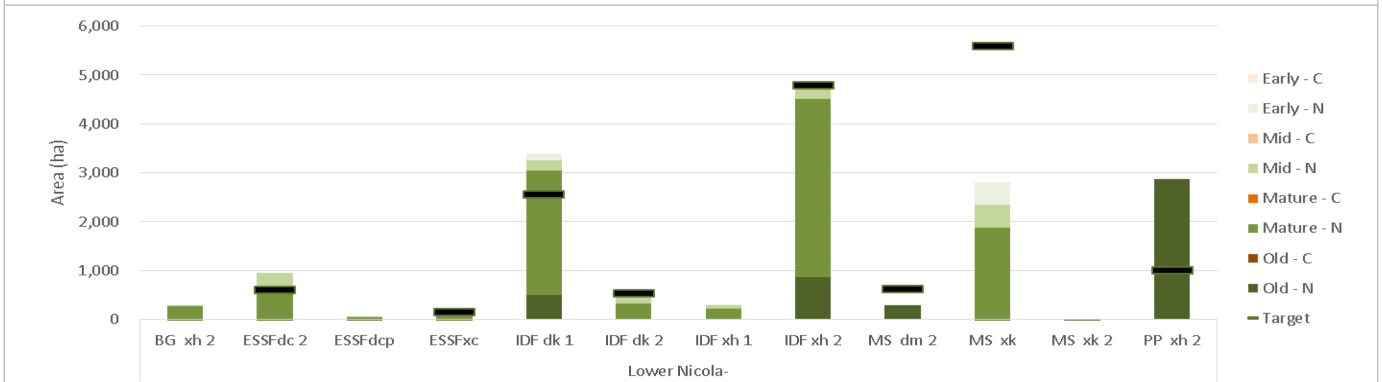
Lower Nicola

Note: 'C' contributes to THLB; 'N' contributes to NHLB

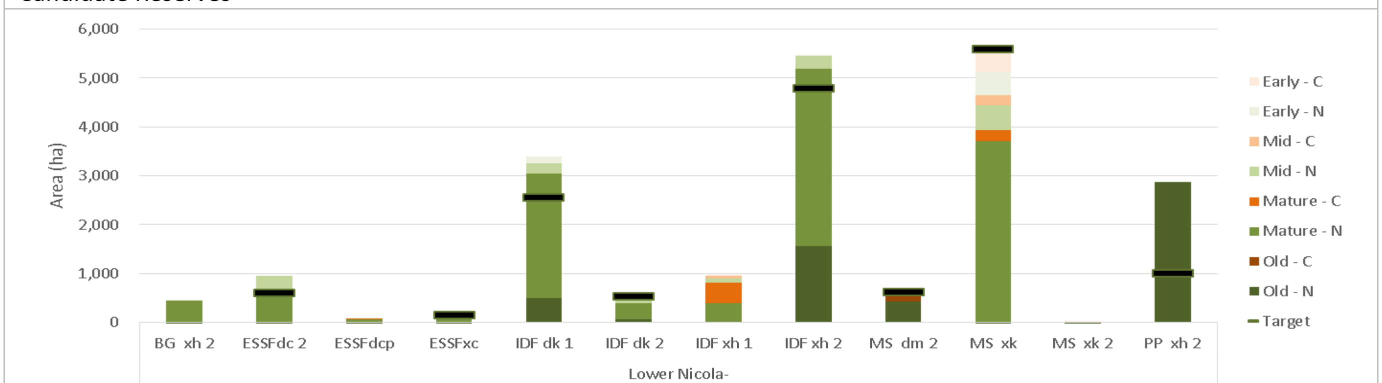
Initial Condition



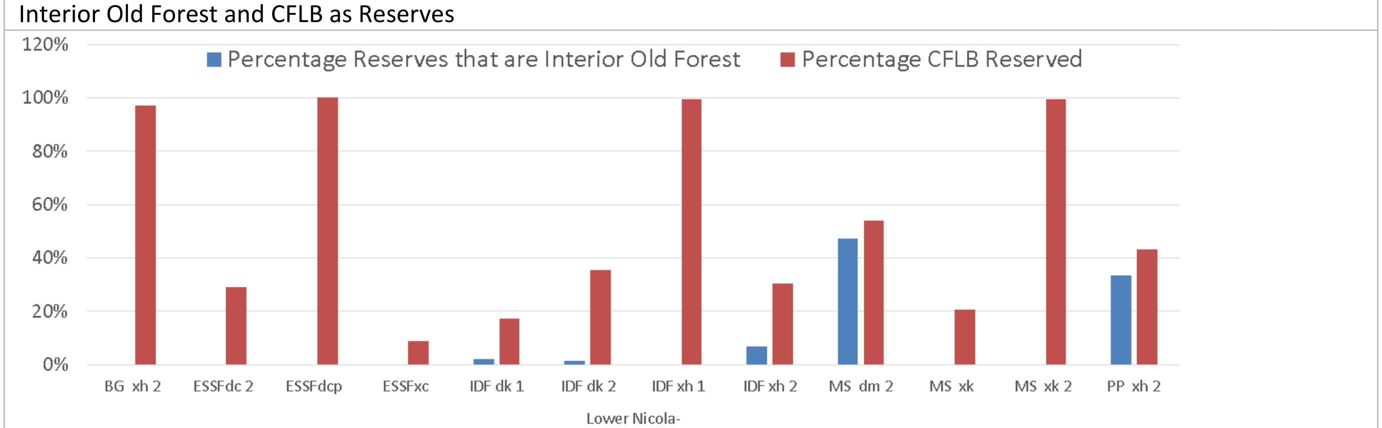
Selected Anchors



Candidate Reserves



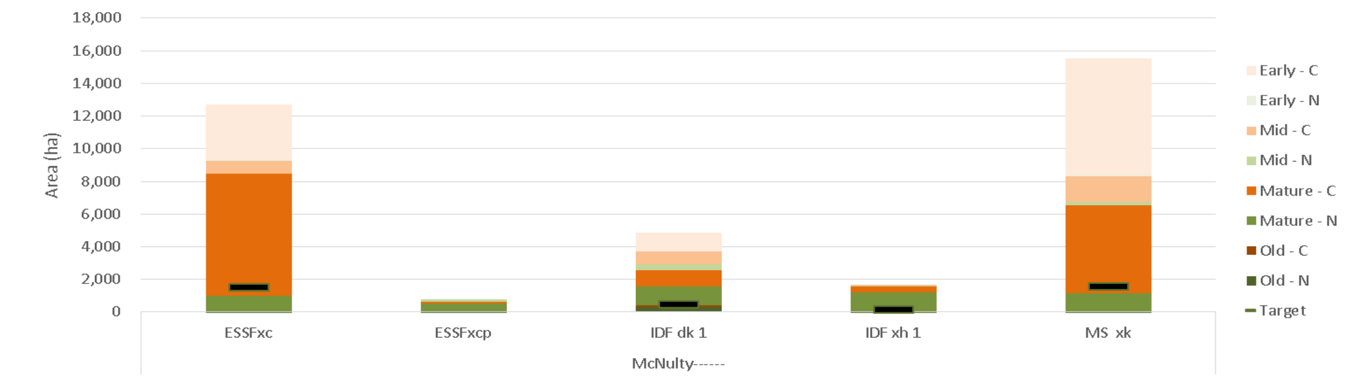
Interior Old Forest and CFLB as Reserves



McNulty

Note: 'C' contributes to THLB; 'N' contributes to NHLB

Initial Condition



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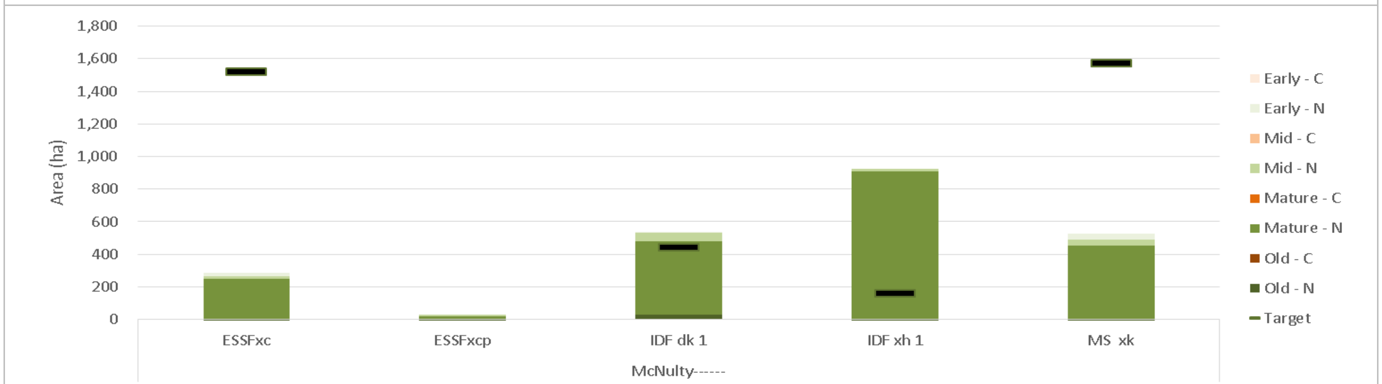
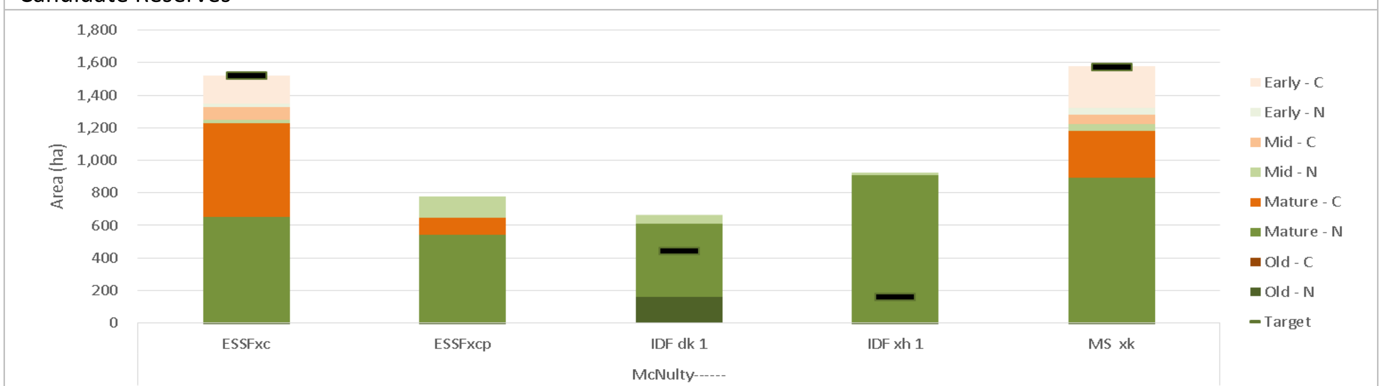
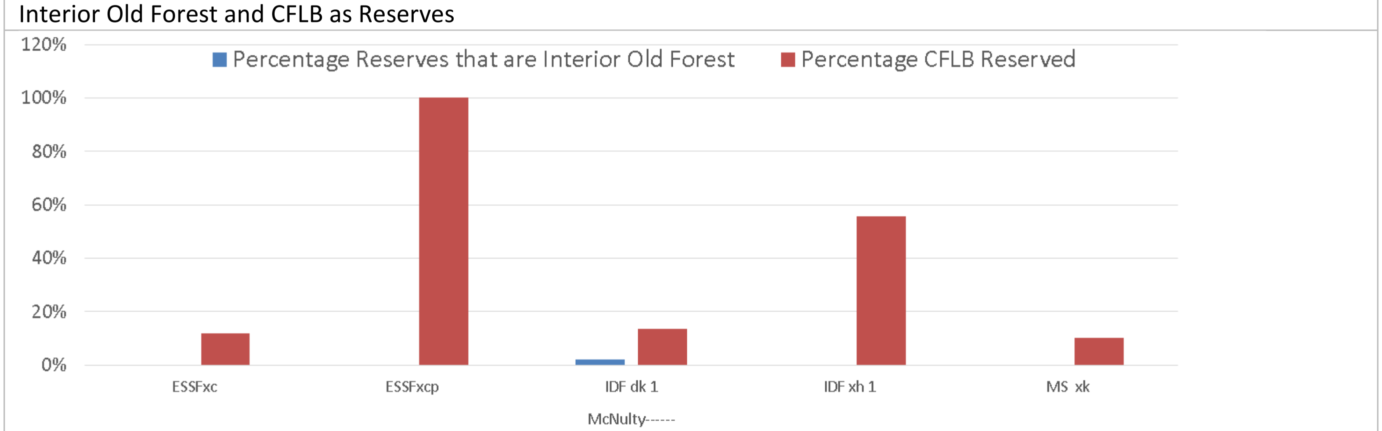


Candidate Reserves



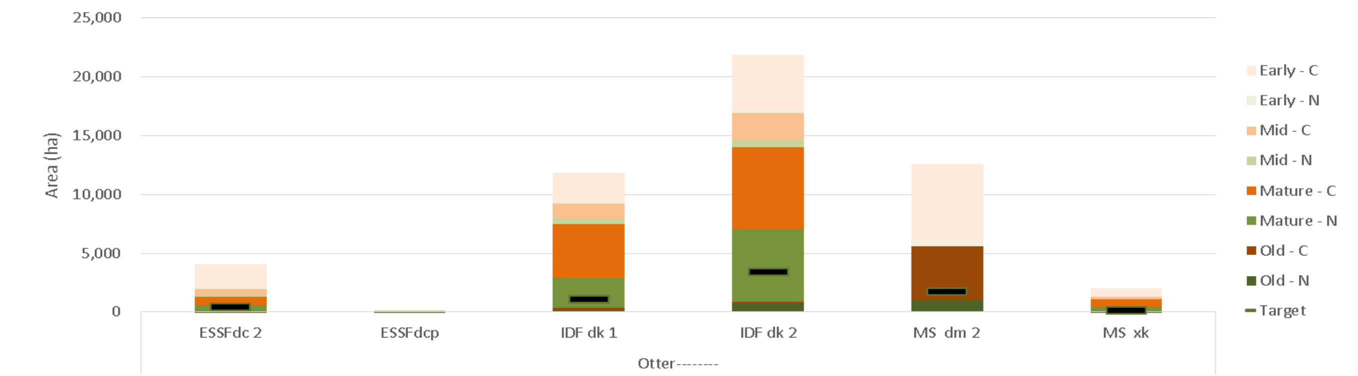
Interior Old Forest and CFLB as Reserves



Otter

Note: 'C' contributes to THLB; 'N' contributes to NHLB

Initial Condition



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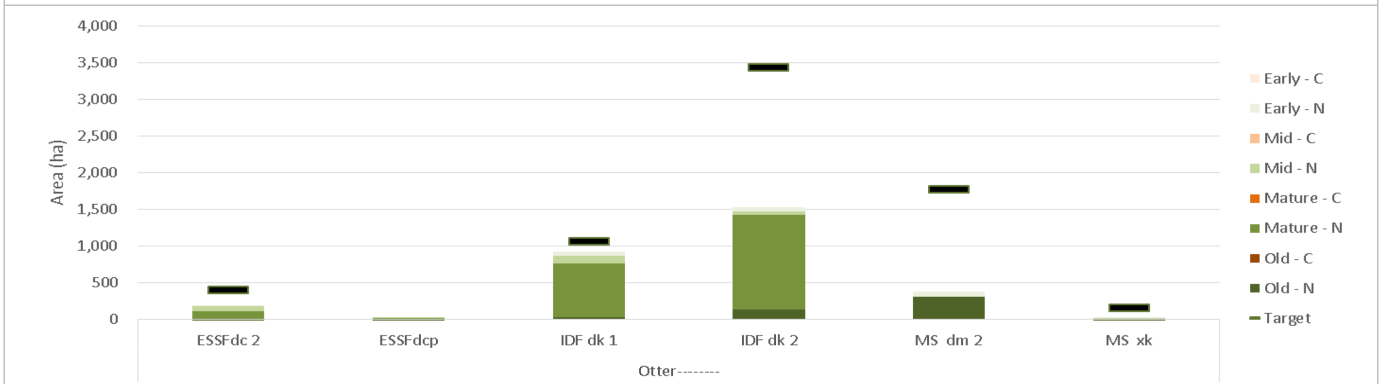
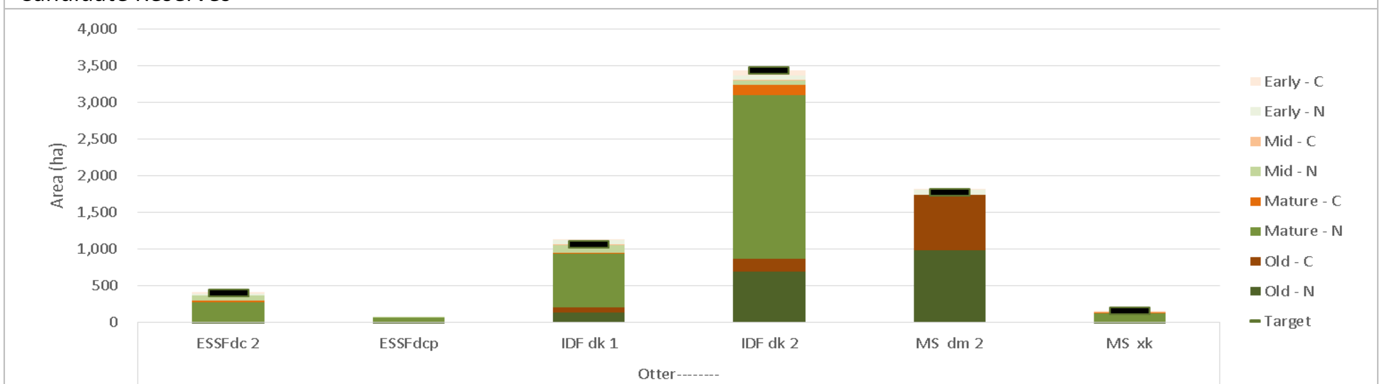
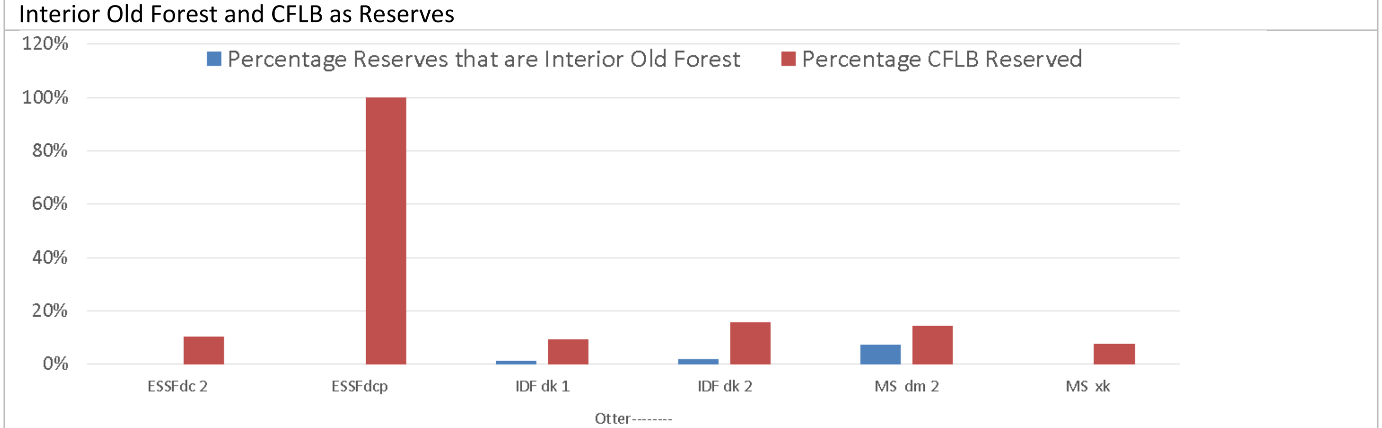


Candidate Reserves



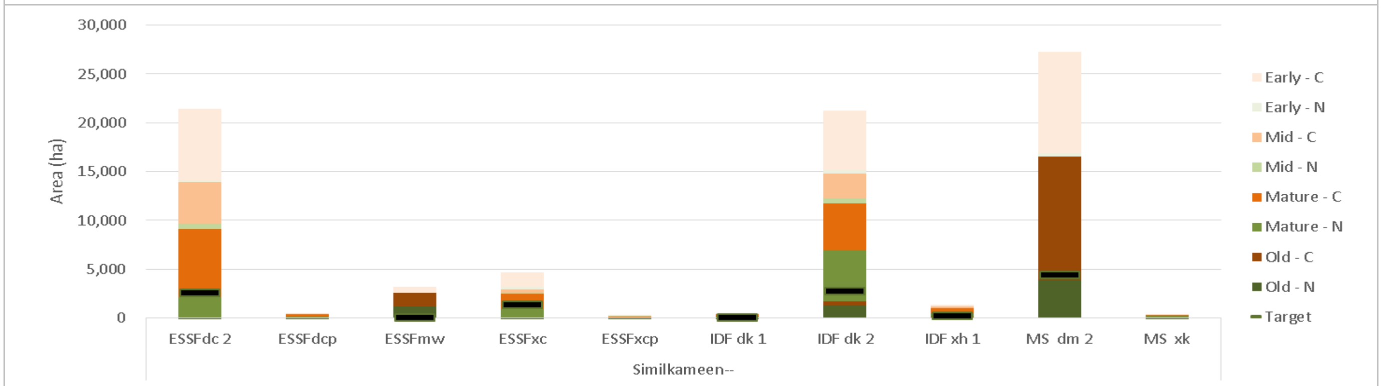
Interior Old Forest and CFLB as Reserves



Similkameen

Note: 'C' contributes to THLB; 'N' contributes to NHLB

Initial Condition



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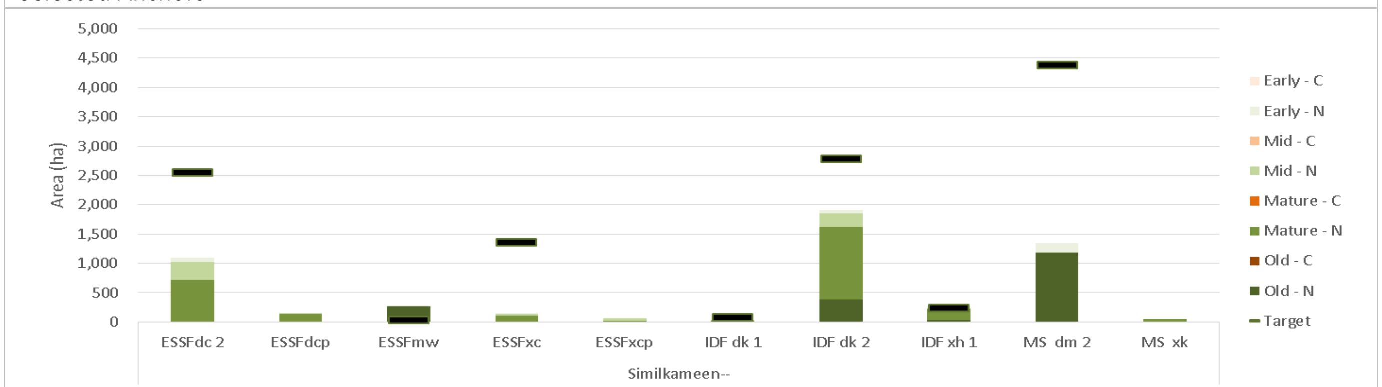
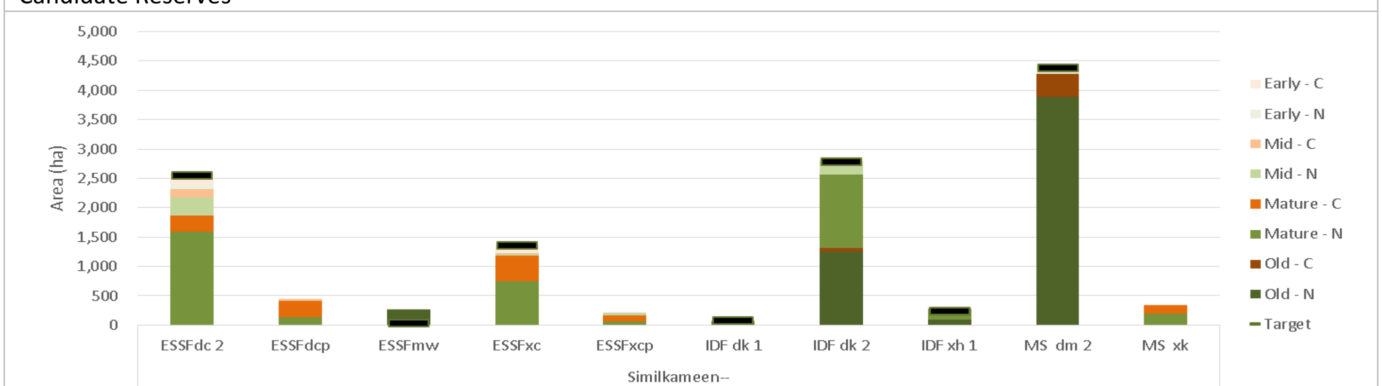
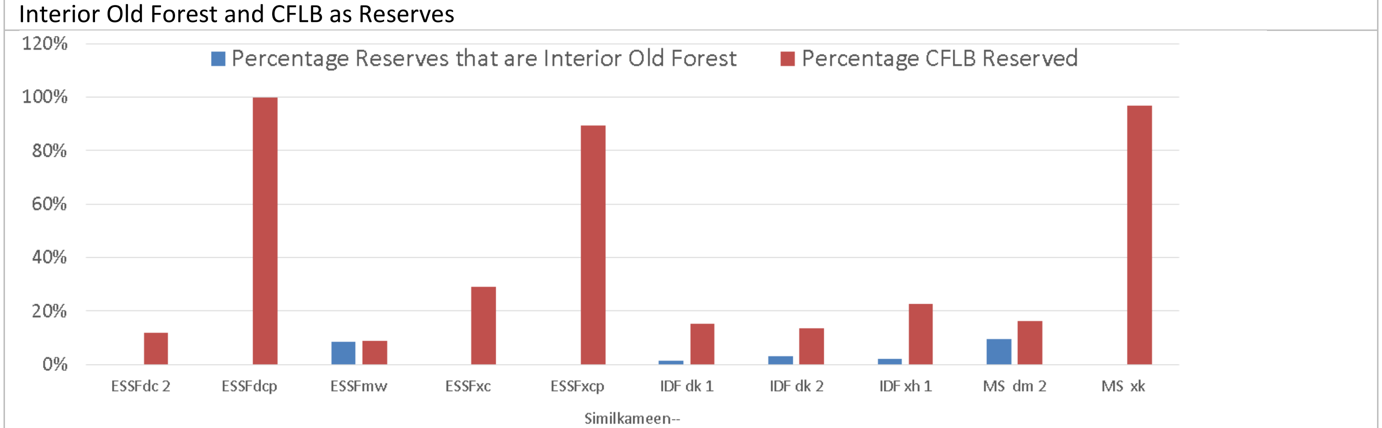


Candidate Reserves



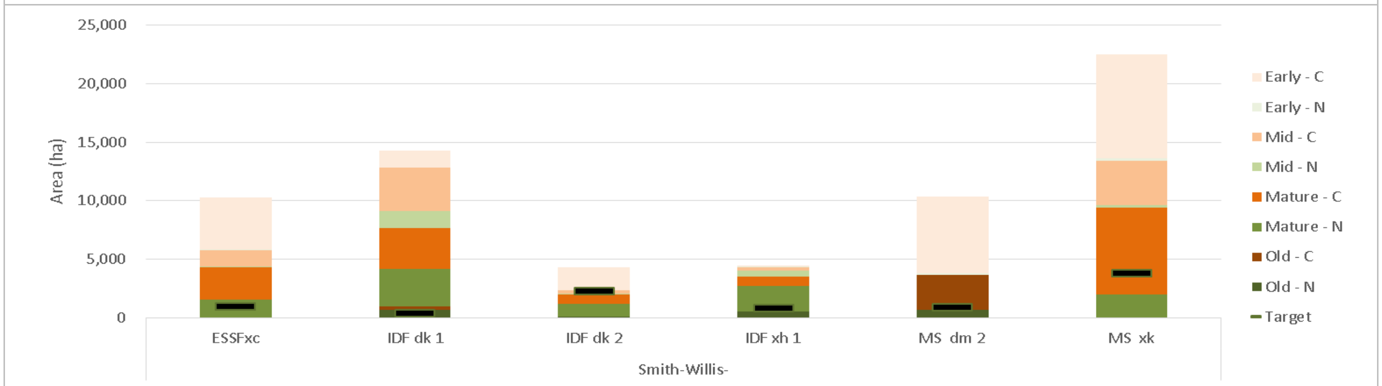
Interior Old Forest and CFLB as Reserves



Smith-Willis

Note: 'C' contributes to THLB; 'N' contributes to NHLB

Initial Condition



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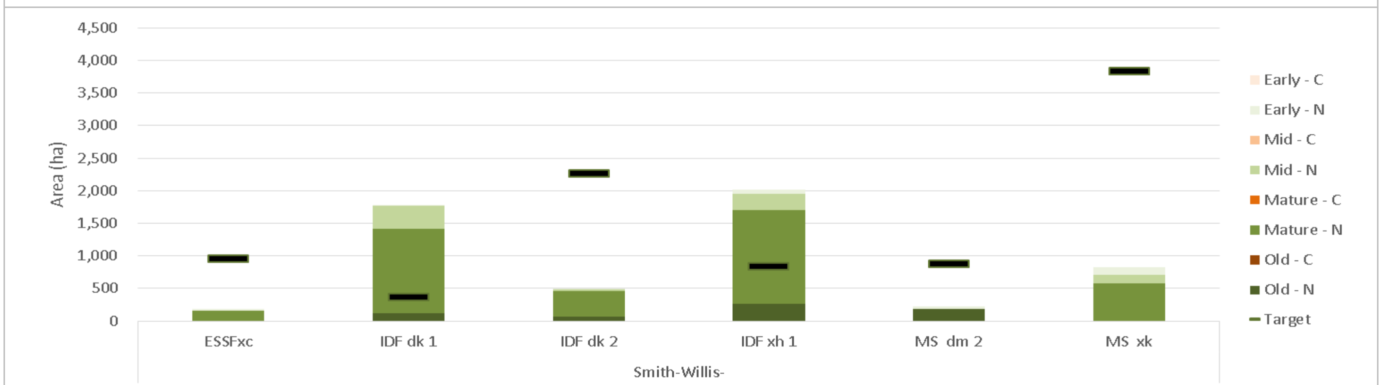

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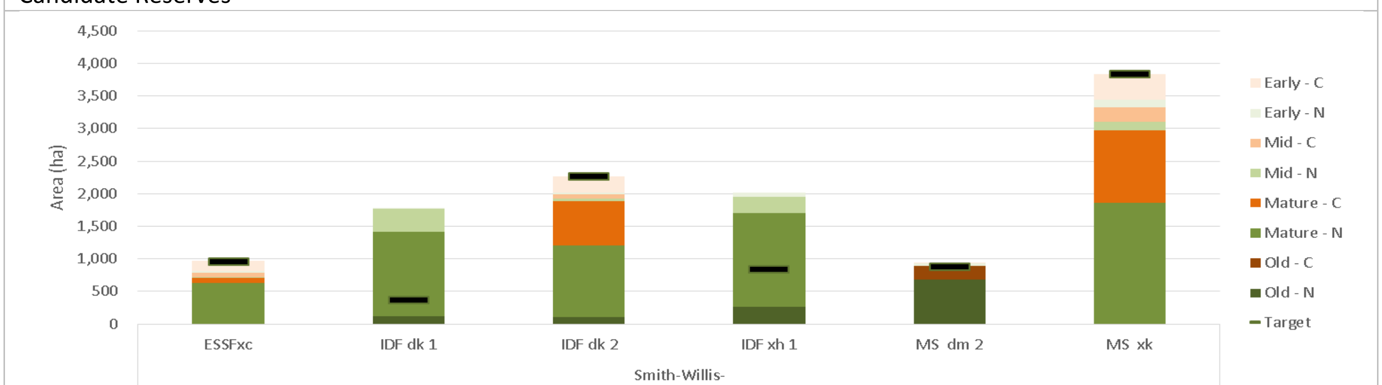
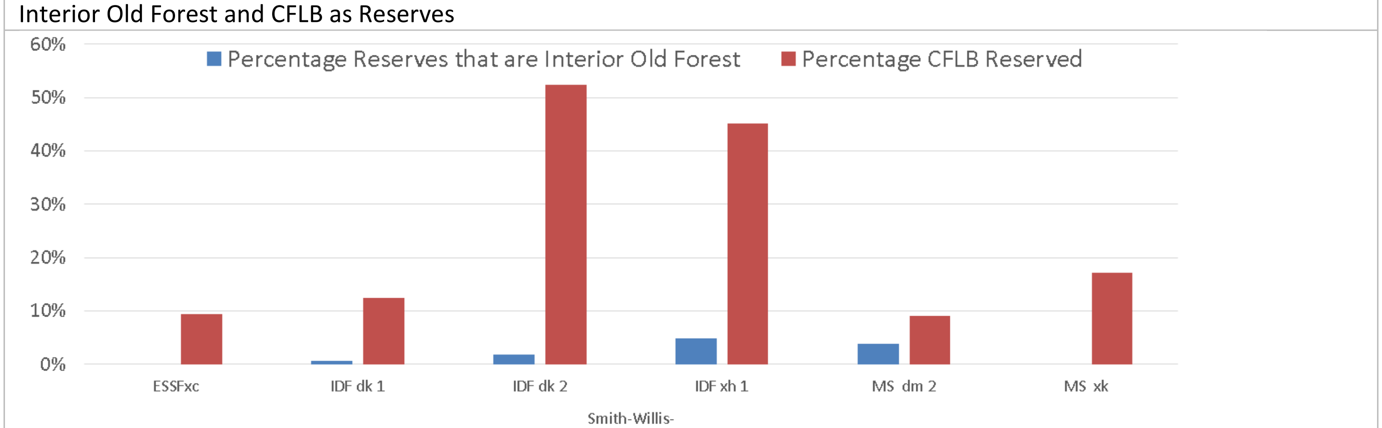


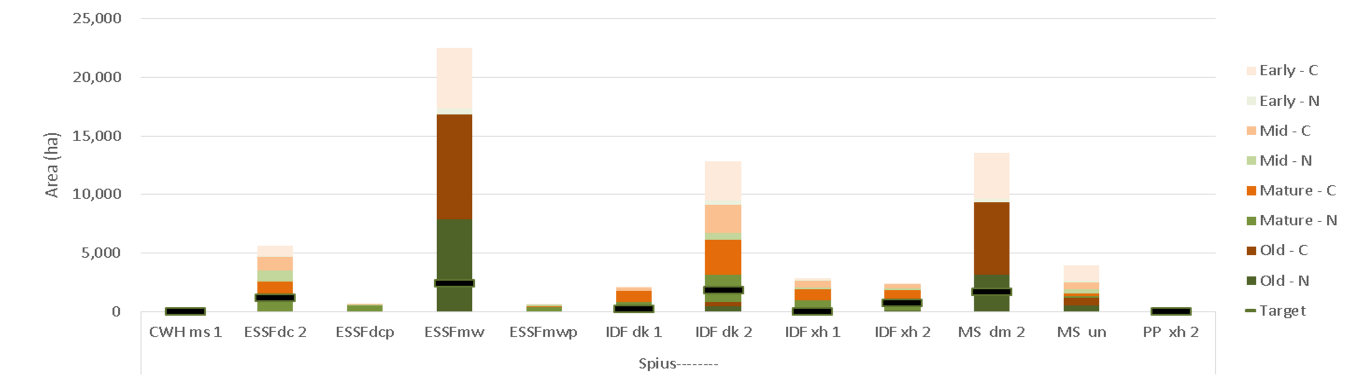
Interior Old Forest and CFLB as Reserves



Spius

Note: 'C' contributes to THLB; 'N' contributes to NHLB

Initial Condition



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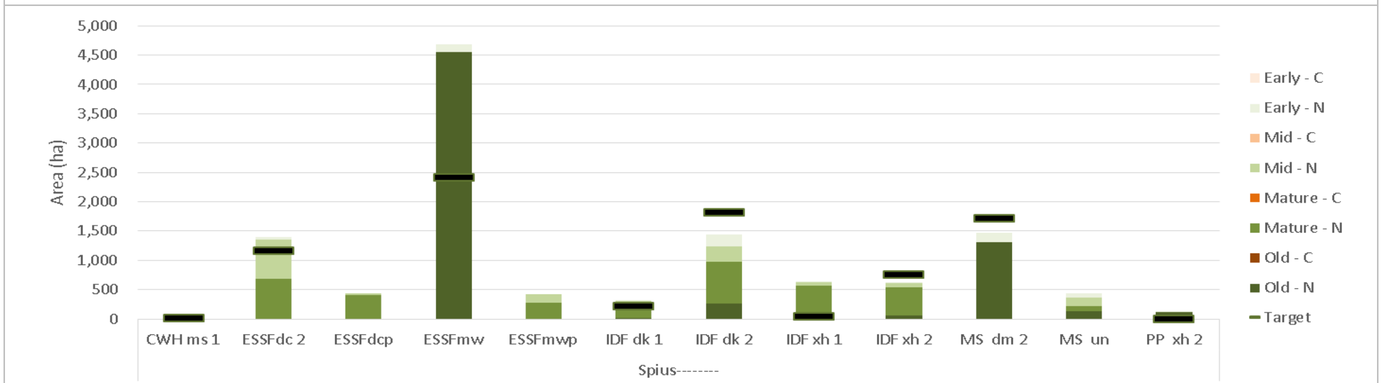

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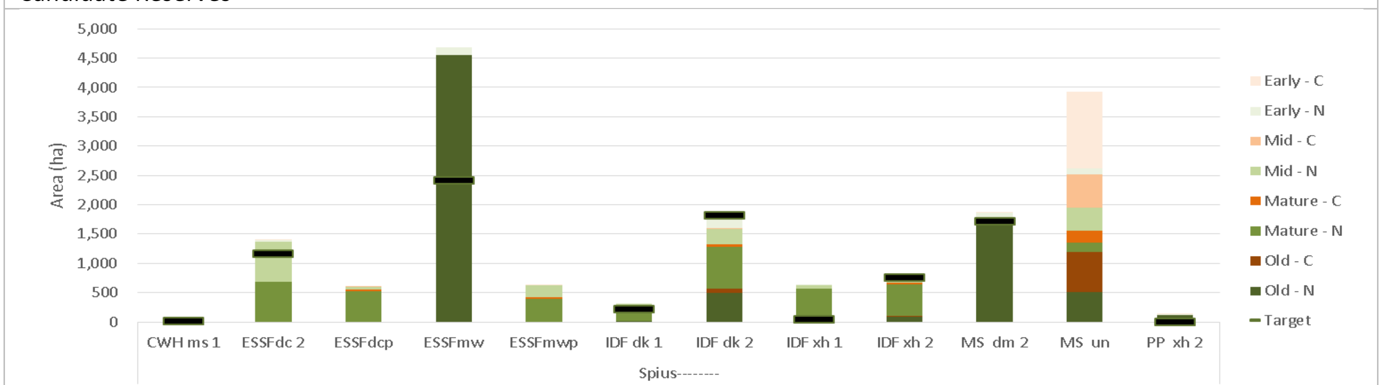
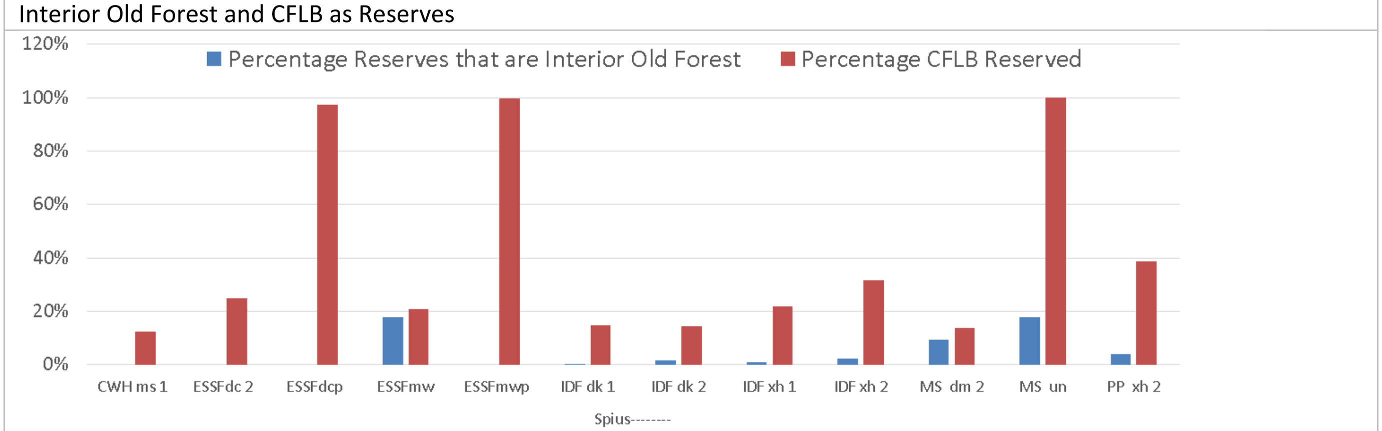


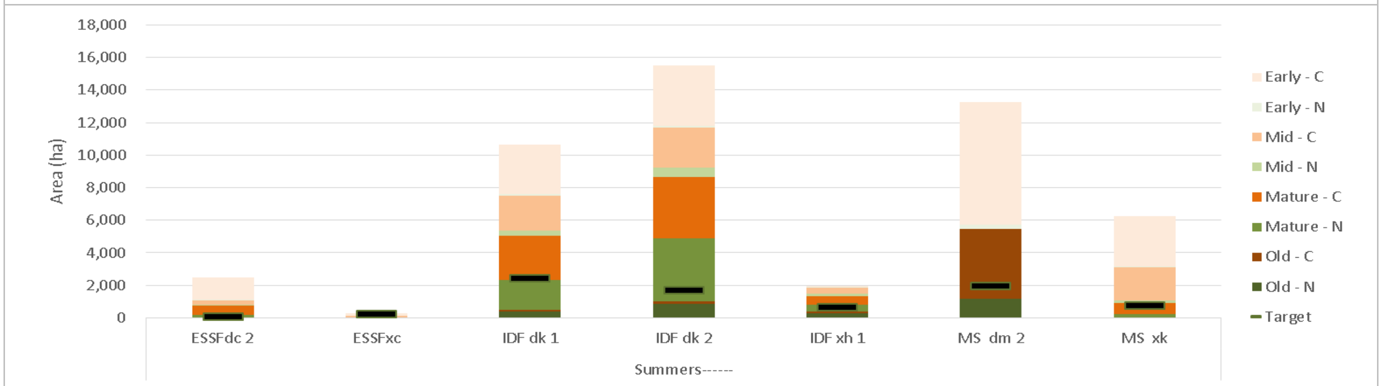
Interior Old Forest and CFLB as Reserves



Summers

Note: 'C' contributes to THLB; 'N' contributes to NHLB

Initial Condition



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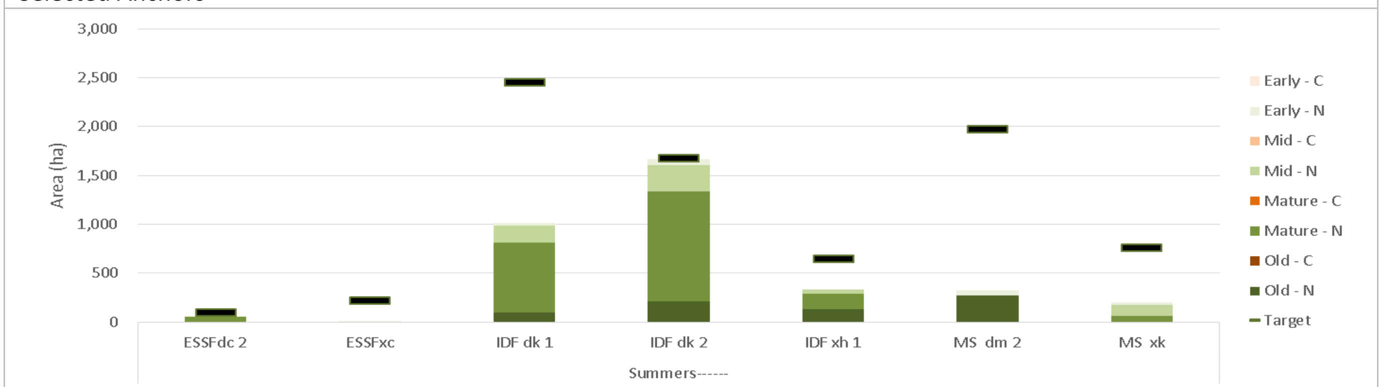
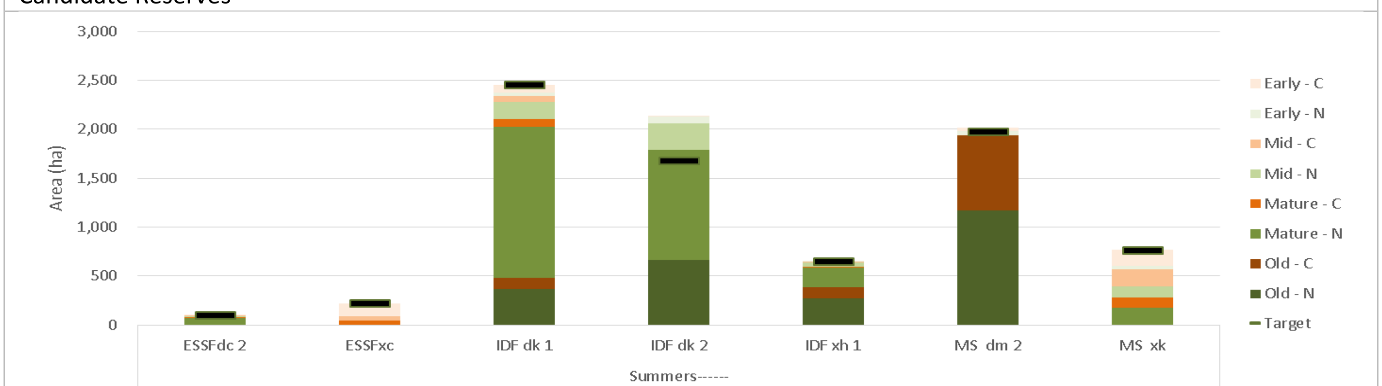
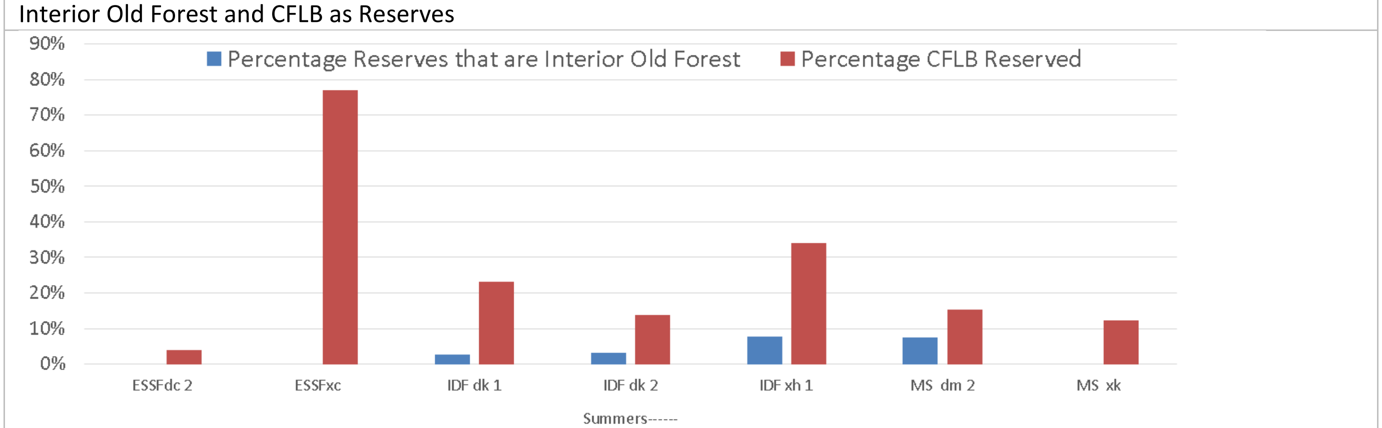


Candidate Reserves



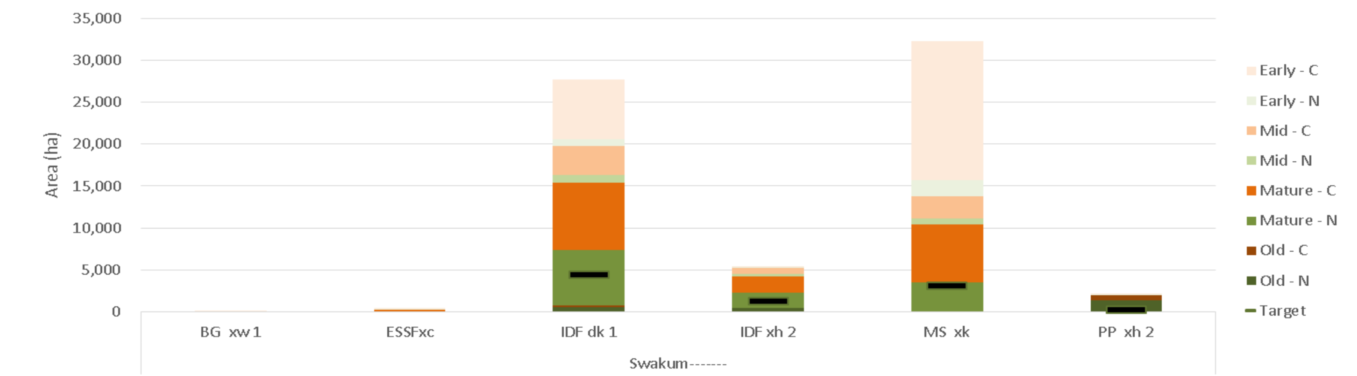
Interior Old Forest and CFLB as Reserves



Swakum

Note: 'C' contributes to THLB; 'N' contributes to NHLB

Initial Condition



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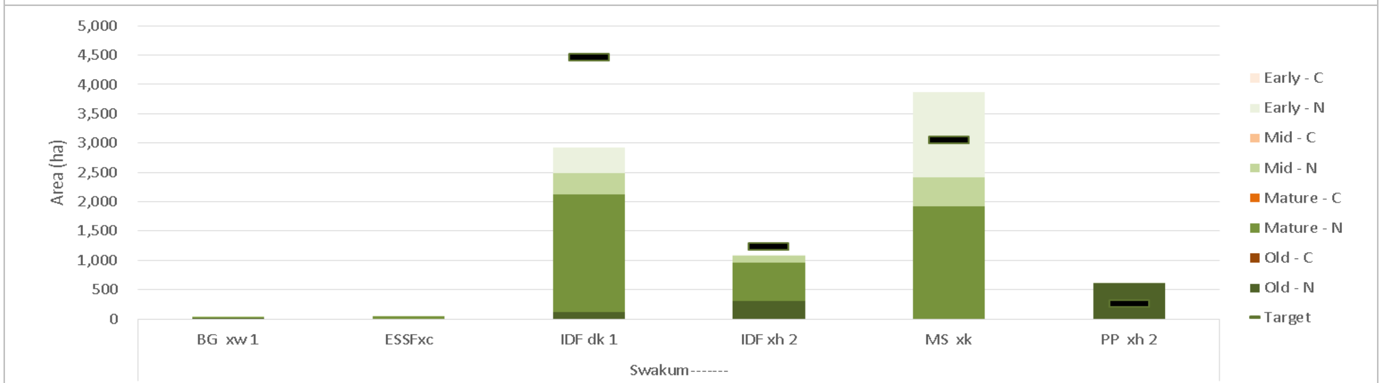
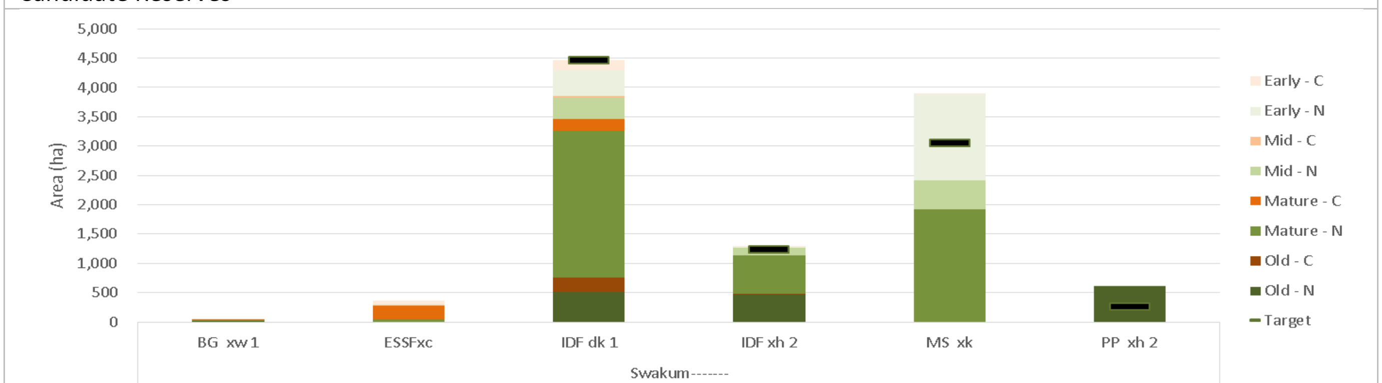
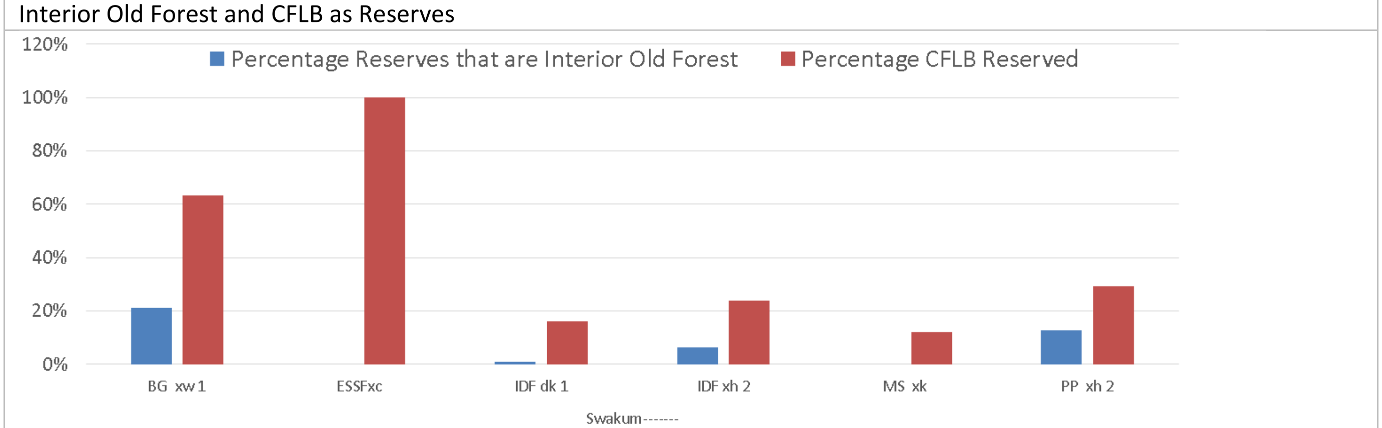


Candidate Reserves



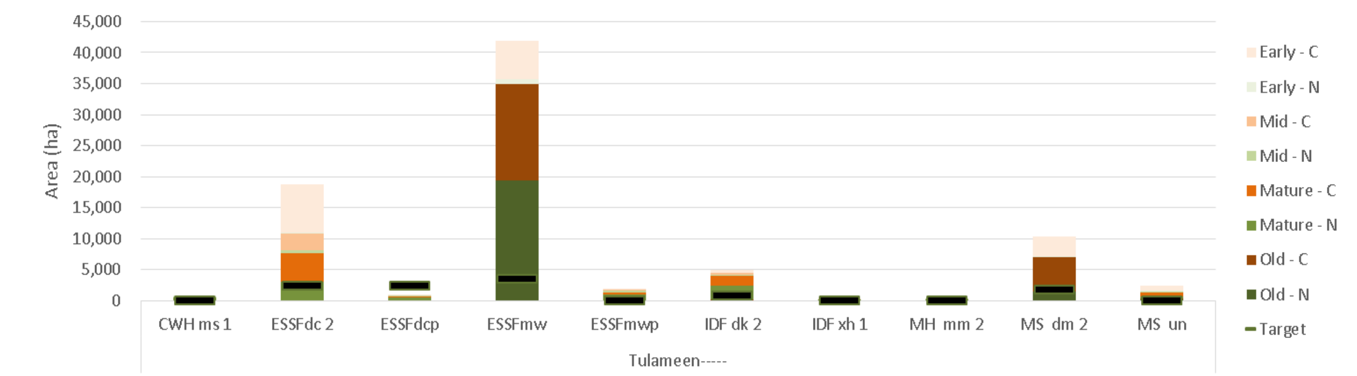
Interior Old Forest and CFLB as Reserves



Tulameen

Note: 'C' contributes to THLB; 'N' contributes to NHLB

Initial Condition



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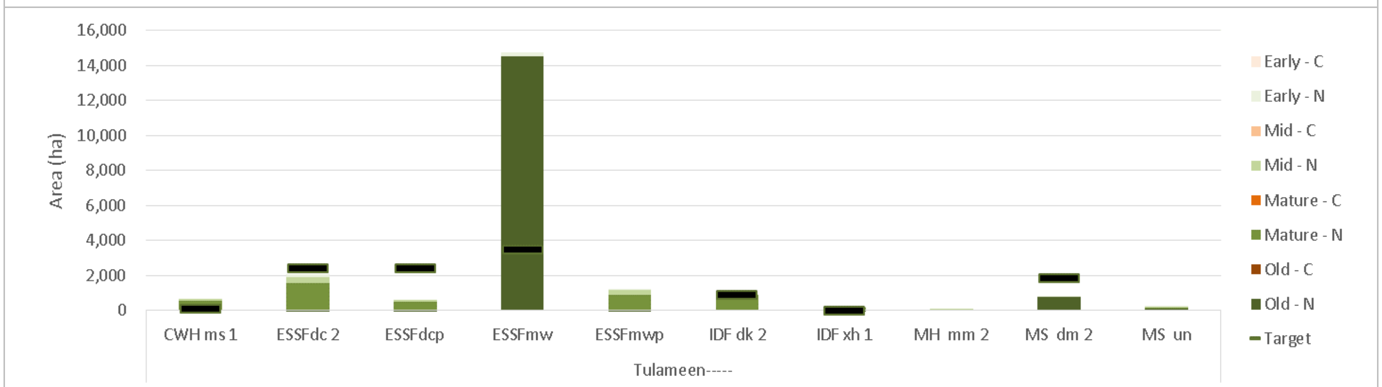
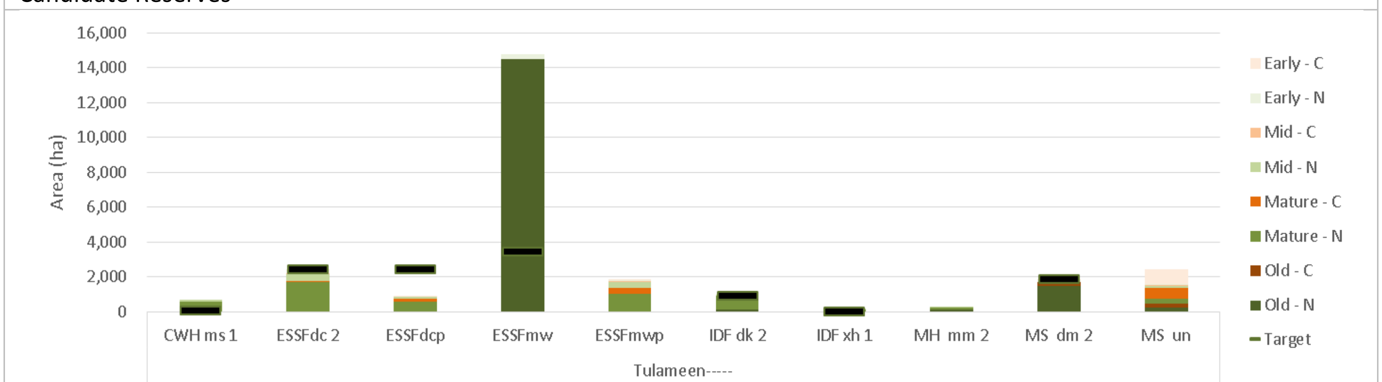
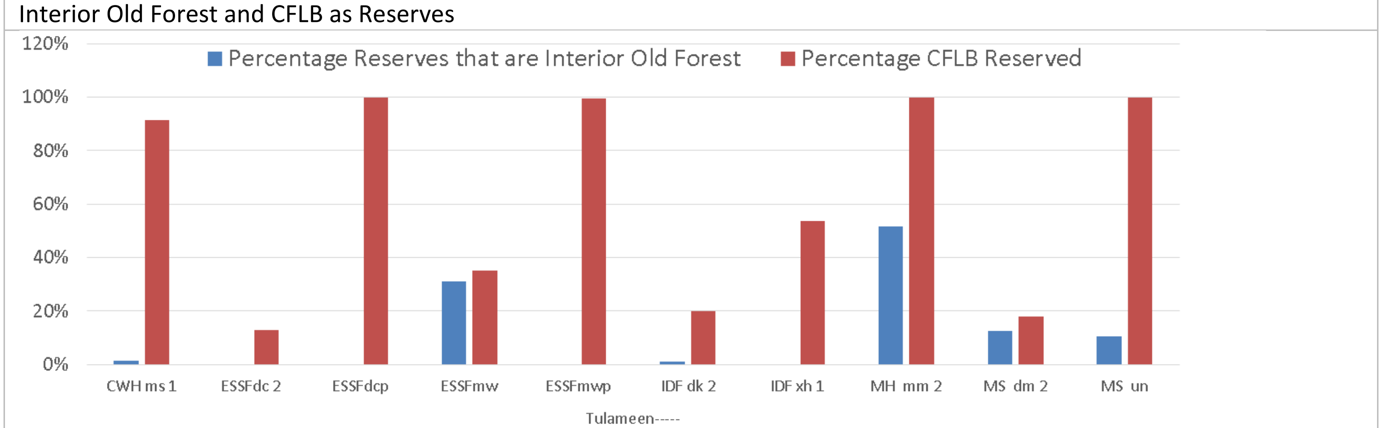


Candidate Reserves



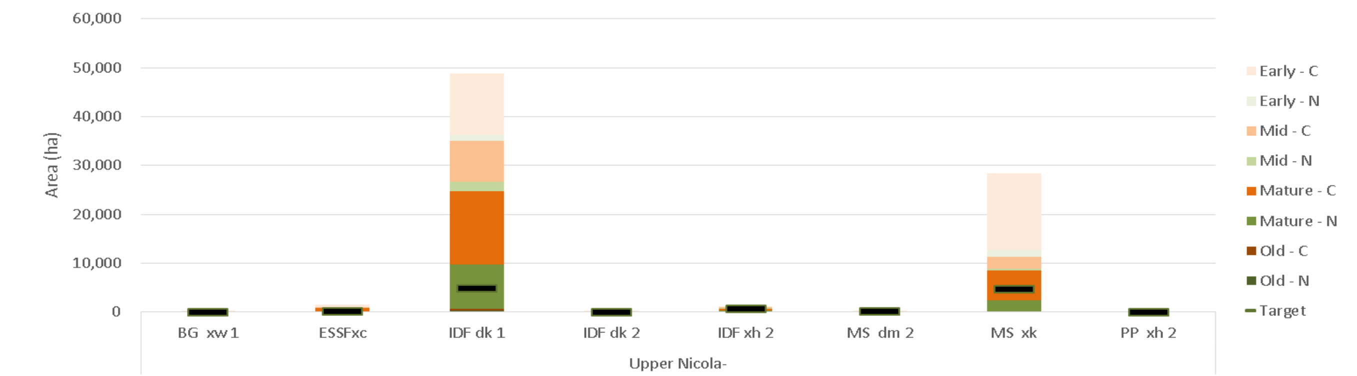
Interior Old Forest and CFLB as Reserves



Upper Nicola

Note: 'C' contributes to THLB; 'N' contributes to NHLB

Initial Condition



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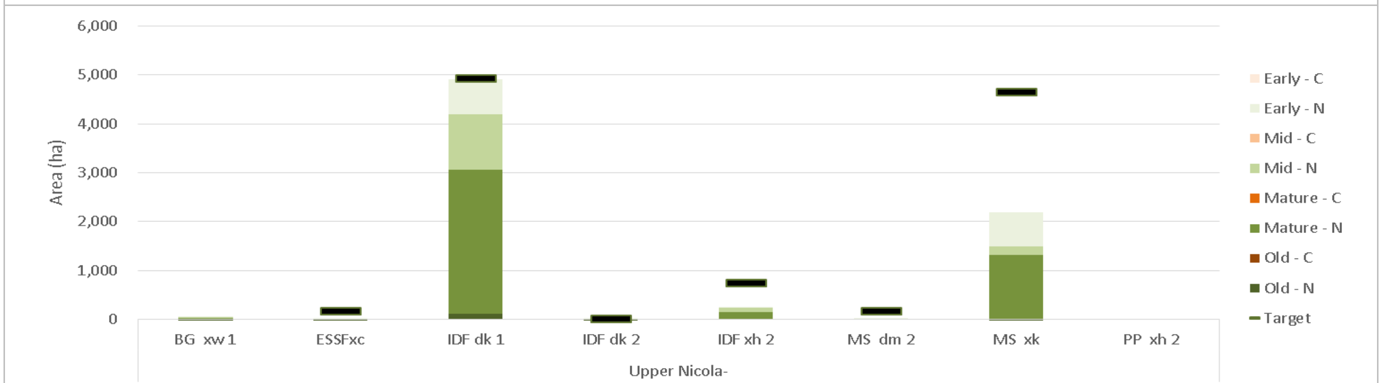

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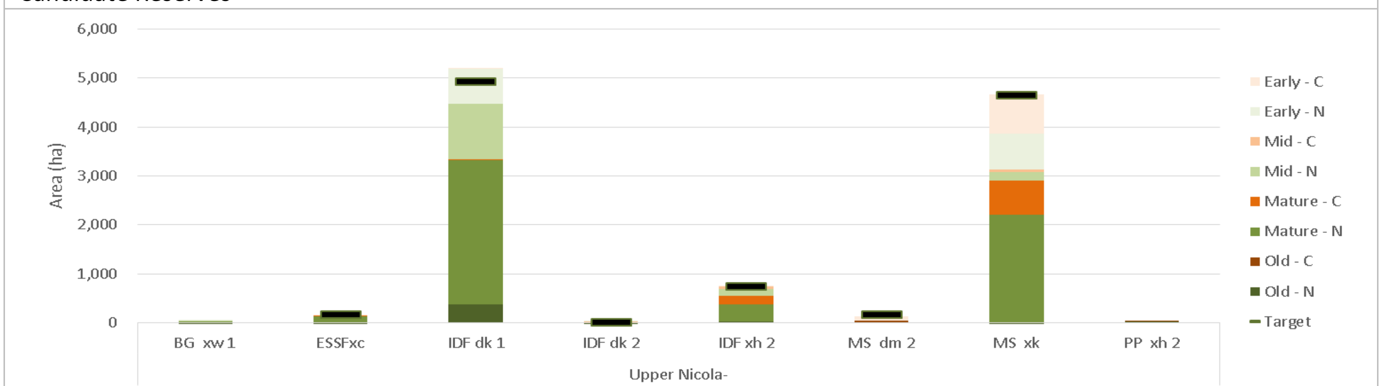

Interior Old Forest and CFLB as Reserves