Integrated Silviculture Strategy

Bulkley Timber Supply Area

Data Package

V 3.4

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Prepared for:

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Table of Contents

List of Figures

List of Tables

1 Introduction

The Resource Practices Branch (RPB) of the Ministry of Forests, Lands and Natural Resource Operations (FLNRO) is developing a new management unit planning framework; Integrated Silviculture Strategy (ISS). The ISS is a sustainable forest management planning framework with the objective to integrate all aspects of landscape-level and operational planning for each Timber Supply Area (TSA).

The ISS will integrate Type 4 Silviculture Strategies with timber supply review (TSR) to reduce duplication and redundancies where possible by sharing inventories, management zones, analysis units, Timber Harvesting Land Base (THLB) definitions and management assumptions. It is expected that the ISS process will improve the linkages to landscape level fire management, the Cumulative Effects Framework, the Forest and Range Evaluation Program's (FREP) multiple resource values assessments (MRVA) and other regional, management unit level or landscape level plans and strategies.

Provincial Timber Management Goals and Objectives (FLNRORD 2017) and the Chief Forester's Provincial Stewardship Optimization/Timber Harvesting Land Base (THLB) Stabilization Project (FLNR 2015) provide guidance to the ISS.

The ISS will consolidate all resource management related goals, objectives and strategies into one plan and then link these to a TSA wide tactical plan. The process includes a framework for monitoring and auditing, and continuous improvement.

The ISS aims to improve resource planning in British Columbia by addressing specific issues such as:

- Species at risk management and reserve allocation. Are the reserves placed where they provide the conditions most needed by species at risk?
- Ability to investigate options to co-locate reserves to provide required habitat benefits while preserving or increasing harvest opportunities;
- Current and predicted harvest levels – are the assumptions regarding the transition from old growth stands to second growth and managed stands accurate and, if not, what are the possible impacts on timber harvest and habitat values?
- What options are available to address habitat and timber supply using silviculture treatments?
- Effective use of public funds for new and existing funding initiatives;
- A feedback loop for adaptive management; ability to assess decision outcomes and modify behaviour based on new and better information; and,
- First Nations consultation; better understanding of the expected impacts of planned activities on First Nations' values.

1.1 Objectives

The project has the following objectives:

- Promote understanding through the geospatial representation of existing and proposed legislation, regulations, and policy that conserve stewardship values;
- Compile information on ongoing monitoring and cumulative effect work, and collaborate to identify additional work needed;

- Collaborate with the intent to comprehend common landscape values;
- Develop decision support products for comprehensive and durable decisions based on scientific and traditional knowledge;
- Manage natural resources to continue providing the values that support traditional and modern-day use;
- Work to identify underlying issues and work towards solutions;
- Integrate the scenario-based silviculture strategy process (Type 4) with the most recent Timber Supply Review (TSR);
- Prioritize activities and treatments necessary to help with achievement of timber supply and habitat needs;
- Create a tactical plan documenting the strategies, targets, activities and treatments to improve or benefit resource values, agreed upon by those on the planning team; and,
- Incorporate climate change as a consideration into the resource management planning process, including the identification of any associated risks (e.g. wildfire).

1.2 Context

This document is the second of four documents that make up an ISS. The documents are:

1 Situational Analysis – describes in general terms the current situation for the unit. The Situational Analysis forms the starting point for the initial planning group meeting to identify opportunities.

2 Data Package - describes the information that is material to the analysis including data inputs and assumptions.

3 Modeling and Analysis report –provides modeling outputs and rationale for choosing a selected scenario.

4 Integrated Silviculture Strategy – represents the selected management scenario which is the basis for the first iteration of the ISS. It includes an investment strategy and provides treatment options, associated targets, timeframes and expected benefits.

When the ISS is complete, a spatial operations schedule will provide direction for harvesting and a land base investment schedule will guide Forest for Tomorrow Annual Operating Plans.

2 Bulkley TSA

The Bulkley TSA is located in north-western BC and covers four main communities: Smithers, Telkwa, Moricetown, and Fort Babine (Figure 1). Smithers is the largest of these communities with a population of 5,350 in 2011, according to BC Stats. The TSA is situated between the Hazelton Mountains in the west and Babine Lake in the east. The Telkwa River watershed forms the southern boundary of the TSA while its northern boundary extends to the headwaters of the Nilkitkwa River.

The Bulkley TSA is part of the FLNRO Skeena Region, North Area, and is administered by the FLNRO Skeena Stikine Natural Resource District in Smithers.

The total area of the Bulkley TSA is 762,734 hectares, of which 500,034 hectares are classified as Crown forested land base (CFLB). The timber harvesting land base (THLB) – the area available for timber harvesting – in the last Timber Supply Review (2014) was 283,510 hectares.

The First Nations whose traditional territories overlap the Bulkley TSA include: Gitxsan Hereditary Chiefs; Kitselas First Nation; Lake Babine Nation; and Wet'suwet'en Nation (Moricetown Band; Skin Tyee Band; and Wet'suwet'en First Nation). The Yekooche First Nation recently expanded their territorial assertion, which now includes a portion of the Bulkley TSA.

The *Bulkley Land and Resource Management Plan* (LRMP), the *Bulkley Valley Sustainable Resource Management Plan* (SRMP) (2005) and associated higher level plan orders direct resource management on all Crown land within the Bulkley TSA. The LRMP was completed in 1998. Legal objectives for biodiversity were established at that time for each individual landscape unit with the exception of the Bulkley Landscape Unit, where objectives were established as policy. In 2005, the Bulkley Valley SRMP was developed for the Bulkley Landscape Unit in a manner similar to the other landscape unit plans but the objectives were not legally established.

In 2000, components of the LRMP – in particular, the resource management zone (RMZ) objectives – were established as legal objectives through the *Bulkley Resource Management Zone Higher Level Plan Order* (HLPO) under the *Forest Practises Code Act*.

In 2006 the original order was amended under the *Land Act* establishing land use objectives for the Bulkley TSA. The 2006 order streamlined the original Bulkley LRMP's legal objectives and incorporated legal objectives from the *Bulkley LRMP Higher Level Plan Order*, Biodiversity Objectives, Landscape Unit Plans, and the Bulkley Valley SRMP. Several orders have been issued under the *Government Actions Regulation* (GAR) of the *Forest and Range Practices Act* and the *Land Use Objectives Regulation* (LUOR) of the *Land Act* to establish components of the LRMP as legal objectives.

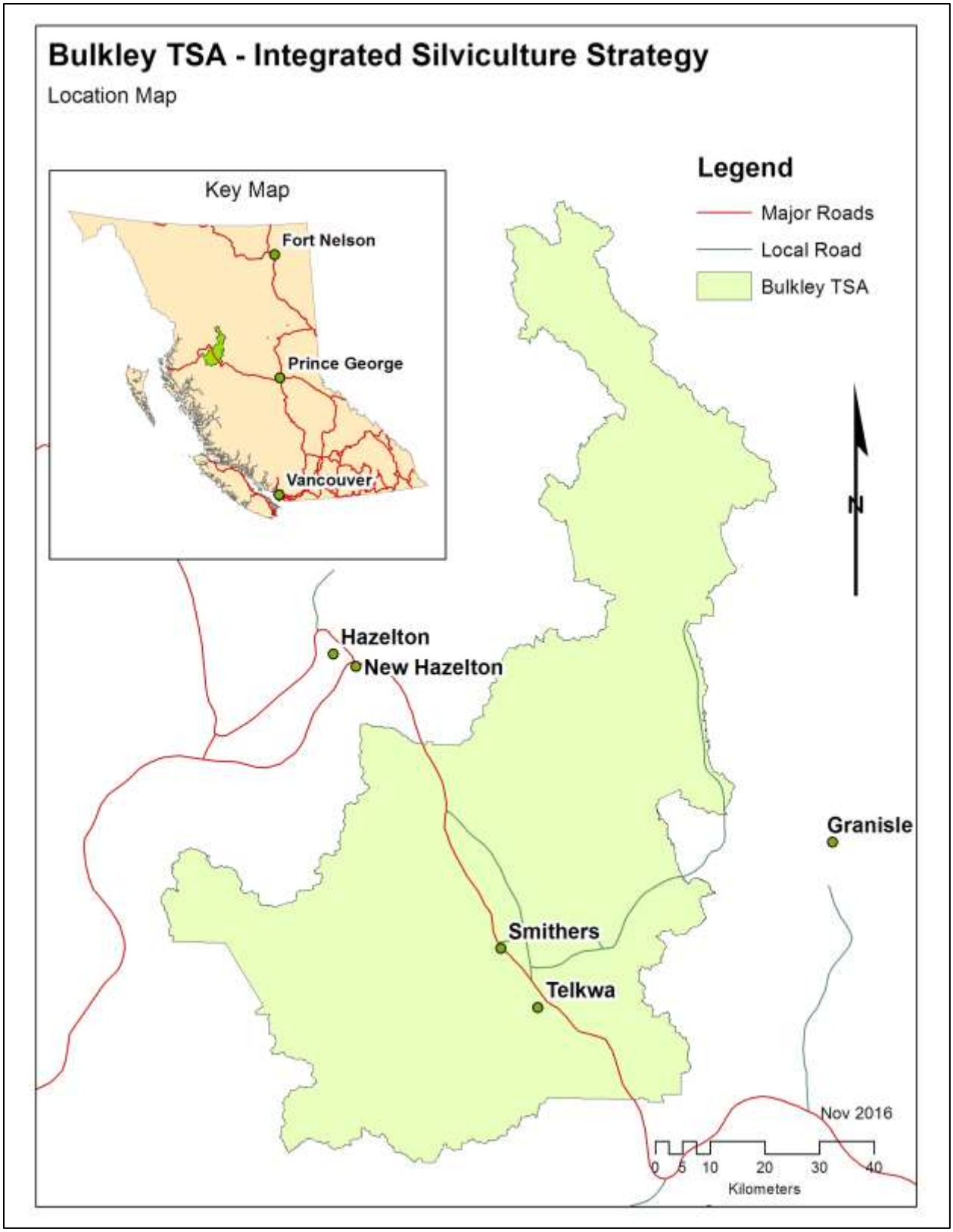

Figure 1: Bulkley TSA

3 Timber Supply

3.1 Historical and Current Annual Allowable Cut (AAC)

The current annual allowable cut (AAC) in the Bulkley TSA is 852,000 m^3 per year of which 502,700 m^3 is attributable to sawlog stands (Table 1). Sawlog stands are stands that are not classified as marginal sawlog or pulpwood stands. This AAC was set in 2014 and will remain in effect until a new AAC is determined, which must occur in 2024 or before.

Table 1: Historical and current AAC

AAC (m^3)		1988	1995	2002	2008	Current (2014)
		895,000	895,00	882,000	852,000	852,000
Partition	Sawlog		528,000			502,700
	Marginal sawlog / pulpwood		367,000			349,300

3.2 Species Profile and Age Class Distribution

The Crown Forested Land Base (CFLB) in the Bulkley TSA is dominated by balsam, spruce, pine and hemlock. Balsam is the leading species on approximately 59% of the CFLB area. The share of spruce is 17% while pine is the dominant species on 19% of the land base (Figure 2). The CFLB is the portion of the TSA with forest cover. It contributes to Crown forest management objectives such as landscape-level biodiversity or visual quality objectives. The CFLB includes protected areas but does not include private land or non-forested land that is not capable of producing a commercial forest.

Pine-leading and spruce-leading stands are more plentiful in the Timber Harvesting Land Base (THLB) than in the CFLB as a whole (Figure 3). While still most common, balsam-leading stands have less of a share in the THLB (Figure 3).

Older age classes dominate the THLB and CFLB in the TSA. Approximately 52% of the THLB is older than 140 years (Figure 4). Age classes 3 and 4 are not well represented.

Figure 5 depicts the THLB in the Bulkley TSA by BEC variant. Approximately 50% of the THLB is in the SBSmc2 variant, while almost 30% is in the ESSFmc variant.

3.3 Harvest Performance and Trends

The harvest has not met the AAC between years 2006 and 2015; approximately 70% of the AAC was harvested during this time period. Past harvest levels in the Bulkley TSA were reduced and effort directed to salvage operations in the Lakes and Prince George TSAs to address the mountain pine beetle (MPB) infestation.

Between 2006 and 2015, approximately 78 percent of the harvested volume was scaled as sawlog, with the remaining volume consisting of low grade and non-scaled cruise based dead and live volumes.

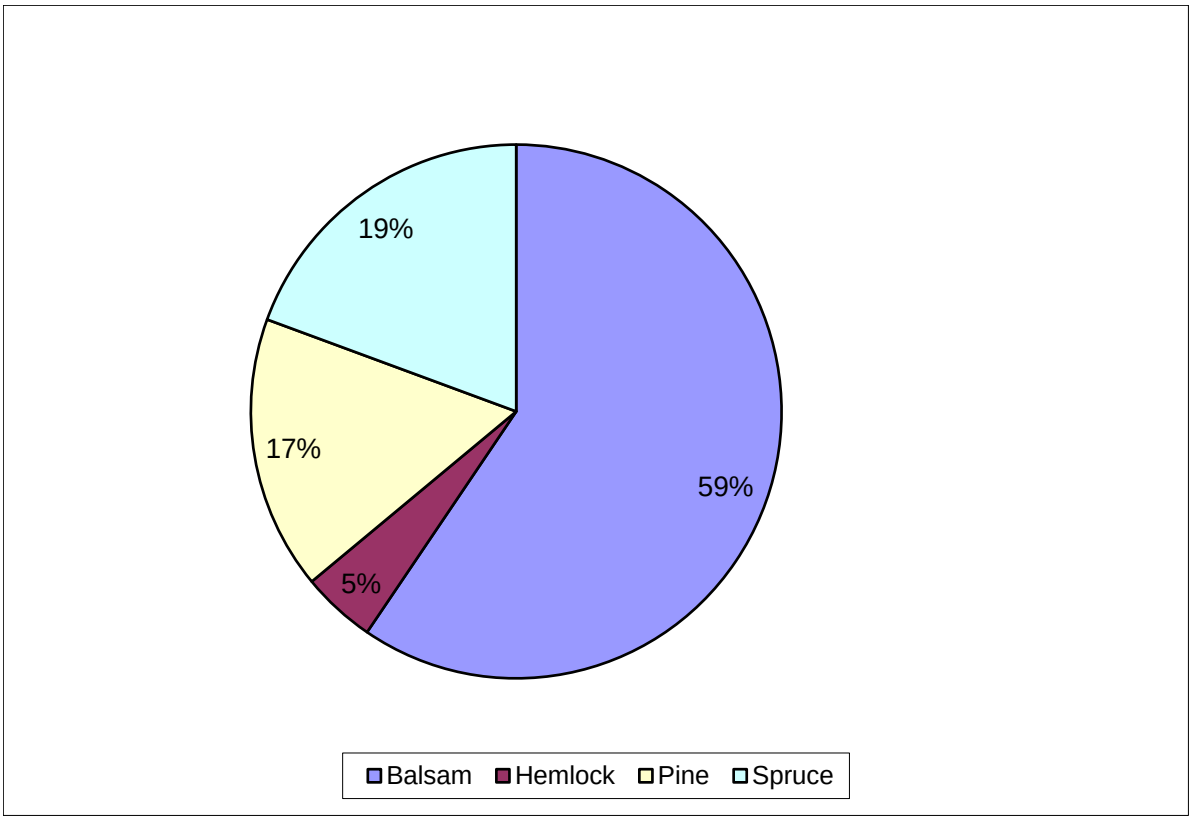

Figure 2: Leading species on the CFLB, Bulkley TSA

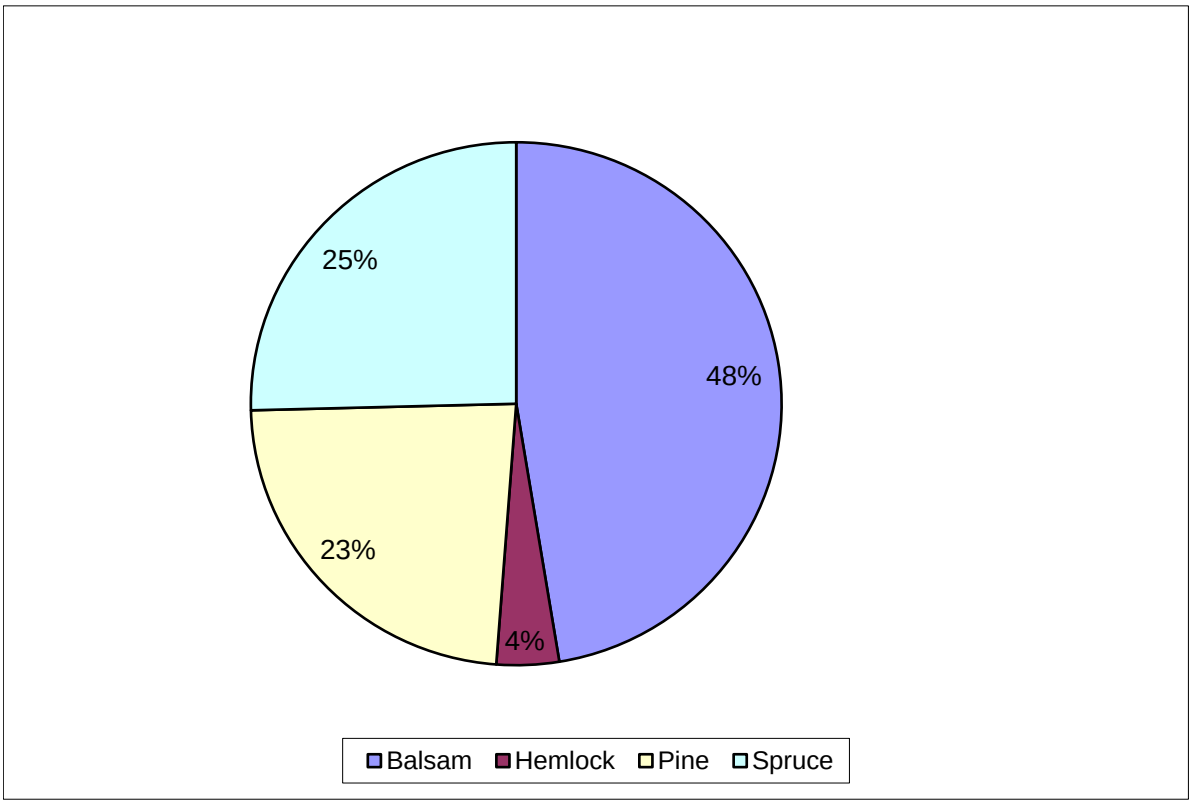

Figure 3: Leading species on the THLB, Bulkley TSA

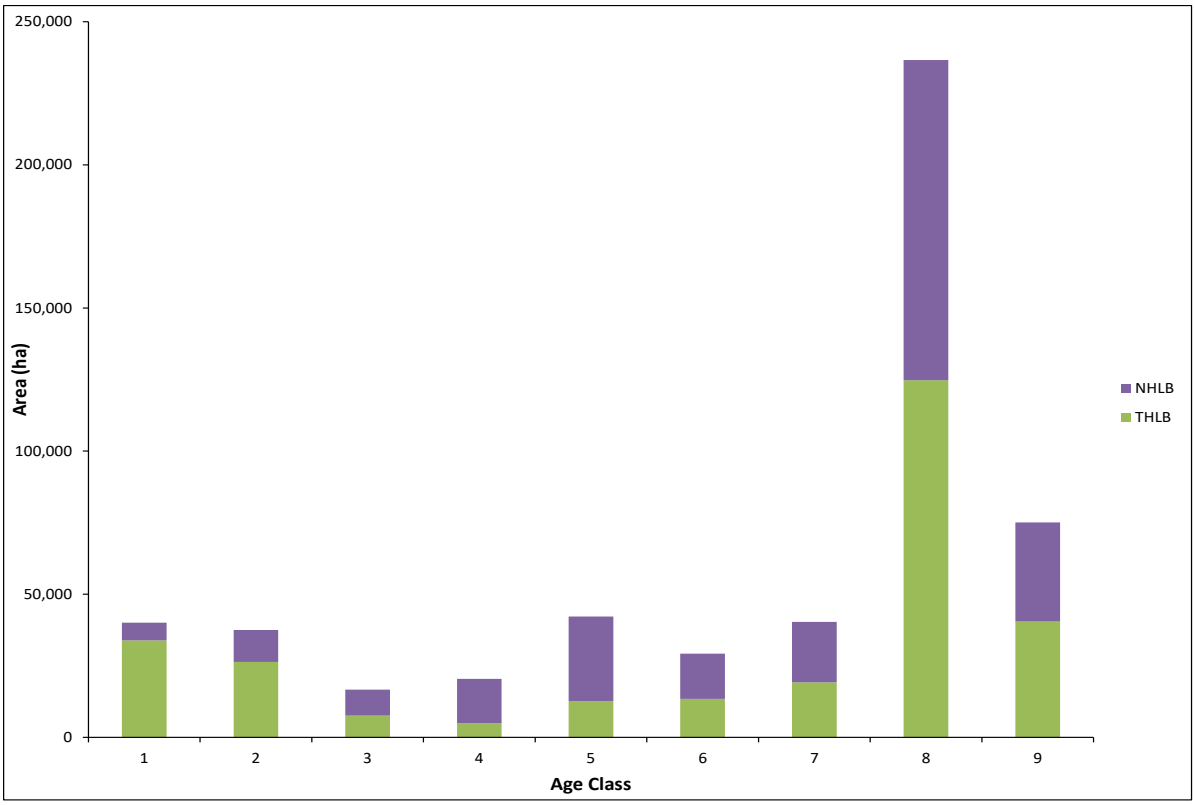

Figure 4: Age class distribution, Bulkley TSA

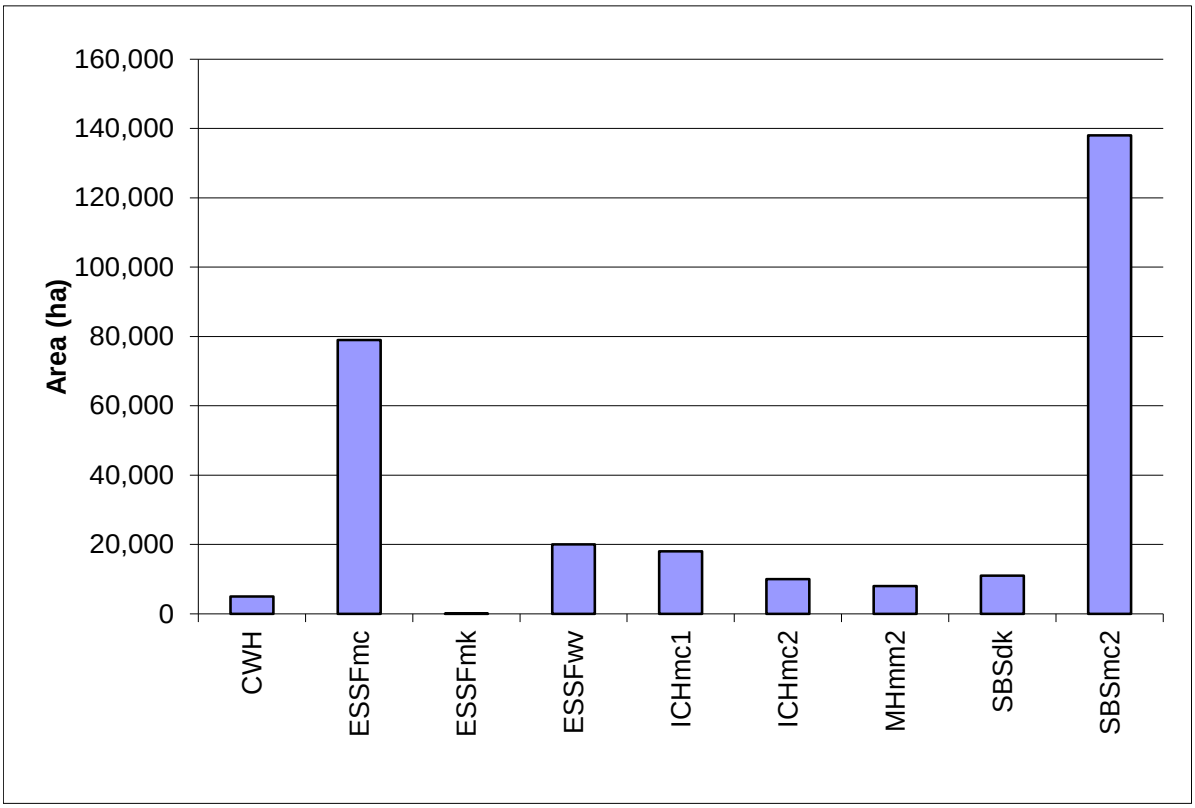

Figure 5: THLB by BEC variant in the Bulkley TSA

4 Modelling Approach

4.1 Model

For this analysis Forest Simulation Optimization System (FSOS) is used for modelling. FSOS can operate as both a simulation and a heuristic optimization model using the same database. Simulation allows for sensitivity analysis and utilizes a hard constraint-based approach. Optimization is a target-oriented approach representing a shift in modeling approach from "what can we take from the forest" to "what can we create in the forest." Blocking and scheduling is conducted separately in simulation, and simultaneously in optimization. Scheduling in simulation progresses one period at a time, while optimization planning considers all periods at the same time. Data can be spatial and/or non-spatial. FSOS accommodates overlapping resource values and constraints and can account for multiple values such as timber, silviculture treatments, carbon allocation, biodiversity, wildlife, and visual quality. Algorithms employed in FSOS include simulated annealing, Tabu search algorithms, and Hill Climbing.

4.2 Analysis Assumptions in a Nutshell

This analysis relied many of the same analysis assumptions that were used in the latest TSR; however, the analysis assumptions were revised through stakeholder meetings to reflect current management in the Bulkley TSA. Table 2 shows the core ISS Base Case assumptions in a nutshell.

Table 2: ISS Base Case assumptions in a nutshell

Objectives and overall assumptions	Characterize current management to the extent practicable
Land base assumptions	• Incorporate projected tenures in the analysis (FNWL); • Remove the Caribou WHA from the THLB; • Remove known NOGO nests and nest buffers from the THLB; • Remove all areas classified as pulp from the THLB; • Remove all areas classified as marginal sawlog located further than 1 km away from a road from the THLB; • Remove all areas classified as marginal sawlog located further than 5-hour cycle time away from Smithers from the THLB; • Marginal Timber in Planning Cell C7 is included in the THLB. • Low site classification changed from TSR; • Use most TSR assumptions as they are; • THLB = 204,978 ha
Harvest assumptions	• Incorporate proposed harvest into the harvest forecast; • Use relative oldest first harvest rule; • Do not limit the harvest of marginal sawlogs in the timber supply model; • Incorporate natural disturbance in the NHLB.
Silviculture and log assumptions	• Use revised managed stand analysis units and yield curves; • Use the provincial site index layer as the site index source for managed stands; • Use TASS for modelling the growth and yield of managed stands; • Separate existing managed stands into eras to reflect differences in management; • Use generic industrial second growth log sort specifications and market values to track production value from harvested managed stands.
Habitat assumptions	• Report on potential (predicted) NOGO forage habitat; • Report on moose habitat; • Report on the areas of predicted Caribou habitat as per assumed Federal Government management direction. • Report on the ECAs for all 4th order watersheds in the TSA. • Report on the area of predicted Marten habitat in the TSA. • Report on the area of predicted undesirable Grizzly Bear habitat in the TSA.

4.3 Data Sources

This analysis built a dataset using land base assumptions that in many cases were the same or similar to those employed in the latest Bulkley TSA TSR. Where new data was available, it was used in this project. The following data has changed since the latest TSR:

- Ownership data;
- Terrain stability data, some new data was available;
- Recreation features data;
- New Vegetation Resource Inventory (VRI). The new inventory covers approximately 20% of the TSA;
- New stand quality for inoperable classification. The new VRI changes this classification;
- New wildlife data (Caribou WHA, UWR);
- Changes in visual quality data;
- New First Nations Woodland Licence;
- Updated road data.

Additional THLB netdowns and management objectives that reflect the goals and objectives of the Bulkley TSA ISS were incorporated into the analysis dataset. Much of the data was provided by the Skeena Stikine Natural Resource District and the Forest Analysis and Inventory Branch (FAIB). Additional data layers were acquired from the British Columbia Geographic Warehouse (BCGW).

Table 3 lists all the data layers used in the analysis.

Table 3: Data Sources

Data	Source	Vintage	Update
Agriculture Development Areas, Wildlife Habitat Management Areas	BCGW	2009	
Alluvial Fans	District	2003	
Community Watershed	BCGW	1995	
Environmentally Sensitive Areas	District	1970's	
Fish Sensitive Watersheds	BCGW		
Forest Ecosystem Network	MoFLNROD Bulkley LRMP	1997	2003
Harvest Depletions	District (Forsite)	2017	
Harvest Method	District	2010	
Landscape Units	BCGW	1997	2001
Ownership	District	2017	
Predictive Ecosystem Mapping	BCGW	2010	
Provincial Forest	BCGW	2001	
Provincial Forest Health Survey	BCGW	2016	
PSTA_Public_Threat_Rating	BC Wildfire Service	2015	
Recreation Sites	BCGW		
Research Installations	District		
Resource Management Zones	BCGW	2009	
Riparian Zones	District		
Roads, Trails, Landings	District		
Sensitive Ecosystem Inventory	EcoCat	1998	

Data	Source	Vintage	Update
Soil Erosion Potential	District		
Terrain Stability	District		
Ungulate Winter Ranges (draft)	District	2017	
Ungulate Winter Ranges (Goat, U-6-007	BCGW	2018	
Vegetation Resources Inventory	BCGW	2017	
Visual Quality Objectives	BCGW		
Wildlife Babine moderate Grizzly Habitat	MoFLNROD Bulkley LRMP	2006	
Wildlife Babine Special Grizzly Mgmt Units	MoFLNROD Bulkley LRMP		
Wildlife Habitat Areas (Caribou)	BCGW	2015	
Wildlife Habitat LRMP	MoFLNROD Bulkley LRMP		
Wildland_Urban_Interface_Buffer_Area	BC Wildfire Service	2015	

4.3.1 Forest Inventory

The Bulkley Vegetation Resource Inventory (VRI) Phase I was completed in 2008, while the Phase II ground and net volume adjustment factor sampling was concluded in 2010. An audit in 2012 uncovered several issues with Phase 1 VRI. The Phase 1 delineation and the species composition and stand age attribute decisions did not meet the ministry standard. Also, lack of confidence in balsam tree live / dead attribution was expressed.

Approximately 20% of the TSA was re-inventoried in 2015. In 2017 FAIB provided a continuous inventory coverage for this project. The 2017 VRI consisted of the re-inventory portion of the TSA, and the updated inventory for the rest of the TSA. The updates accounted for past harvesting and mortality in pine stands. The 2017 VRI is projected to January 1, 2016.

The latest TSR did not include the Phase II inventory adjustment in the Base Case due to the perceived over estimation of merchantable volume. The partial re-inventory of the TSA would also make it questionable to use the Phase II VRI adjustments in this project. For these reasons, no inventory adjustments are used in the ISS.

4.3.2 Cycle Time

Cycle time, which is defined as the round-trip time required to haul wood from the forest to the mill, was used as an input to the ISS Base Case and subsequent learning scenarios. It was calculated in a stand-alone analysis using a raster least-cost path procedure. Cycle time was calculated for Fresh Water Atlas (FWA) Assessment Units, not for individual resultant polygons.

FWA Assessment Units were edited to divide some large units into smaller units that were more compact. Splitting larger FWA units ensured that resultant polygons in the unit were within a few kilometers of the FWA unit centroid. The edited FWA Assessment Units had 208 polygons that contained THLB area. The centroid for each FWA Assessment Unit was calculated as the THLB area weighted average of the resultant polygons within the unit. The largest distance between a resultant polygon and the FWA Assessment Unit centroid was 15.3 km, however 90% of the resultant polygons were within 5.3 km of the centroid. Cycle time was calculated from these centroids to a haul site in Smithers located at 19th Ave and Pacific St.

A raster cost path analysis was used to calculate the time required to travel between the FWA Assessment Unit centroids and Smithers. This raster analysis used a 100 m cell resolution and determined the minimum cost path between the centroids and Smithers.

The cost of travelling through a raster cell was the time, in minutes, it takes to cross the cell derived from the road speed. Speed is the average of empty and loaded haul speeds.

Several sources of road data were used. The main roads were provided by the Skeena Stikine Natural Resource District. The Bulkley Haul Speed dataset linked the main roads up with the Bulkley Haul Speed Ledger data, providing empty and loaded haul speeds for sections of the road.

A missing section of Highway 16 (from Moricetown to Seaton) was added from the DRA roads dataset. This section used haul speed information from the Kispiox Haul Speed Ledger.

Built and planned roads were used to complete the network, where main roads were not available. These were assigned an in-block speed based on slope. Road sections <= 6% were assigned an average speed of 17.5 km/hour, while roads > 6% were assigned an average speed of 12.5 km/hour.

The least cost path was calculated between each FWA assessment unit and Smithers. Unroaded areas were assigned a high cost to ensure that the least cost path favored roads. Figure 6 shows the cycle time by FWA assessment units. The white units have no THLB and cycle time was not calculated.

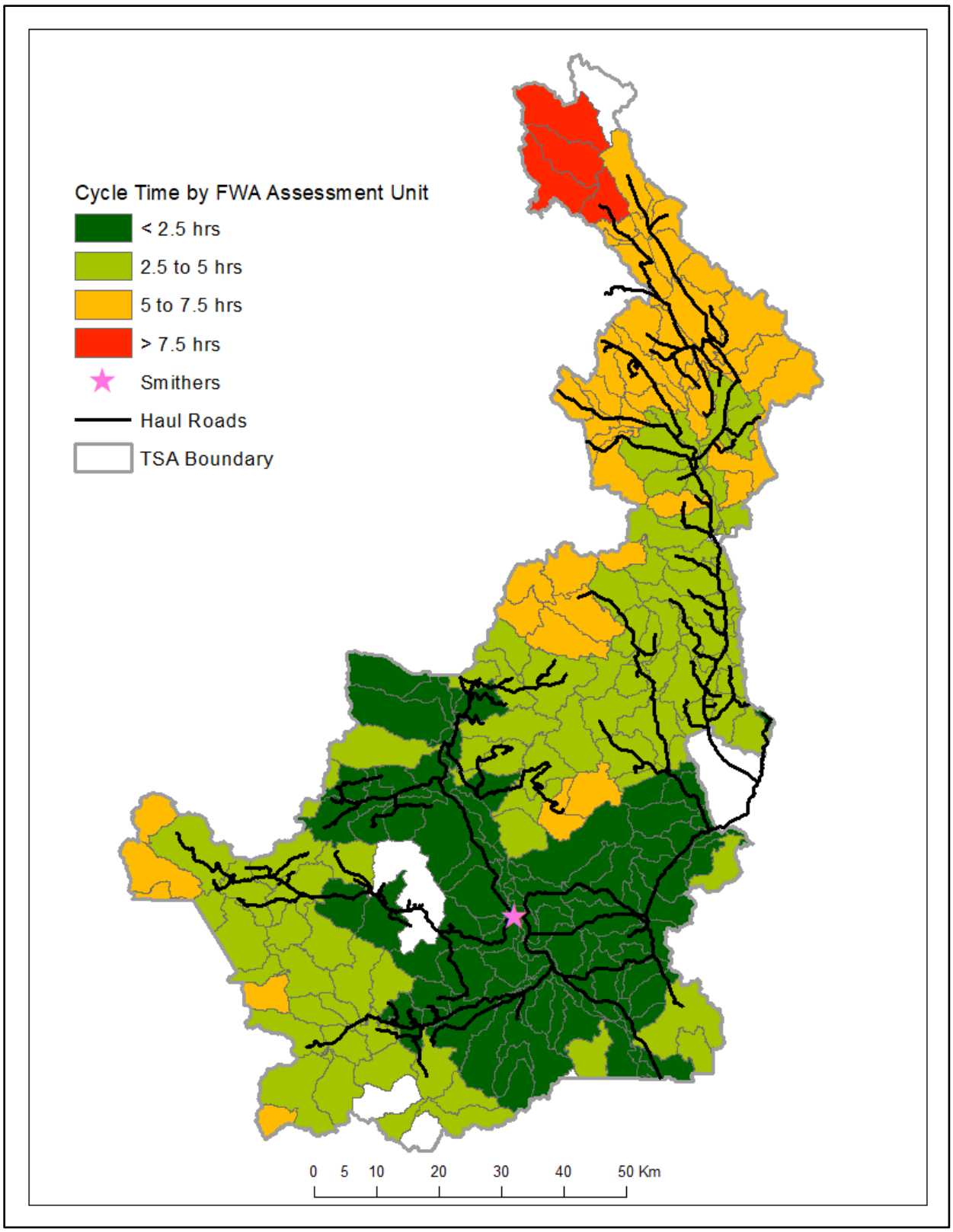

Figure 6: Cycle time by FWA assessment units

4.3.3 Stand Quality Classification

The intent in this project was to use the stand quality classification as per TSR, because it is generally supported by the licensees and the Ministry staff. The source documents for the stand quality classification are the Updated TSR Data Package, the AAC determination binder (confidential) and three documents that contained the coding for the last TSR: MM_metadata.docx (TSR1_QUAL_RW.txt code), PFT_Recode_Logic.docx and PFT_Rewrite.txt.

The stand quality classification for the Bulkley TSA TSR netdown was completed in two stages using two different sets of definitions. First, the stands were classified into four site classes: low, poor, medium, and good. The intent was to use these classes for the harvest method classification and to exclude any stands that fell into the low site class from the THLB as low site. The low site cut-offs were SI < 8 for Balsam and Hemlock, SI < 7.5 for Pine and Spruce. In addition, any stands that were not projected to meet the volume of 150 m^3 per ha by the age of 140 were to be excluded from the THLB.

After the updated TSR data package was published, the low timber growing potential netdown was changed: only stands with SI < 5 were removed from the THLB with the intent of also removing any stands that are not projected to meet the volume of 150 m^3 per ha by the age of 140, as noted above. However, upon review of the previous TSR data files, it became obvious that the 150 m^3 per ha at age 140 rule had not been applied in the TSR for the THLB netdown or the stand quality classification.

Table 4 shows the stand quality classification that was used in this analysis. It follows the classification employed in the latest TSR; however, the classification has been modified to remove some of the inconsistencies discovered in the TSR classification discussed above.

The stands are classified into five categories: sawlog, marginal sawlog, pulp, problem forest type (PFT) deciduous and PFT low site. In addition to the classification shown in Table 4, all previously logged stands were considered sawlog quality and all sawlog classified stands in the C7 planning unit (planning cells A30, A302, A303) were classified as marginal sawlog (including any logged stands).

Table 4: Stand Quality Definition

ID	Species /ITG	Site Class	SI	Projected Height	Inventory Species	BEC	BCLCS_LEVEL_3	Stand Quality
1	Pine Spruce (ITG 21, 24, 25, 26, 28, 30, 31)	P, M, G						Sawlog
2	Balsam Fir (ITG 18, 20)	M, G		>=24m (for Site Class M)		Not CWH		Sawlog
3	Balsam Fir (ITG 18, 20)	L	>=5	>24m				Sawlog
4	Pine Spruce (ITG 21, 24, 25, 26, 28, 30, 31)	L	>=5	>=18				Sawlog
5	Balsam Fir, Spruce with Helmlock secondary (ITG 19, 23)	L	>=5	>24	Spp2 (Hw) < 40%			Sawlog
6	Balsam Fir (ITG 18, 20)	P, M		<24m (for Site Class M)		Not CWH		Marginal
7	Balsam Fir (ITG 18)	L	>=5	>=18 and <=24				Marginal
8	Balsam Fir (ITG 20)	L	>=5	>=17 and <=24				Marginal
9	Balsam Fir, Spruce with Helmlock secondary (ITG 19, 23)	L	>=5	>=18 and <=24	Spp2 (Hw) < 40%			Marginal
10	Hemlock leading stands (ITG 12-17) or Balsam or Spruce leading stands with Hemlock secondary (ITG 19,23)	P, M, G						Pulp
11	Balsam Fir (ITG 18, 20)	P, M, G				CWH		Pulp
12	Balsam Fir, Spruce with Helmlock secondary (ITG 19, 23)	L	>=5		Spp2 (Hw) >= 40%			Pulp
13	Hemlock leading stands (ITG 12-17)	L	>=5					Pulp
14	Deciduous (ITG >= 35)							PFT_Decid
15	ITG 18	L	>=5	< 18				PFT_Low
16	ITG 20	L	>=5	<17				PFT_Low
17	Pine Spruce (ITG 21, 24, 25, 26, 28, 30, 31)	L	>=5	<18				PFT_Low
18	Balsam Fir, Spruce with Hemlock secondary (ITG 19, 23)	L	>=5	<18	Spp2 (Hw) < 40%			PFT_Low
19	ALL	L	>=5				W	Wetland
20	ALL		<5					PFT_Low

5 Land Base Assumptions

Land base assumptions define the crown forested land base (CFLB) and timber harvesting land base (THLB). The THLB is designated to support timber harvesting while the CFLB is identified as the broader land base that contributes toward meeting both timber and non-timber objectives such as biodiversity.

A netdown is the process in which areas are removed from the total land base to determine the CFLB and the THLB. The removal process is attribute-based (netdown factors), and an area can theoretically be removed from the CFLB or THLB for more than one reason as a result of overlapping resource issues. In practise, however, once an area has been removed, it cannot be deducted again further along in the process.

A netdown is sensitive to the order in which the netdown factors are applied; a different netdown order will return different net areas removed for the various netdown factors, however, the final CFLB and THLB areas will be the same.

The Bulkley TSA land base classification is as follows:

Excluded Land Base (EXLB): this category includes non-crown owned or managed lands, as well as non-forested areas.

Crown Forested Land Base (CFLB): this category represents the total forested areas under crown management.

Non-Harvestable Land Base (NHLB): this category represents the portion of the CFLB where, following current forest practises, harvesting will not or cannot occur. The NHLB includes areas that are currently not harvestable due to economic considerations, meaning that the possibility exists that at least some of NHLB might become harvestable under different economic conditions.

Timber Harvesting Land Base (THLB): this category represents the productive forested land where harvesting is possible based on current legislation and forest practices.

The results of the netdown are shown in Table 5; these reductions are described below in further detail (areas listed are gross areas and not additive to Table 5).

Table 5: THLB Netdown

Description	Net Area (ha)	Gross Area (ha)
Total Area	**762,734**	
Private and Non-Crown Land	98,642	98,642
First Nation Woodland License	9,258	10,031
Non-Forest	151,081	181,661
Existing Road	6,711	10,617
Crown Forested Land Base	**497,042**	
Parks and Reserves	49,890	110,931
Environmentally Sensitive –Regeneration	9,583	13,513
Environmentally Sensitive – Avalanche Areas	832	4,657
Environmentally Sensitive – Soils	29,084	61,438
VQO Preservation	1,153	3,753
Recreation Sites	1,927	3,528
Inoperable	44,238	107,653
Low Site	66,052	200,998
Problem Forest	13,356	148,274
Marginal Operable	44,943	108,241
Wildlife Habitat Areas (Caribou)	8,548	50,379
Northern Goshawk Nests	337	565
Research Plots and Permanent Sample Plots	212	780
Red and Blue listed ecosystems	230	1,835
Riparian Reserve and Management Zones	9,196	34,431
Recreation Trails	1,380	6,864
Wildlife Tree Retention Areas	11,200	0
Timber Harvesting Land Base	**204,878**	
Future Roads	5,565	879
Future Timber Harvesting Land Base	**199,313**	

5.1 Crown Forested Land Base (CFLB)

The crown forested land base (CFLB) represents the total forested area that is managed by the Crown. All lands that are not managed by the Crown are excluded as are areas that are non-forested. Areas where forests do not grow or where they grow poorly are also excluded.

As shown in Table 5 above three broad categories of lands are removed from the total land base:

1. Private and Non-Crown Land, Lands not Managed by the Crown;
2. Non-Forest;
3. Existing Roads, Trails and Landings.

5.1.1 Private and Non-Crown Land, Lands not Managed by the Crown

Several categories of non-crown land were excluded from the CFLB. These areas were excluded based on their ownership codes and include privately owned lands, federal and Indian reserves and miscellaneous leases (Table 6).

Allowable annual cuts (AACs) are determined individually for tree farm licences, woodlots and community forest agreements and First Nation woodland licences; these lands are excluded from the CFLB as shown in Table 6.

Table 6: Area outside ownership data layer

Ownership Code	Ownership Description	Gross Area (ha)
40	Private Land	53,017
52	Indian Reserve	2,820
77	Woodlot	9,916
78	First Nation Woodland Licence	10,031
79	Community Forest	32,831
99	Misc. Lease	57
Total		**108,672**

5.1.2 Non-Forest

Non-forest areas such as alpine, lakes, rocks, etc. are removed from the land base. For this analysis, the following areas were classified as non-forest (Table 7).

Table 7: Non-forest areas

Non-Forest Category	Non-Forest Definition	Gross Non-Forest Area Accounting for Overlaps (ha)	Total Non-Forest Area with Overlaps (ha)
Non-Vegetated	BCLCS level 1 = "N" and no logging history	59,453	59,453
Non-Treed	BCLCS level 2 = "N" and no logging history	100,314	100,314
Alpine	BCLCS level 3 = "A" and no logging history	0	20,287
Low Stocking	Projected height < 5 m or crown closure layer 1 + 2 < 20% (and both no logging history)	21,894	61,034
Total Non-Forest		181,661	

In Table 7 logging history is defined as follows:

- Depletion (and not a reserve). Data provided by Forsite Consultants as part of the Bulkley Higher Level Plan Order 2016 Analysis, or;
- VRI harvest date is not null, or;
- VRI Opening Indicator = “Y”, or;
- VRI Opening ID > 0, or;
- VRI Non-Forest Descriptor = “NSR”

5.1.3 Existing Roads, Trails and Landings

Existing roads, trails and landings are removed from the CFLB. Large roads, such as highways, are classified in the forest cover inventory as non-forest polygons. Smaller roads, trails and landings not

shown in the inventory due to their small size and linear shape are also considered unproductive and netted out of the land base considered available for non-timber values and timber harvesting.

Existing roads and trails data were provided by the Skeena Stikine Natural Resource District. The provided dataset did not include right-of-way (ROW) classes. As per direction from the district, an older road dataset with ROW classes was conflated with the new road dataset. Where new roads did not receive a ROW class, they were assigned a class based on their road attributes or given a default width of 15 m.

Table 8 shows the existing road widths and the road areas, the assumed loss of growing area due to roads, trails and landings.

Table 8: Reductions for existing roads and trails

Road Width (m)	Road Length (km)	Road Area
10	73	71
15	3,653	5,380
20	1,276	2,505
30	574	1,691
40	247	969
Total	5,823	10,617

5.2 Timber Harvesting Land Base (THLB)

The timber harvesting land base (THLB) is the portion of the CFLB where timber harvesting can occur. It is productive forest land that is harvestable according to current forest practices and legislation. The THLB is derived by removing areas from the CFLB that cannot be harvested for various reasons as further detailed below.

5.2.1 Parks and Protected Areas

National, provincial and regional parks and protected areas within the TSA are not considered part of the THLB. The analysis will account for any contribution forested areas within parks and protected areas have in meeting biodiversity and wildlife values.

Parks and protected areas were defined based on two datasets: ownership and the Bulkley LRMP Higher-Level Plan. The removed areas, less the Special Management Zone 1, are shown in Table 9.

Table 9: Ownership codes for defining parks and protected areas

Ownership Code	Ownership Description	Area (ha)
60	Crown Ecological Reserve	1,375
62N	Crown Forest Management Unit (TSA)	781
63	Crown Provincial Park Class A	38,261
69N	Crown Miscellaneous Reserves	14,563
Total without SMZ		54,980

In addition to reductions by ownership, the Special Management Zone 1 (SMZ1) area from the Bulkley LRMP Higher-Level Plan Order (2000) is excluded from the THLB. The SMZ1 area is 66,339 ha, of which 10,387 ha overlaps with other park ownership codes.

The resulting gross reduction due to parks and protected areas is 110,931 ha.

5.2.2 Environmentally Sensitive Areas

Areas with sensitive soils, regeneration problems and avalanche areas were removed from the THLB (Table 10).

Table 10: Environmentally sensitive areas

Environmentally Sensitive Areas	Gross Area (ha)
Regeneration Issues	13,513
Avalanche Areas	4,657
Sensitive Soils	61,438

Table 11 provides a breakdown of sensitive soils.

Table 11: Breakdown of sensitive soils

Sensitive Soils Type	Gross Sensitive Soil Area Accounting for Overlaps (ha)	Reduction %	Gross Sensitive Soil Reduction Accounting for Overlaps (ha)
Telkwa Bulbous Toe	211	100%	211
Highly Unstable Soils	18,223	94%	17,130
Moderately Unstable Soils	21,922	89%	19,511
Unstable Soils, no TSM data	20,926	97%	20,298
Alluvial Fans	10,720	40%	4,288
Total	**72,002**		**61,438**

Sensitive Soils definition makes use of four different input datasets.

- Telkwa Bulbous Toe is a location in ownership data with unstable soils that are not captured in terrain stability mapping.
- Terrain stability mapping (TSM), where it exists, was used to define highly unstable and moderately unstable soils.
- Soil Erosion Potential was used to fill in areas where no TSM data existed
- Fans were mapped in a separate dataset.

Terrain Stability data takes precedence over Soil Erosion Potential proxy data in cases of overlaps. TSM or Erosion data takes precedence over fans (since the former has higher reductions).

Unstable soils and alluvial fans had an exception for past logging. Logged area were not considered unstable. The gross area of unstable and alluvial fans with past logging was 7,856 ha; no reduction percent was applied to this area.

5.2.3 Visual Quality Objective Preservation

Visually Sensitive Areas with a Visual Quality Objective (VQO) of Preservation were removed from the THLB. The Preservation areas comprised 3,753 ha gross land base.

Separate forest cover targets for Retention, Partial Retention and Modification VQO's are described in section 6.5.2.

5.2.4 Recreation

Recreation reserves, recreation sites, and UREPs (Sect 15, 16 and 17 where tenure sub-purpose is UREP/RECREATION RESERVE) were combined into a single dataset by the Bulkley Natural Resource District. Each recreation area was assigned a percent inclusion in the THLB by the District staff. In cases where multiple recreation locations overlap, the most restrictive recreation value was used. Reductions to the land base for recreation areas are shown in Table 12.

Table 12: THLB reductions for recreation

Recreation THLB Inclusion (%)	Gross Area (ha)	Gross Area Reduction from THLB (ha)
0	74	74
25	2,082	1,561
50	817	409
75	5,936	1,484
100	9,009	0
Total	**17,919**	**3,528**

5.2.5 Inoperable Stands

Stands are considered inoperable when there are physical or economic barriers to harvesting. Inoperable stands were defined based on harvest method mapping, stand quality classification and biogeoclimatic subzone.

Inoperable ("I") harvest method stands were removed from the THLB as physically inoperable. Marginal Sawlog ("M") and Pulp ("P") stand quality stands that were in cable or helicopter harvest method areas were removed from the THLB as economically inoperable, due to the low value timber and high cost access methods.

High elevation woodland biogeoclimatic subzones were removed from the THLB, due to local climate and soil moisture levels being considered too harsh to permit successful reforestation. The woodland subzones were mapped in the PEM Woodland data and consist of the "ESSFmcw", "ESSFmkw", "ESSFwvw", or "MHmm2w" biogeoclimatic subzones.

Reductions to the THLB for inoperable stands are summarized in Table 13.

Table 13: Inoperable stands

Inoperable Class	Inoperable Definition	Gross Inoperable Area Accounting for Overlaps (ha)	Total Inoperable Area with Overlaps (ha)
Woodlands BECs	WDLND_SUBZ = "YES"	65,485	65,485
Physically Inoperable	Harvest Method = "I"	9,753	10,740
Economically Inoperable	Harvest Method = "C" or "H" and Stand Quality = "M" or "P"	32,415	39,916
Total		**107,653**	

5.2.6 Low Site

Stands with low productivity will not meet the minimum harvest criteria and are removed from the timber harvesting land base (Table 14). These sites have a low site index (< 5.0 m) or are sparse and not fully occupied by commercial tree species. An exception is made for stands with a history of logging.

Additionally, natural stands (>= 47 years old in 2016) with yield curves that never meet minimum harvest volumes were also removed from the THLB. The volume used to assess if the MHV was met was the volume at age 140 if the stand was <= 140 years old, or the current inventory if the stand was > 140 years old. No exception was made for past logging history for low volume stands.

Table 14: Low site

Low Site Class	Low Site Definition	Gross Low Site Area Accounting for Overlaps (ha)	Total Low Site Area with Overlaps (ha)
Low Site	Site Index < 5 m and no logging history	59,729	59,729
Sparse	BCLCS level 4 = "TC" or "TM" and BCLCS level 5 = "SP" and no logging history	29,329	43,947
Low Volume	Age >= 47 and Assessed Volume < 150 m^3/ha	111,941	191,481
Total		**200,998**	

5.2.7 Problem Forests

Problem forests are those that are physically operable and meet low site and volume criteria but are not currently utilized. Problem forest types are deciduous or black spruce leading stands or those that have a low stand quality (Table 15). Stands with a history of logging were exempt from removal from the THLB. 7,686 ha of mostly deciduous stands are exempt from the problem forest definition due to past logging.

Table 15: Problem forest types

Problem Forest Class	Problem Forest Definition	Gross Problem Forest Area Accounting for Overlaps (ha)	Total Problem Forest Area with Overlaps (ha)
Deciduous leading	Leading Species = "AC" or "AT" or "EP" and no logging history	46,134	46,134
Black Spruce leading	Leading Species = "SB" and no logging history	7,941	7,941
Stand Quality Problem	Stand Quality = "PFT_D" or "PFT_L" or "PFT_NF" and no logging history	94,199	146,620
Total		**148,274**	

5.2.8 Marginal Operable

Marginal operable stands were stands that are deemed uneconomic due a combination of their quality and accessibility. All pulp-quality stands were deemed to be marginally operable and removed from the THLB. Marginal sawlog stands that had a cycle time greater than five hours were also removed, with the exception of stands located in the planning cell C7. Finally, marginal sawlog areas that had a cycle time less than 5 hours but were more than 1km from a road were also removed from the THLB. The removal of marginal operable stands is displayed in Table 16.

Table 16: Marginal Operable

Marginal Operable	Marginal Operable Definition	Gross Area (ha)
Pulp Stands	Stand Quality = "P"	30,101
Marginal Sawlogs with cycle time longer than 5 hrs.	Stand Quality = "M" and Cycle Time > 150 (one way cycle time in minutes)	37,028
Marginal Sawlogs with cycle time less than 5 hrs and more than 1km from a road.	Stand Quality = "M" and Cycle Time <= 150 and Accessible = "remote"	41,112
Total		**108,241**

5.2.9 Caribou Wildlife Habitat Area

The Northern Caribou wildlife habitat area (WHA) #6-333 is located in the south of the TSA and has a No Harvest Zone and a Conditional Harvest Zone. The No Harvest Zone is removed from the THLB and covers 50,379 ha gross area.

5.2.10 Northern Goshawk Nests

Areas within a 100-ha buffer of Northern Goshawk (NOGO) nests were removed from the THLB. There were 9 nest sites, located in five clusters (breeding areas). 565 ha of gross area was removed from the THLB.

5.2.11 Research Plots and Permanent Sample Plots

Research installations and permanent sample plots (PSPs) were removed from the THLB. There were 167 ha gross area of PSPs and 614 ha gross area of research installations, for a combined 780 ha gross removal from the land base.

5.2.12 Red and Blue Listed Ecosystems

The Bulkley TSA has objectives set by government to manage for red and blue-listed ecological communities. Identified red and blue-listed ecosystems were removed from the THLB within the Core Ecosystem and Copper River SMZ2 as described in Table 17.

Table 17: Red and blue listed ecosystems in specific, geographically defined areas

Sensitive Ecosystems	Gross Area (ha)	Reduction (%)	Gross Area Reduction from THLB (ha)
Red-Listed Communities in Core Ecosystems and in Copper River SMZ2	971	100	971
Blue-Listed Communities in Core Ecosystems	568	100	568
Blue-Listed Communities in the Copper River SMZ2	314	70	220
Total	1,853		1,759

Table 18 lists the identified ecosystem communities that were removed from the THLB. Non-identified red and blue-listed ecosystems were omitted. The following identified ecosystems were listed in TSR, but do not exist within the Core Ecosystems or Copper River SMZ2: CWHws2/10, and three miscellaneous noteworthy communities (sensitive ecosystem Class/R_E_CODE: NF/0, NF/29, W/31).

Table 18: Red and blue listed ecological communities

Description	Red or Blue	PEM Attributes		Sensitive Ecosystem Attributes	
		BEC Label	BEC Site Series	Class	R_E_CODE
CWHws2/02	Red	CWHws2	02		
CWHws2/07	Blue			FP	22
CWHws2/08	Blue			FP	9
ESSFmk/02	Blue	ESSFmk	02		
ICHmc1/02	Blue	ICHmc1	02		
ICHmc1/06	Blue	ICHmc1	06		
ICHmc2/02	Blue	ICHmc2	02		
ICHmc2/07	Blue	ICHmc2	07		
ICHmc2/08	Blue	ICHmc2	08		
SBSdk/07	Red	SBSdk	07		
SBSdk/08	Red	SBSdk	08		

Description	Red or Blue	PEM Attributes		Sensitive Ecosystem Attributes	
		BEC Label	BEC Site Series	Class	R_E_CODE
SBSdk/81	Red			NF	21
SBSdk/82	Red			NF	6
Misc. noteworthy	Blue			NF	18
Misc. noteworthy	Blue			M	0

5.2.13 Riparian

Streams, lakes, and wetlands areas were managed with buffer zones along the streams and around wetlands and lakes. The buffer zones were separated into riparian reserve zones and riparian management zones. Table 19 describes the average reserve and management zone width. All of the reserve zone area and a portion of the management zone were removed from the THLB. The management zone reduction varied between the BCTS and PIR and CanFor operating areas. The increased management zone reduction in the Reiseter SMZ2 reflects PIR's commitment to use a 20 m RRZ around S4, S5, and S6 streams, which was not reflected in the spatial riparian data.

Table 19: Riparian management areas

Description	Riparian Class	Reserve Zone Width (m)	Management Zone Width (m)	RMZ Reduction by Operating Area (%)		Gross Riparian Area (ha)
				BCTS	PIR and CanFor	
Streams	S1	50	20	20	25	5,090
	S2	30	20	20	25	688
	S3	20	20	20	25	21,467
	S4/S5	0	30	10	5 or 70 in Reiseter SMZ2	3,113
	S6	0	20	0	5 or 100 in Reiseter SMZ2	45
Wetlands	W1/W5	10	40	10	25	3,260
	W3/W4	0	30	10	5	335
Lakes	L1	10	30	10	25	393
	L3/L4	0	30	10	5	40
Total						**34,431**

5.2.14 Recreation Trails

Recreation trails were buffered by 50 m (100 m total width) and removed from the THLB. The gross area is 6,864 ha.

5.2.15 Wildlife Tree Retention Areas

The Bulkley LRMP Objectives Set by Government provides targets for wildlife tree retention by landscape unit and BEC subzone (Table 20). These targets are removed aspatially from the THLB area of each resultant polygon.

Table 20: In block reductions for wildlife tree retention

Landscape Unit	BEC Variant								
	CWHws2	ESSFmc	ESSFmk	ESSFwv	ICHmc1	ICHmc2	MHmm2	SBSdk	SBSmc2
Babine		3%							7%[1]
Blunt		3%							7%
Bulkley		5%			3%	5%		5%	7%
Chapman		5%							11%
Copper	5%	1%		3%			1%		5%
Corya				1%	3%	5%			
Deep Creek		1%						1%	3%
Harold Price		3%		1%	1%	1%			7%
Kitseguecla				1%	7%	3%			
Nilkitkwa		1%							5%
Reiseter		1%			7%	5%		3%	5%
Telkwa	3%	3%	1%	1%				3%	7%
Torkelson		3%							7%
Trout Creek				1%	7%	3%		1%	

There were some Landscape Unit and BEC subzone combinations that had THLB area and lacked an entry in the LRMP WTRA targets. Though the areas of these individual units were small, they added up to 10,455 ha of THLB (prior to WTRA reductions). These areas were assigned WTRA reduction targets from neighbouring units as described in Table 21.

Table 21: In block reductions for wildlife tree retention for LU/BEC combinations not identified in the LRMP

Landscape Unit	BEC Variant	WTRA (%)	Comment
Babine	BAFA, ESSFmcp, ESSFmcw, ESSFmvp	3	assign ESSFmc target
Blunt	BAFA, ESSFmcp, ESSFmcw, ESSFwv	3	assign ESSFmc target
Blunt	ICHmc1	7	using Reiseter LU ICHmc1 target
Bulkley	BAFA, ESSFmcp, ESSFmcw, ESSFwv, ESSFwvp, ESSFwvw	5	assign ESSFmc target
Chapman	BAFA, ESSFmcp, ESSFmcw	5	assign ESSFmc target
Copper	BAFA	3	majority of BAFA located above ESSFwv
Copper	ESSFwvp, ESSFwvw	3	assign ESSFwv target
Copper	CMA, MHmmp	1	using MH targets
Copper	ESSFmcp, ESSFmcw	1	using ESSFmc targets
Copper	ICHmc1	7	default for areas with no LRMP target
Corya	BAFA, ESSFwvp, ESSFwvw	1	assign ESSFwv target
Deep Creek	ESSFmcp, ESSFmcw	1	assign ESSFmc target

[1] SBSmc2 within the Babine SMZ2 and PIR FDU received a WTP reduction of 34%

Landscape Unit	BEC Variant	WTRA (%)	Comment
Harold Price	BAFA	1	majority of BAFA located abouve ESSFwv
Harold Price	ESSFmcp, ESSFmcw	3	assign ESSFmc target
Harold Price	ESSFwvp, ESSFwvw	1	assign ESSFwv target
Kitseguecla	BAFA, ESSFwvp, ESSFwvw	1	assign ESSFwv target
Nilkitkwa	BAFA, ESSFmcp, ESSFmcw	1	assign ESSFmc target
Reiseter	ESSFmcp, ESSFmcw	1	assign ESSFmc target
Reiseter	ESSFwv, ESSFwvp, ESSFwvw	1	located between Harold Price and Corya LUs
Telkwa	BAFA	1	BAFA mostly located above ESSFmk
Telkwa	ESSFmcp, ESSFmcw	3	assign ESSFmc target
Telkwa	ESSFmkp, ESSFmkw	1	assign ESSFmk target
Telkwa	ESSFwvp, ESSFwvw	1	assign ESSFwv target
Telkwa	ICHmc1	7	default for areas with no LRMP target
Torkelson	BAFA	3	BAFA mostly located above ESSFwv
Torkelson	ESSFmcp, ESSFmcw	3	assign ESSFmc target
Torkelson	ESSFwv, ESSFwvw	1	using Harold Price LU ESSFwv target
Trout Creek	BAFA, ESSFwvp, ESSFwvw	1	assigned ESSFwv target
Trout Creek	ESSFmcp	1	assign Copper LU ESSFmc target

WTRA reductions were allowed to overlap with other aspatial reductions (ESA_Soil, Recreation, Blue listed, Riparian, Trails) that may occur inside the same resultant polygon. Existing aspatial reductions (if they existed) within a polygon were utilized to meet the WTRA requirements. In cases where the WTRA target was greater than the existing aspatial reductions, a WTRA reduction was added to bring the non-THLB area within a polygon up to the WTRA target. For example, if the WTRA target was 11%, and 8% of the resultant polygon was already removed from the THLB under riparian, the WTRA reduction for that polygon would be 3% (11% - 8%).

Pacific Inland Resources (PIR) uses an enhanced retention level in their operations within the distinct portions of the Babine Special Management Zone (SMZ2). The WTRA retention in this area is set at 34%.

WTRA reductions removed 11,200 ha from the THLB.

5.2.16 Future Roads

There were two sources of future road reductions: spatial proposed road buffers, and aspatial reductions to mature areas of the THLB.

Spatial proposed roads were buffered by their designated road width (Table 22) and the area was removed from the THLB after the first harvest pass.

Table 22: Proposed Roads

Right-of-Ways Width (m)	Road length (km)
10	5.5
15	595.7

A 3.9% aspatial area reduction was applied to areas of natural stands (age in 2016 >= 47). A total of 7,129 ha was removed from the THLB after the first logging pass.

6 Management Assumptions

This section provides details on how non-timber resource values are integrated with timber objectives in modeling and what assumptions are used for forest management.

6.1 Age 2016 Calculation Assumptions

The VRI age was updated with harvest data from depletion and VRI sources. The update process was:

1. Age 2016 set to VRI age
2. Age 2016 updated for past harvest depletions. Age 2016 set to depletion dataset age.
3. Null Age2016 updated to age based on VRI harvest date (if available)
4. Remaining null age set to zero, if stand part of the CFLB

6.2 Harvesting

6.2.1 Utilization Assumptions

The utilization level defines the minimum top diameter inside bark (DIB) and minimum diameter at breast height (DBH) of stems that must be removed from harvested areas. It also specifies the maximum height of stumps that may be left. These factors are used to determine the merchantable stand volume in the analysis.

The utilization levels used in this analysis are shown in Table 23.

Table 23: Utilization levels used in the analysis

Leading species	Utilization			
	Minimum Stump Diameter(cm)	Minimum DBH (cm)	Maximum stump height (cm)	Minimum top DIB (cm)
All Pine	12.5	12.5	30	10
All other	17.5	17.5	30	10

6.2.2 Minimum Harvest Criteria

Minimum harvest criteria define the earliest age, volume per ha or other criterion such as DBH at which stands become eligible for harvest within the timber supply model. Minimum harvest criteria can have a profound effect on modeled harvest levels by creating acute timber supply shortages, or “pinch points”, that constrain the rest of the planning horizon.

The minimum harvestable criteria for this analysis are shown in Table 24.

Table 24: Minimum Harvest Criteria

Leading species	HMM Stand Quality	Minimum Harvest Criteria		
		Height (m)	Diameter (cm)	Volume (m^3/ha)
All	Pulp	21	21	150
All Pine	Sawlog, Marginal	18	18	150
All Non-Pine	Sawlog, Marginal		25	150

6.2.3 Harvest Scheduling

Simulation models are rule-driven and require harvest scheduling rules to control the order in which stands are harvested. It is important that these rules organize the harvest in a way that realizes the productive potential of the land base in a reasonable manner to understand the impacts of the timber supply assumptions and constraints.

The "relative oldest first" rule is a commonly used harvest rule that will be used in the ISS Base Case. In this rule, the age of a stand is related to its minimum harvestable age. Stands that have the greatest proportional difference between their actual age and their minimum harvest age are given priority for harvest, subject to forest cover requirements.

6.2.4 Harvest Priority

Harvest priority can be used to override the harvest rule. It can be used in modelling to reflect situations when it is known that some areas will be targeted for harvesting. Such targeting may be required to address issues such as forest health, for example. Forsite Consultants provided data for this project that was compiled as part of the Bulkley Higher Level Plan Order 2016 Analysis. The data included proposed harvest blocks for approximately 7 years. These blocks were incorporated into the analysis by forcing the timber supply model to harvest them during the first 10 years.

6.2.5 Silviculture and Harvesting Systems

Clear cut with reserves is the most common silvicultural system in the Bulkley TSA. Retention levels vary throughout the TSA and are highest in Babine SMZ2 within PIR Forest Development Unit. Trees are retained to meet riparian or wildlife habitat objectives or higher-level plan objectives. Wildlife tree retention is described under section 5.2.15.

6.3 Growth and Yield

Growth and yield assumptions define the net volumes that are realized when natural and managed stands are harvested. They also describe various tree and stand attributes over time (i.e., volume, height, diameter, presence of dead trees, etc.).

6.3.1 Analysis Units

An analysis unit is a grouping of similar forest areas with the objective of simplifying the analysis and the interpretation of analysis results.

6.3.1.1 Natural Stands

Stands established up to 1970 are considered natural stands in this analysis. Their growth and yield will be modeled using the Variable Density Yield Prediction (VDYP7) yield model. Inventory site index estimates are the most appropriate for modelling these stands.

The natural stand yield curves were not aggregated. Rather, the analysis file contains one natural stand yield curve for each forest cover polygon; there are 37,530 natural stand yield curves in total.

6.3.1.2 Managed Stands

Stands established after 1970 are considered managed stands in this analysis. Their growth and yield will be modeled using the Tree and Stand Simulator (TASS). Provincial site productivity layer estimates of site index are the best estimates of site productivity for modelling managed stands.

Based on differences in silvicultural regimes over time, managed stands were classified in three categories: old plantations, contemporary plantations and future stands. Old plantations were established between 1971 and 1996; these are currently between 21 and 46 years old. Contemporary plantations were established between 1997 and 2017 (currently 0 to 20 years old).

Analysis units for managed stands are based on ecology, using the existing Predictive Ecosystem Mapping (PEM) data, to BEC variant and site group level. Some old era units were further refined based on leading species using RESULTS data and professional experience. Table 25 presents the analysis units used in this analysis for old plantations. Analysis units for contemporary and future plantations are shown in Table 26 and Table 27, respectively.

Table 25: Analysis units, old plantations

Analysis Unit	BEC Variant	Site Group	Leading Species	Forest Health
1	CWHws2	ws2-all	All	
2	ESSFmc	mc-dry-fresh	Pl	
3	ESSFmc	mc-dry-fresh	Sx	
4	ESSFmc	mc-dry-fresh	Bl	
5	ESSF/MH	ESSF-MH-moist-wet	Pl	
6	ESSF/MH	ESSF-MH-moist-wet	Sx	
7	ESSF/MH	ESSF-MH-moist-wet	Bl	
8	ESSF	wv-dry-fresh	All	
9	ICHmc1	mc1-all	Pl	Dothistroma
10	ICHmc1	mc1-all	Sx	
11	ICHmc1	mc1-all	Bl	
12	ICHmc2	mc2-all	Pl	Dothistroma
13	ICHmc2	mc2-all	Sx	
14	ICHmc2	mc2-all	Decid	
15	SBSdk	dk-all	Pl	
16	SBSdk	dk-all	Sx	
17	SBSdk	dk-all	Decid	
18	SBSmc2	mc2-dry-fresh	Pl	
19	SBSmc2	mc2-dry-fresh	Sx	
20	SBSmc2	mc2-dry-fresh	Bl	
21	SBSmc2	mc2-moist-wet	Pl	
22	SBSmc2	mc2-moist-wet	Sx	
23	SBSmc2	mc2-moist-wet	Bl	

Table 26: Analysis units, contemporary plantations

Analysis Unit	BEC Variant	Site Group	Forest Health
100	CWHws2	ws2-all	
101	ESSFmc	mc-dry-fresh	
102	ESSFmc	mc-moist	
103	ESSFmc	mc-wet	
104	ESSFwv	wv-dry-fresh	
105	ESSFwv	wv-moist-wet	
106	ICHmc1	mc1-all	Dothistroma
107	ICHmc2	mc2-all	Dothistroma
108	MHmm2	mm2-all	
109	SBSdk	dk-all	
110	SBSmc2	mc2-dry-fresh	
111	SBSmc2	mc2-moist-wet	

Table 27: Analysis units, future plantations

Analysis Unit	BEC Variant	Site Group	Forest Health
200	CWHws2	ws2-dry-fresh	
201	CWHws2	ws2-moist-very moist-wet	
202	ESSFmc	mc-dry-fresh	
203	ESSFmc	mc-moist	
204	ESSFmc	mc-wet	
205	ESSFmk	mk-all	
206	ESSFwv	wv-dry-fresh	
207	ESSFwv	wv-moist-wet	
208	ICHmc1	mc1-all	Dothistroma
209	ICHmc2	mc2-all	Dothistroma
210	MHmm	mm2-all	
211	SBSdk	dk-all	
212	SBSmc2	mc2-dry-fresh	
213	SBSmc2	mc2-moist-wet	

6.3.1.2.1 Operational Adjustment Factors in Managed Stand Yields

The yield tables generated by TASS are based on the data observed and collected in research plots established by FLNRO and industry. Historically, this research has been carried out in fully stocked, even-aged stands with no significant incidences of pests and diseases.

Operational adjustment factors (OAF) are usually applied to yields to reflect average operational growing conditions.

OAF 1 allows for yield reductions associated with non-productive areas in the stand, uneven spacing of crop trees (clumping), and endemic and random loss. The standard OAF1 of 15% is considered a province-wide approximation of the difference between research plots and actual yields, and is composed of the following estimates:

- Espacement 4%
- Non-productive 4%
- Random risk 3%
- Endemic losses 4%

The standard OAF 1 of 15% will be applied to all yield curves generated by TASS.

OAF 2 allows for increasing volume losses towards maturity, attributable to decay, waste and breakage, disease and pest factors. The standard OAF2 of 5% is also a province-wide approximation of the difference between research plot yields and actual yields. As this difference increases with age, the impact of OAF 2 also accelerates with age.

6.4 Silviculture

6.4.1 Regeneration Activities in Managed Stands

Regeneration assumptions for managed stands (established after 1970) were developed by the silviculture working group using available RESULTS data and professional opinion. Table 28, Table 29,

and Table 30 summarize the assumptions for old, contemporary and future managed stands respectively.

Genetic gain is incorporated into yield estimates for contemporary and future plantations based on RESULTS data (Section 6.4.3).

The silviculture working group reviewed the most recent forest health reports and noted concerns for hard stem rusts in young lodgepole pine stands and past *Dothistroma* infestations in young lodgepole pine stands. The working group concluded that, due to past rehabilitation efforts in response to *Dothistroma* and to the predominance of mixed species reforestation in rust-prone areas over the last 30 years, the modelling should stay consistent with the most recent TSR OAF assumptions (e.g. OAF2 of 15%).

Table 28: Regeneration assumptions for existing old plantations

AU	Description	SI Species	SI	Method	Initial Density	Species Composition	Regen Delay (years)	OAF 1	OAF 2	Ingress Species Composition	Ingress Period (years)	Ingress Density (Total)	Distribution
1	CWHws2-All	Sx	20.9	P	1020	Sx87Pl13	1	15%	5%	Ba38Pl24Hw19Sx19	10	2600	Clumpy
2	ESSFmc-Dry-Fresh	Pl	17.1	P	1350	Pl85Sx15	1	15%	5%	Pl80Sx15Bl5	10	1000	Clumpy
3	ESSFmc-Dry-Fresh	Sx	15.5	P	1350	Sx86Pl14	1	15%	5%	Sx65Bl17Pl12At7	10	1000	Clumpy
4	ESSFmc-Dry-Fresh	Sx	15.1	P	500	Sx70Pl30	1	15%	5%	Bl100	10	1000	Clumpy
5	ESSF-MH-Moist-Wet	Pl	17.2	P	1300	Pl85Sx15	1	15%	5%	Pl80Sx15Bl5	10	1000	Clumpy
6	ESSF-MH-Moist-Wet	Sx	16.1	P	1300	Sx85Pl15	1	15%	5%	Sx66Bl23Pl11	10	1000	Clumpy
7	ESSF-MH-Moist-Wet	Sx	15.4	P	500	Sx70Pl30	1	15%	5%	Bl100	10	1000	Clumpy
8	ESSFwv-Dry-Fresh	Sx	13.2	P	1065	Sx68Pl32	1	15%	5%	Pl32Sx27At21Bl20	10	2035	Clumpy
9	ICHmc1-All	Pl	21.0	P	1150	Pl79Sx21	1	15%	5%	Sx64Bl20Hw8At8	10	2000	Clumpy
10	ICHmc1-All	Sx	23.3	P	1150	Sx84Pl16	1	15%	5%	Pl32Sx31Bl30At8	10	2000	Clumpy
11	ICHmc1-All	Sx	23.2	P	700	Sx91Pl9	1	15%	5%	Bl51Hw34At11Pl5	10	2000	Clumpy
12	ICHmc2-All	Pl	21.0	P	1150	Pl73Sx27	1	15%	5%	Pl54Sx20At19Bl8	10	2100	Clumpy
13	ICHmc2-All	Sx	22.2	P	1150	Sx90Pl10	1	15%	5%	Sx70At15Pl7Bl8	10	2100	Clumpy
14	ICHmc2-All	Sx	22.4	P	550	Sx60Pl40	1	15%	5%	At70Bl21Hw9	10	2100	Clumpy
15	SBSdk-All	Pl	20.3	P	1050	Pl86Sx14	1	15%	5%	Pl71At18Sx11		2650	Clumpy
16	SBSdk-All	Sx	19.3	P	1050	Sx80Pl20	1	15%	5%	Sx55At25Pl14Bl5		2650	Clumpy
17	SBSdk-All	Sx	19.3	P	1050	Sx65Pl35	1	15%	5%	At89Sx5Pl3Bl3		2650	Clumpy
18	SBSmc2-Dry-Fresh	Pl	18.8	P	1230	Pl82Sx18	1	15%	5%	Pl65Sx14At13Bl8		1400	Clumpy
19	SBSmc2-Dry-Fresh	Sx	19.4	P	1315	Sx69Pl17Bl14	1	15%	5%	Sx65Pl17At18		1315	Clumpy
20	SBSmc2-Dry-Fresh	Sx	19.2	P	880	Sx57Pl43	1	15%	5%	Bl71At29		1400	Clumpy
21	SBSmc2-Moist-Wet	Pl	18.9	P	1230	Pl77Sx23	1	15%	5%	Pl60Sx18At13Bl9		1400	Clumpy
22	SBSmc2-Moist-Wet	Sx	19.1	P	1360	Sx68Pl13Bl19	1	15%	5%	Bl0Sx72Pl13At15		1270	Clumpy
23	SBSmc2-Moist-Wet	Sx	18.6	P	900	Sx87Pl13	1	15%	5%	Ba38Pl24Hw19Sx19		1400	Clumpy

Table 29: Regeneration assumptions for existing contemporary plantations

AU	Description	SI Species	SI	Method	Initial Density	Species Composition	Regen Delay (years)	OAF 1	OAF 2	Ingress Species Composition	Ingress Period (years)	Ingress Density (Total)	Distribution
100	CWHws2-All	Sx	21.1	P	1150	Sx44Pl35Ba21	1	15%	5%	Sx36Ba48Pl16	10	3290	Clumpy
101	ESSFmc-Dry-Fresh	Sx	15.3	P	1300	Sx52Bl27Pl21	1	15%	5%	Pl42Bl38Sx20	10	1800	Clumpy
102	ESSFmc-Moist	Sx	16.2	P	1300	Sx52Bl27Pl21	1	15%	5%	Pl42Bl38Sx20	10	1800	Clumpy
103	ESSFmc-Wet	Sx	14.4	P	1100	Sx57Bl32Pl11	1	15%	5%	Bl50Sx5000	10	1800	Clumpy
104	ESSFwv-Dry-Fresh	Sx	13.3	P	1275	Sx62Pl21Bl17	1	15%	5%	Pl41Sx33At26	10	1500	Clumpy
105	ESSFwv-Moist-Wet	Sx	13.9	P	1250	Sx59Pl21Bl20	1	15%	5%	Sx59Pl24Hw17	10	1500	Clumpy
106	ICHmc1-All	Sx	23.1	P	1020	Sx65Pl35	1	15%	5%	Sx34Pl18Ba43At5	10	2380	Clumpy
107	ICHmc2-All	Sx	22.0	P	1055	Sx73Pl27	1	15%	5%	Pl34Sx26At21Bl18	10	2545	Clumpy
108	MHmm2-All	Sx	23.7	P	900	Sx50Pl50	1	15%	5%	Ba45Hw22Sx16Pl16	10	7600	Clumpy
109	SBSdk-All	Sx	18.5	P	1280	Sx65Pl35	1	15%	5%	Pl66At33Bl2	10	2300	Clumpy
110	SBSmc2-Dry-Fresh	Sx	19.3	P	1225	Sx51Pl49	1	15%	5%	Pl46Sx23Bl23At8	10	2275	Clumpy
111	SBSmc2-Moist-Wet	Sx	19.1	P	1225	Sx51Pl49	1	15%	5%	Sx34Bl38Pl25At3	10	2275	Clumpy

Table 30: Regeneration assumptions for future plantations

AU	Description	SI Species	SI	Method	Initial Density	Species Composition	Regen Delay (years)	OAF 1	OAF 2	Ingress Species Composition	Ingress Period (years)	Ingress Density (Total)	Distribution
200	CWHws2-Dry-Fresh	Sx	21.1	P	1200	Sx61Bl20Pl19	1	15%	5%	Ba49Sx29Pl22	10	3200	Clumpy
201	CWHws2-Moist-Vmoist-Wet	Sx	22.8	P	1200	Sx61Bl20Pl19	1	15%	5%	Ba47Pl27Sx26	10	3400	Clumpy
202	ESSFmc-Dry-Fresh	Sx	15.0	P	1250	Sx62Bl29Pl9	1	15%	5%	Pl48Bl44Sx8	10	1800	Clumpy
203	ESSFmc-Moist	Sx	16.4	P	1250	Sx62Bl29Pl9	1	15%	5%	Bl40Pl31Sx29	10	1500	Clumpy
204	ESSFmc-Wet	Sx	14.6	P	1000	Sx62Bl29Pl9	1	15%	5%	Bl57Sx36Pl7	10	1800	Clumpy
205	ESSFmk-All	Sx	13.1	P	1250	Sx70Bl30	1	15%	5%	Bl64Hm34Sx2	10	1800	Clumpy
206	ESSFwv-Dry-Fresh	Sx	13.0	P	1400	Sx58Pl21Bl21	1	15%	5%	Pl41At26Sx33	10	1500	Clumpy
207	ESSFwv-Moist-Wet	Sx	13.7	P	1350	Sx58Bl21Pl21	1	15%	5%	Sx60Pl21Hw19	10	1500	Clumpy
208	ICHmc1-All	Sx	23.2	P	960	Sx84Pl16	1	15%	5%	Sx37Pl30Bl26At7	10	2490	Clumpy
209	ICHmc2-All	Sx	22.3	P	1250	Sx65Bl23Pl12	1	15%	5%	Pl46Sx29At25	10	2220	Clumpy
210	MHmm2-All	Sx	21.6	P	900	Sx50Pl50	1	15%	5%	Ba45Hw22Sx16Pl16	10	7600	Clumpy
211	SBSdk-All	Sx	18.9	P	1400	Sx87Pl13	1	15%	5%	Pl65At34Bl1	10	2300	Clumpy
212	SBSmc2-Dry-Fresh	Sx	19.3	P	1225	Sx51Pl49	1	15%	5%	Pl46Sx23Bl23At8	10	2275	Clumpy
213	SBSmc2-Moist-Wet	Sx	18.9	P	1225	Sx51Pl49	1	15%	5%	Sx34Bl38Pl25At3	10	2275	Clumpy

6.4.2 Not satisfactorily restocked (NSR) areas

In this analysis all not satisfactorily restocked (NSR) is considered current. It is assumed to regenerate within the regeneration delay detailed under Section 6.4.1 above.

6.4.3 Genetic Gain

Where available, class A seed from seed orchards is used for regeneration due to its advanced volume production. The weighted average genetic gain for each species and BEC variant is presented in Table 31 and Table 32. The future stand estimates are based on the weighted averages of the most recent 3 years of planting.

Table 31: Genetic gain; contemporary plantations

BEC Variant	Species	Weighted Average Genetic Gain (%)
CWHws2	Sx	3.5
CWHws2	Pli	0.5
ESSFmc-Dry-Fresh	Sx	5.0
ESSFmc-Dry-Fresh	Pli	3.0
ESSFmc-Moist	Sx	5.0
ESSFmc-Moist	Pli	3.0
ESSFmc-Wet	Sx	5.0
ESSFwv-Dry-Fresh	Sx	5.0
ESSFwv-Dry-Fresh	Pli	2.0
ESSFwv-Moist-Wet	Sx	5.0
ESSFwv-Moist-Wet	Pli	2.0
ICHmc1	Sx	6.0
ICHmc1	Pli	3.0
ICHmc2	Sx	6.0
ICHmc2	Pli	3.0
SBSmc2-Dry-Fresh	Sx	13.0
SBSmc2-Dry-Fresh	Pli	4.0
SBSmc2-Moist-Wet	Sx	13.0
SBSmc2- Moist-Wet	Pli	4.0
SBSdk	Sx	15.2
SBSdk	Pli	0.4

Table 32: Genetic gain; future plantations

BEC Variant	Species	Weighted Average Genetic Gain (%)
CWHws2-Dry-Fresh	Sx	16.0
CWHws2-Dry-Fresh	Pli	14.0
CWHws2-Moist-Wet	Sx	16.0
CWHws2-Moist-Wet	Pli	14.0
ESSFmc-Dry-Fresh	Sx	16.0
ESSFmc-Dry-Fresh	Pli	14.0
ESSFmc-Moist	Sx	16.0
ESSFmc-Moist	Pli	14.0
ESSFmc-Wet	Sx	16.0
ESSFmc-Wet	Pli	14.0
ESSFmk	Sx	16.0
ESSFwv-Dry-Fresh	Sx	16.0
ESSFwv-Dry-Fresh	Pli	14.0
ESSFwv-Moist-Wet	Sx	16.0
ESSFwv-Moist-Wet	Pli	14.0
ICHmc1	Sx	16.0
ICHmc1	Pli	14.0
ICHmc2	Sx	16.0
ICHmc2	Pli	14.0
SBSmc2-Dry-Fresh	Sx	16.0
SBSmc2-Dry-Fresh	Pli	14.0
SBSmc2-Moist-Wet	Sx	16.0
SBSmc2- Moist-Wet	Pli	14.0
SBSdk	Sx	16.0
SBSdk	Pli	14.0

6.4.4 Juvenile Spacing and Fertilization

Based on the RESULTS data and local knowledge, it was determined that little juvenile spacing and fertilization had occurred in the TSA over the last 40 years or so. As a result, the silviculture working group decided against modeling these treatments in the analysis.

6.4.5 Industrial Recoverable Volume

Industrial recoverable volume estimates are based on the logs that are expected to be marketed, maximizing the financial benefit to the licensee (when operating on Crown land in BC). Industrial preferred log lengths for sawlogs are 6.2 m, 5.6 m, 5.0 m, 4.4 m, 3.8 m and 3.2 m. Preferred lengths for peelers are 5.4 m, 8.1 m and 10.7 m. Pulp sorts also include the log length of 5 m. Minimum top diameters inside bark (DIB) vary depending on the log size.

Government's net volume estimates are based on calculating appraisal stumpage rates and determining Annual Allowable Cuts (AAC), and use different top DIB, minimum log length and log length.

Industrial recoverable volumes were used for this project to compare the impacts of different silvicultural regimes on timber yield and value.

6.4.6 Industrial Sorts and Values

The average industrial selling prices used for this project are based on expert opinion. Sets of "Low" and "High" prices were used to differentiate values based on quality. High prices are surrogates for logs with better quality. Low prices are surrogates for "fast grown" trees with poor taper, low rate of growth (ROG) and big branches. In this analysis, average values will be used for all species with the exception of some pine stands, where low log prices will be used (see Section 8.2) in a learning scenario.

Industrial sorts and values are used in this project to compare the impacts of different silviculture regimes on timber value.

6.4.7 Bucking Simulation

Sort specifications and log values for this project for spruce, pine, balsam, hemlock and Douglas-fir are summarized in Table 33, Table 34, Table 35 and Table 36 (respectively).

Table 33: Spruce industrial log sorts and values

Sort	Min Top (cm)	Lengths (m)	Average Value	Low Value	High Value
Large S/L	30	3.2 to 6.2	$63.00	$50.00	$103.00
Peeler	23	5.4,8.1,10.7	$82.00	$50.00	$122.00
Med S/L	20	3.2 to 6.2	$60.00	$50.00	$90.00
Sml S/L	10	3.2 to 6.2	$57.00	$47.00	$85.00
Pulp	8	5	$29.00	$29.00	$29.00

Table 34: Pine industrial log sorts and values

Sort	Min Top (cm)	Lengths (m)	Average Value	Low Value	High Value
Large S/L	30	3.2 to 6.2	$60.00	$47.00	$100.00
Med S/L	20	3.2 to 6.2	$57.00	$47.00	$87.00
Sml S/L	10	3.2 to 6.2	$54.00	$44.00	$82.00
Pulp	8	5	$29.00	$29.00	$29.00

Table 35: Balsam industrial log sorts and values

Sort	Min Top (cm)	Lengths (m)	Average Value	Low Value	High Value
Large S/L	30	3.2 to 6.2	$57.00	$45.00	$87.00
Med S/L	20	3.2 to 6.2	$54.00	$45.00	$84.00
Sml S/L	10	3.2 to 6.2	$51.00	$42.00	$79.00
Pulp	8	5	$29.00	$29.00	$29.00

Table 36: Hemlock industrial log sorts and values

Sort	Min Top (cm)	Lengths (m)	Average Value	Low Value	High Value
Large S/L	30	3.2 to 6.2	$60.00	$45.00	$87.00
Med S/L	20	3.2 to 6.2	$57.00	$45.00	$84.00
Sml S/L	10	3.2 to 6.2	$54.00	$42.00	$79.00
Pulp	8	5	$35.00	$35.00	$35.00

Table 37: Douglas-fir industrial log sorts and values

Sort	Min Top (cm)	Lengths (m)	Average Value	Low Value	High Value
Large S/L	30	3.2 to 6.2	$80.00	$50.00	$113.00
Peeler	23	5.4,8.1,10.7	$82.00	$50.00	$122.00
Med S/L	20	3.2 to 6.2	$70.00	$50.00	$100.00
Sml S/L	10	3.2 to 6.2	$62.00	$47.00	$85.00
Pulp	8	5	$29.00	$29.00	$29.00

6.5 Integrated Resource Management

Modern natural resources management requires that multiple forest characteristics are retained across the landscape. These multiple characteristics are often referred to as forest cover objectives or requirements. It is important to identify how the THLB, and the productive forest that does not contribute to the THLB, are accounted for in the forest cover requirements. The most common way to express forest cover requirements is through maximum allowable disturbance or minimum area retention.

6.5.1 Landscape Green-up

As a surrogate for spatial cutblock adjacency constraint and patch size distribution, a landscape green-up constraint will be applied in the ISS base case, specifying that no more than 33% of the THLB area in each landscape unit outside of all habitat areas, special management zones, areas with VQOs, fish-sensitive watersheds, core ecosystems, and landscape corridors, may be under 3m tall.

6.5.2 Visual Resources

Visual quality objectives (VQO) are managed on the CFLB. Forest cover requirements for visual quality objectives are composed of two values:

- Visually Effective Green-up (VEG)—the stand height at which regeneration is perceived as a newly established forest, above which the stand is considered to have no visual impact; and
- Percent Planimetric Denudation—the maximum proportion of the productive area of a visual polygon that can be below the VEG height.

Preservation VQOs were removed from the THLB in the land base netdown.

6.5.2.1 Visually Effective Green-Up

Visually Effective Green-up (VEG) is calculated according to the *Procedures for Factoring Visual Resources into Timber Supply Analyses (*BC Ministry of Forests *et al*. 1998*)*. The procedures specify VEG tree heights for slope classes to account for the effect of slope on visual impact.

This analysis uses the area-weighted average of these slope classes to calculate VEG height for each visual quality polygon. A 1ha DEM was classified into slope classes and each raster cell was assigned a VEG height, based on the VEG heights shown in Table 38. The area-weighted average VEG height was calculated for each visual quality polygon. The average VEG height was the target height required for a stand to be greened-up.

Table 38: Visual Effective Green-up heights (m) and Plan to Perspective Ratio by slope class

Slope (%)	0-5	5.1-10	10.1-15	15.1-20	20.1-25	25.1-30	30.1-35	35.1-40	40.1-45	45.1-50	50.1-55	55.1-60	60.1-65	65.1-70	70+
P2P Ratios	4.68	4.23	3.77	3.41	3.04	2.75	2.45	2.22	1.98	1.79	1.6	1.45	1.29	1.17	1.04
VEG Height (m)	3.0	3.5	4.0	4.5	5.0	5.5	6.0	6.5	6.5	7.0	7.5	8.0	8.5	8.5	8.5

6.5.2.2 Percent Planimetric Denudation

The maximum allowable disturbance area for each visual quality polygon, by Visual Quality Objective (VQO), is given in Table 39. These targets are given in perspective view and need to be converted to planimetric view for modelling the visual quality objectives.

As with the VEG heights, a Plan to Perspective (P2P) ratio was assigned to each 1ha raster cell, based on slope class (Table 38). The average P2P ratio was summarized for each visual quality polygon. The final maximum allowable disturbance (in planimetric view) was calculated by multiplying the perspective view target by the P2P ratio for each visual quality polygon. The resulting plan view target was used to model visual quality objectives in the TSA and were applied to the CFLB portion of each visual polygon.

Table 39: Visual classes and maximum allowable disturbance

Visual Quality Objective	Maximum Allowable Disturbance (perspective view)	Total CFLB Area (ha)
Retention	1.5 %	7,961
Partial Retention	7 %	77,808
Modification	18 %	27,000
Total		112,967

6.5.3 Watersheds

6.5.3.1 Community Watersheds

Harvesting is allowed in community watersheds; however, operations must be planned in such a way that no harmful substance may enter the water. There are three officially designated community watersheds in the Bulkley TSA (John Brown Creek, Corya Creek, and Canyon Creek). One more is pending designation (Kathlyn Creek) and two are being managed as community watersheds despite their lack of designation (Tyhee Lake and Seymour Lake).

Community watersheds are managed operationally through Forest Stewardship Plans. In this analysis, harvest in community watersheds was limited to a maximum of 5% of the CFLB within each watershed over a 5-year period.

6.5.3.2 Fisheries Sensitive Watersheds

Government objectives for fisheries sensitive watersheds relate to the needs of fisheries values. Conserving hydrological condition, stream bed dynamics and channel integrity are all high priorities, as are the quality, quantity and the timing of flow. Harvest is not allowed until a watershed assessment is completed. This assessment determines thresholds for indicators of watershed stability: equivalent clearcut area (ECA), peak flow index, road density, and stream crossing density.

There are five legally established fisheries sensitive watersheds (FSWs) in the Bulkley TSA: Cumming, Gramaphone, West Babine, Jonas and Toboggan Creeks. In addition, four watersheds are under consideration for FSW designation: Five Mile Creek, Heal Creek, Nine Mile Creek, and Tsazakwa Creek.

FSWs are managed through FSP commitments as shown in Table 40. In this analysis, Cumming Creek, Gramophone Creek and West Babine Creek are modeled as per the ECAs noted in Table 40. Jonas Creek and Toboggan Creek are excluded from harvest. In operations, road and stream crossing densities are controlled; however, these controls are not applied in the forest estate modelling.

Table 40: Fisheries sensitive watersheds

Watershed	Equivalent Clearcut Area Threshold (%)	Peak Flow Index Threshold (%)	Notes
Cumming Creek	30	35	Road density <= 1.4 km/km2; Stream crossing density <= 0.5/km2
Gramophone Creek	25	35	Road density <= 1.6 km/km2; Stream crossing density <= 0.5/km2
West Babine Creek	35	45	Road density <= 1.3 km/km2; Stream crossing density <= 0.5/km2
Jonas Creek	n/a	n/a	No harvest until watershed assessment completed and indicator thresholds set
Toboggan Creek	n/a	n/a	No harvest until watershed assessment completed and indicator thresholds set

6.5.3.3 Fourth Order Watersheds

Equivalent Clearcut Area (ECA) was used as an indicator for watershed health. An ECA of 20% is considered desirable. The achievement of ECA was not controlled in the ISS Base Case; it was only reported as in indicator for all the 4th order watersheds. There are 102 4th order watersheds included in the analysis; these are listed in Table 41.

Table 41: Fourth order watersheds in the analysis

Watershed Name	Forest Area (ha)
Barbeau Creek	3,847
Upper Nilkitkwa River	4,424
West Nilkitkwa River	9,966
Coyle Creek	3,523
Charleston Creek	4,821
Lower West Nilkitkwa	3,151
East Nilkitkwa	2,094

Watershed Name	Forest Area (ha)
North Nilkitkwa	1,860
Lower Babine 1	3,263
Lower Babine 2	1,956
Lower Babine 3	2,229
Bairnsfather Creek	2,285
West Nilkitkwa Lake Creek	1,829
East Nilkitkwa Lake Creek	1,115
South Nichyeskwa	3,833
Southwest Nichyeskwa	1,254
North Nichyeskwa	2,304
Boucher Creek	10,520
Heal Creek	1,853
Fourteen Mile Creek	1,878
Eighteen Mile Creek	2,892
Nineteen Mile Creek	3,159
Twelve Mile Creek	2,686
Five Mile Creek	3,952
Nine Mile Creek	3,949
Tsezakwa Creek	5,656
Lower South Harold Price	1,613
Maish Creek	2,808
Netalzul Creek	3,586
Luhk Creek	2,456
Howal Creek	2,094
Torkelsen Creek	4,816
Blunt Creek	18,652
Upper Harold Price Creek	9,128
Nata Creek	2,340
Bristol Creek	2,113
Cronin Creek	2,262
Upper Fulton River	9,900
McKendrick Creek	6,426
Bristow Creek	5,467
Ganokwa Creek	3,468
Upper Canyon Creek	9,129
Thompson Creek	1,533
Deep Creek	7,219
Coffin Creek	3,683
Tyhee Creek	256
Robin Creek	3,692
Helps Creek	3,211
Lacroix Creek	90

Watershed Name	Forest Area (ha)
Kwun Creek	2,177
South Kwun Creek	3,321
Boulder Creek	2,993
John Brown Creekl	6,032
Causqua Creek	5,118
Corya Creek	5,401
Driftwood Creek	4,531
Kathlyn Creek	2,066
North Tyhee Creek	366
Seymour Creek	181
Powers Creek	530
Toboggan Creek	3,932
Reiseter Creek	12,880
Trout Creek	8,501
Gramophone Creek	4,687
Cumming Creek	2,509
West Howson Creek	3,416
Winfield Creek	3,044
Sinclair Creek	4,266
Tsai Creek	1,749
Tenas Creek	13,452
Howson Creek	15,803
Upper Telkwa River	11,397
Pine Creek	5,709
Coal Creek	5,090
West Serb Creek	2,352
South Mulwain Creek	3,604
Hankin Lake	2,569
Passby Creek	13
Aldrich Lake	7
Serb Creek	9,021
Mulwain Creek	9,066
Red Canyon Creek	4,939
Upper Nichyeskwa Creek	2,968
Kitseguecla River above TSA bo	8,311
Bulkley Boulder	1,036
Bulkley John Brown 1	295
Bulkley John Brown 2	228
Bulkley Gramophone 1	706
Bulkley Gramophone 2	229
Bulkley Gramophone 3	514
Bulkley Driftwood 1	742

Watershed Name	Forest Area (ha)
Bulkley Robin 1	27
Bulkley Robin 2	395
Bulkley Coffin	518
Lower North Telkwa	85
Bulkley Driftwood 3	940
Bulkley Driftwood 2	100
Bulkley Driftwood 4	723
Bulkley Seymour	283
Hunaker	246
Bulkley John Brown 1	395
McQuarrie Creek	2,629

6.5.4 Wildlife

The ISS Base Case includes those forest cover requirements that constrain timber harvest. It also contains indicators that do not constrain harvest; however, these are reported throughout the planning horizon. All wildlife and habitat related forest cover indicators are shown in Table 42.

Wildlife habitat is established and managed through various policy and legislative instruments including the Identified Wildlife Management Strategy (IWMS), approval of ungulate winter ranges (UWR) and wildlife habitat areas (WHA), and management practices identified in plans establishing legal objectives.

The Bulkley LRMP and the associated higher-level plan orders set objectives for managing wildlife habitat in the Bulkley TSA. Legal objectives are defined for moose, mule deer, mountain goat, woodland caribou and grizzly bear.

Bulkley TSA has no legally established UWRs; however, the Bulkley Valley Sustainable Resource Management Plan (BVSRMP) identifies objectives for mapped Wildlife Habitat Management Areas (WHMAs). Some portions of WHMAs may be established as UWRs in the future. Moose and mule deer are managed through FSPs and no additional timber harvesting constraints are applied in the ISS Base Case in managing moose and mule deer populations. Moose habitat is reported by 4th order watershed in the ISS Base Case (section 6.5.4.1)

High-value mountain goat habitat areas are not removed from the THLB as per the latest AAC determination; however, draft UWR for goat may be included in some scenarios.

In 2015 a legal order established a Wildlife Habitat Area (#6-333) for the Telkwa caribou herd. This WHA consists of a core no-harvest area and a conditional harvest zone at lower elevations where LRMP legal objectives set by government apply. The ISS Base Case also includes woodland caribou habitat as an indicator. The tracked habitat target is that inferred from the Federal Caribou Recovery Strategy, i.e. 90% of the forested area within the mapped caribou habitat should be “undisturbed”, interpreted as older than 140 years (section 6.5.4.3).

Forest cover requirements for grizzly bear are applied in high value grizzly habitat areas and mixed forest habitat grizzly bear areas; they reflect current management and FSP commitments. Mid seral (41 to 80 years) is tracked for the TSA. It is assumed that more than 30% mid seral within a BEC variant is an indicator of poor Grizzly bear habitat, as per the provincial cumulative effects protocol.

Coarse woody debris (CWD) is considered a critical component of marten habitat. Late seral stage will be used in this analysis as a surrogate for marten habitat.

The interior subspecies of Northern goshawk (NOGO) is provincially blue-listed. The mapped nesting locations within the TSA are currently protected through scheduling operations around critical life cycle phases, by establishing wildlife tree patches and other reserves, or by avoiding nests during road and cutblock layout. The current nest sites (plus a 100 m radius buffer) are removed from the THLB.

The ISS Base Case also tracks projected suitable foraging habitat for NOGO. A forage area is 2,400 ha in size measured from the center of a (projected) nest, or a centroid of a nest cluster (breeding area). Forage habitat is defined as forest, at least 120 years of age (section 6.5.4.2).

Table 42: Wildlife and habitat related forest cover constraints and targets

Species	Area Target	Age/Height	Notes
Moose	33%/33%/33%	<40, 41-80,>80	Currently managed through operations, no constraints. Only reported in the ISS Base Case. Reference land base = CFLB
Mule Deer	n/a	n/a	Currently managed through operations, no constraints.
Mountain Goat, high value habitat	n/a	n/a	Remains in the THLB in the ISS Base Case as per the latest AAC determination. Draft goat UWR may be removed from the THLB in some scenarios.
			GAR order in 2018. High value habitat was removed from the THLB in the Selected Management Scenario.
Woodland Caribou, Core WHA	n/a	n/a	No harvest area
Woodland Caribou, WHA conditional harvest area outside of the Bulkley Valley Landscape Unit	Minimum 60%	>80 years	SBSmc2, Reference land base = CFLB
	Maximum 28%	<40 years	SBSmc2, Reference land base = CFLB
	Minimum 45%	>80 years	SBSdk, Reference land base = CFLB
	Maximum 39%	<40 years	SBSdk, Reference land base = CFLB
Woodland Caribou, WHA conditional harvest area within the Bulkley Valley Landscape Unit	Minimum 10%	>140 years	Reference land base = CFLB
Woodland Caribou, Core WHA plus the conditional harvest area	Minimum 90%	>140 years	Only reported in the ISS Base Case, Reference land base = CFLB. May be enforced in some scenarios.
Grizzly Bear High-Value Habitat	Minimum 80%	>50 years	Babine LU only, Reference land base = CFLB
Grizzly Bear Mixed-Forest Habitat	Maximum 25%	< 3 m tall	Babine LU only, Reference land base = CFLB
Grizzly Bear Moderate-Value Habitat	n/a	n/a	Access restrictions in operations.
Grizzly bear habitat	Max 30%	41-80	Tracked. May be enforced in some scenarios. Reference land base = CFLB
Marten Habitat	n/a	Late seral	Tracked. Late seral is assumed to be marten habitat. Reference land base = CFLB
Northern Goshawk, Nest Areas	n/a	n/a	100 m buffer around nests removed from the THLB.
Northern Goshawk, Forage Areas. Current and projected	Minimum 60%	>80 years	Each forage area is 2,400 ha in size measured from the center of a nest, or a centroid of a nest cluster. Only reported in the ISS Base Case, Reference land base = CFLB
Babine SMZ2 within BCTS FDU	Minimum 30%	> 140 years	Reference land base = CFLB

6.5.4.1 Moose Habitat

The desired future condition for moose is set to have the forested land base in each of the seral stages described in Table 43, within each fourth order watershed in the TSA.

Table 43: Moose habitat in the analysis

Seral Stage	Stand Age	Share of Forested Area	BEC	Elevation
Early	0 to 40	1/3	SBS dk and SBS mc	<=1,000 m
Mid	41 to 80	1/3		
Mature	81 and older	1/3		

The moose habitat condition is reported in the ISS Base Case; however, the seral objectives are not enforced.

6.5.4.2 Northern Goshawk (NOGO)

Northern Goshawk (NOGO) forage habitat was accounted for by accommodating the foraging territory around existing breeding areas (8,845 ha) and projected territories (119,293 ha) in the analysis. A network of projected territories was received from FLNRORD in Smithers. Their general criteria for developing the network was as follows:

- BEC Zones: CWH, ICH, SBS;
- Age Class: >60% greater than 80 years (age class 5 and greater);
- Territory Area: 2400 ha;

The CFLB area for the existing and projected NOGO territories was 128,138 ha in total. The target for each forage unit (circle) was 60% of forage habitat with the age required for habitat of 81 and older. The achievement of NOGO forage habitat is not enforced in the ISS Base Case; it is only reported as an indicator.

6.5.4.3 Woodland Caribou

The ISS Base Case includes woodland caribou habitat as an indicator. The tracked habitat target is that inferred from the Federal Caribou Recovery Strategy, i.e. 90% of the forested area within the mapped caribou habitat should be older than 140 years. This indicator is only reported in the ISS Base Case.

6.5.5 Landscape Level Biodiversity

The Bulkley LRMP and the associated higher-level plan orders set objectives for biodiversity in the Bulkley TSA. The biodiversity objectives consist of objectives for seral stage distributions, ecosystem representation, connectivity, tree species diversity and stand structure.

6.5.5.1 Core Ecosystems and Landscape Riparian Corridors

The Ecosystem Network, consisting of Core Ecosystems (CE) and Landscape Riparian Corridors (LRC) facilitate ecosystem representation and connectivity in the Bulkley TSA. CEs are established to maintain biodiversity, represent a cross section of naturally occurring ecosystems, maintain some areas with interior forest conditions, and retain representative examples of rare and endangered plant communities.

LRCs are designed to provide habitat connectivity and reduce fragmentation by maintaining landscape corridors dominated by mature tree cover and containing most of the structure and function associated with old forest.

CEs are protected from range use and timber harvesting with some exceptions. Timber harvesting may be allowed, if it is necessary to protect the integrity and function of the ecosystem or provide access for forest health control activities or timber harvesting of isolated timber outside of the core ecosystem. Timber harvesting for mineral and energy exploration and development is allowed. The forest estate model is set to allow minimal harvest in these areas; CEs are modeled by allowing a maximum of 5% of the CFLB within each landscape unit and CE be less than 50 years old throughout the planning horizon as shown in Table 44.

The guideline for management within LRCs is to maintain 70 percent of the existing structure and function of the forest within these corridors (Table 44). Industrial, agricultural, recreational and tourism activities are permitted if they are compatible with the objectives of the landscape corridor.

Table 44: Ecosystem Network Objectives

Ecosystem Network	Area Target	Age/Height	Notes
Core Ecosystems	Maximum 5%	<50 years	By landscape unit
Landscape Riparian Corridors	Minimum 70%	>80 years	By landscape unit

6.5.5.2 Seral Stage Objectives

Seral stage objectives are set to maintain biodiversity by sustaining a natural seral-stage distribution in each landscape unit (LU), natural disturbance type (NDT) and BEC variant. The targets are set for early seral (maximum), mature and old seral (minimum), and old seral (minimum). The definitions for old, mature and young are shown in Table 45, while the seral stage targets are presented in Table 46. The targets are to be met by LU, NDT and BEC variant within the Crown Forested Land Base.

Table 45: Seral Stage Age Definitions by BEC Subzone

Seral Stage	BEC Subzone	Age
Old (late seral)	SBSdk, SBSmc2	>140 years
	All other subzones	>250 years
Mature	MHmm2, ESSFmc, ESSFmk, ESSFwv	>120 years
	ICHmc1, ICHmc2, SBSdk, SBSmc2	>100 years
	CWHws2	>80 years
Young	All	<=40 years

LRMP seral stage targets do not exist for landscape units and BEC Subzones that cover 90,176 ha CFLB of the TSA, including 6,559 ha of THLB. Most of these ecosystems are high elevation and have limited THLB area, but five units have 5,583 ha of THLB within 16,366 ha of CFLB. These landscape unit and BEC Subzones are the: Bulkley ICHmc1, Bulkley ICHmc2, Copper ICHmc1, Harold Price ICHmc2, and Copper MHmmp.

Table 46: Non-spatial Seral Stage Objectives

Landscape Unit	BEC Subzone	Natural Disturbance Type (NDT)	Minimum Old (%)	Minimum Mature (%)	Maximum Young (%)
Babine	ESSFmc	2	9	28	36
	SBSmc2	3	11	23	54
Blunt	ESSFmc	2	9	14	n/a
	SBSmc2	3	11	11	n/a
Bulkley Valley	SBSdk, SBSmc2	3	10	n/a	n/a
Chapman	ESSFmc	2	9	14	n/a
	SBSmc2	3	11	11	n/a
Copper	ESSFwv, MHmm2	1	19	36	22
	CWHws2	2	9	34	36
	ESSFmc	2	9	28	36
	SBSmc2	3	11	23	54
Corya	ESSFwv	1	28	54	17
	ICHmc1, ICHmc2	2	13	46	27
Deep Creek	ESSFmc	2	9	14	n/a
	SBSdk, SBSmc2	3	11	11	n/a
Harold Price	ESSFwv	1	19	36	22
	ESSFmc	2	9	28	36
	ICHmc1	2	9	31	36
	SBSmc2	3	11	23	54
Nilkitkwa	ESSFmc	2	13	42	27
	SBSmc2	3	16	34	40
Reiseter	ESSFmc	2	9	28	36
	ICHmc1, ICHmc2	2	9	31	36
	SBSdk. SBSmc2	3	11	23	54
Telkwa	ESSFmk	2	19	36	22
	ESSFwv	1	19	36	22
	CWHws2	2	9	34	36
	ESSFmc	2	9	28	36
	SBSdk, SBSmc2	3	11	23	54
Torkelson	ESSFmc	2	9	14	n/a
	SBSmc2	3	11	11	n/a
Trout Creek/ Kitseguecla	ESSFwv	1	19	36	22
	ICHmc1, ICHmc2	2	9	31	36
	SBSdk, SBSmc2	3	11	23	54

6.5.5.3 Babine SMZ2 within BCTS Forest Development Unit

BCTS is committed to meeting the Babine SMZ2 management objectives within their Forest Development Unit. Their objective is to maintain at least 30% of the Crown Forested Land Base older than 140 years.

6.5.5.4 Patch Size Distribution

The Bulkley HLPO also sets targets for patch size distributions as a resource objective. The intent of this objective is to allocate harvesting spatially in the landscape while maintaining block size limits. The patch size distribution is not modeled in a spatially explicit manner. Rather, a landscape green-up constraint will be applied as a surrogate as described in section 6.5.1.

6.5.6 Fire Threat Rating

A Provincial Strategic Threat Analysis (PSTA) of wildfire risk was created at the strategic level to inform the government's landscape fire management planning and fuel treatment programs. It was created by combining the weighted results of three important components of wildfire threat:

- Head Fire Intensity (90th percentile) - 60%
- Fire Density - 30%
- Spotting impact - 10%

Head Fire Intensity (HFI) represents the intensity of the flaming front, which is related to suppression effort and impacts to values. Fire density represents the ignition and fire spread potential based on historic fire occurrence patterns. Spotting impact represents the ability of embers from a burning biomass fuel (such as a group of trees) to be sent aloft for some distance over the landscape and start new fires.

The final fire threat analysis values ranging between low and extreme and the corresponding areas for Bulkley TSA are shown in Table 47.

Table 47: Fire threat areas in Bulkley TSA

Fire Threat Description	Forest Area (ha)	THLB Area (ha)
Extreme	6,892	3,356
High	297,196	130,399
Moderate	178,782	65,864
Low	13,857	5,194
Total	**496,727**	**204,813**

The Wildland Urban Interface is any area where combustible wildland fuels (e.g. vegetation) are found adjacent to homes, farm structures or other buildings. The Wildland Urban Interface Buffer consists of areas within two kilometres of a community with a density of between six and 250 structures per square kilometre. The data was updated to 2016 for built structures and was provided by FLNRORD for the analysis. It helps identify built up areas that may be at risk due to wildfires and can help guide planning processes for modifying or reducing the amount of forest or range fuels in order to mitigate the risk of fire in the built environment. The buffered area and threat descriptions within the Bulkley TSA are shown in Table 48.

Table 48: Fire threat areas within wildland urban Interface buffer area in the Bulkey TSA

Fire Threat Description	Forest Area (ha)	THLB Area (ha)
Extreme	2,723	1,381
High	16,173	9,571
Moderate	17,579	5,747
Low	1,520	229
Total	**37,995**	**16,929**

6.6 Natural Disturbance Assumptions

6.6.1 Non-Harvestable Land Base

A disturbance function was used in the analysis to prevent the non-timber harvesting land base from continually aging and providing a disproportionate, and often improbable, amount of old forest cover conditions to satisfy landscape biodiversity requirements.

In contrast, the Bulkley TSA TSR analysis did not disturb the NHLB, but instead used static ages in the NHLB, which left the NHLB age class distribution fixed to the initial starting conditions.

The document "Modeling Options for Disturbance Outside the THLB – Working Paper" (Forest Analysis Branch, 2003) provides direction for disturbing areas of the landscape outside of the THLB. There are a variety of possible approaches to applying a disturbance in the non-timber harvesting land base. The age reset by variant for the non-timber harvesting land base methodology was applied in this analysis. The methodology is as follows:

1. List the estimated return interval for disturbance and old seral age in each variant and NDT in the TSA (taken from the Biodiversity Guidebook or Landscape Unit Planning Guide Appendix 2).
2. Calculate the expected percent of the forest above the old seral age. This calculation uses a negative exponential distribution and assumes that the probability of disturbance is independent of forest age. The calculation is "percent forest greater than age t = exp(-[t/b])", where b is the average disturbance interval and t is the old seral age.
3. Calculate a rotation age based on the age distribution described in step 2 (old age / (1- % forest above seral age).
4. Divide the contributing non-THLB area in the variant by the calculated rotation age to determine the annual minimum disturbance target for each variant.

Table 49 identifies the target area to be disturbed annually within each BEC variant for the Bulkley TSA. The non-timber harvesting land base areas reported for each BEC Unit only include the area for polygons that are completely non-THLB and do not include aspatial, non-THLB portions of THLB polygons in the land base.

Table 49: Target NHLB area to be disturbed annually in each BEC variant

BEC Unit	NDT	Mean Disturbance Interval	Old Seral Age	Forest Above Old Seral Age (%)	Rotation Age	Non- THLB Area (ha)	Annual Disturbance Area (ha)	Annual Disturbance %
CWHws2	2	200	250	28.7%	350	7,306	20.9	0.29%
ESSFmc	2	200	250	28.7%	350	73,860	210.8	0.29%
ESSFmk	2	200	250	28.7%	350	2,037	5.8	0.29%
ESSFwv	1	350	250	49.0%	490	22,905	46.8	0.20%
ICHmc1	2	200	250	28.7%	350	14,127	40.3	0.29%
ICHmc2	2	200	250	28.7%	350	7,260	20.7	0.29%
MHmm2	1	350	250	49.0%	490	6,827	13.9	0.20%
SBSdk	3	125	140	32.6%	208	9,575	46.1	0.48%
SBSmc2	3	125	140	32.6%	208	54,979	264.6	0.48%

The annual disturbance areas were applied to random stands in the NHLB by BEC Unit. When disturbed, the stands age was reset to 0. The implementation only allowed stands to be disturbed once, which results in the disturbance rate in the SBS portions of the forest being lower than the target after 208 years.

The following high elevation BEC Units do not have a mean disturbance interval given in the Biodiversity Guidebook and were left undisturbed in the analysis: BAFA, CMA, ESSFmcp, ESSFmcw, ESSFmkp, ESSFmkw, ESSFwvp, ESSFwvw, MHmmp. These BEC Units also lack seral stage management targets in the Bulkley LRMP, therefore allowing these stands to age indefinitely does not impact the calculation of landscape biodiversity targets.

6.6.2 Timber Harvesting Land Base

6.6.2.1 Non-Recoverable Losses (NRL)

Non-recoverable losses (NRL) provide an estimate of the average annual volume of timber damaged or killed within the THLB and not salvaged or accounted for by other factors. These losses result from natural events such as insects, diseases, wind, wildfires, etc. The values shown in Table 50 indicate the estimated annual volume that will not be salvaged; the values are based on the latest TSR (FNLR, 2012).

The TSR estimated the NRLs in the TSA to be 7,700 m^3/year for the first two decades and 10,550 m^3/year from year 21 on. The NRLs for the first 20 years (7,700 m^3/year) excluded the losses by the mountain pine beetle (MPB). The MPB killed volume was assumed to be utilized up to 15 years after the death of the stand. After 15 years, the pine volume is no longer available. The TSR further assumed that after 20 years, the MPB related NRLs would revert to their previous historic levels as defined for TSR2, i.e. 2,850 m^3/year.

This analysis also applied a 15-year shelf life to the dead pine in the VRI; however, the NRLs were based on the TSR total of 10,550 m^3/year and used from the beginning of the planning horizon. The latest TSR NRLs were prorated to the ISS Base Case THLB. As discussed above, the TSR THLB of 283,510 ha was assumed to have NRLs of 10,550 m^3/year. The ISS Base Case THLB of 204,878 ha prorated NRLs are 7,624 m^3/year.

Non-recoverable losses are removed from the harvest volume for each timber supply forecast.

Table 50: Non-recoverable losses, Bulkley TSA

Cause of Loss	Annual Non-Recoverable Loss in THLB (TSR, m^3/yr)	Prorated Non-Recoverable Loss in THLB (m^3/yr)
Wind	5,228	3,778
Fire	2,472	1,786
Insects (MPB)	2,850[2]	2,060[3]
Total	10,550	**7,624**

[2] After two decades

[3] Throughout the planning horizon

7 Objectives for the Bulkley TSA

Coarse objectives were developed for the Bulkley TSA through several stakeholder meetings. The objectives were developed for broad values considered important to the stakeholder group: economic values, environmental values and social values.

The objectives are expressed as statements of what ideally is desired on the land base; however, not all objectives might be realized as stated when attempting to achieve them simultaneously. The objectives are not ranked or constrained by targets; this provides maximum flexibility and learning from scenario analysis.

Each objective contains a performance measure or indicator to facilitate meaningful quantitative and qualitative comparisons between different scenarios and ultimately management options. Note that the objectives and performance measures are focused on addressing critical issues that have been raised by stakeholders; however, there are other non-listed objectives that will be captured as current management as driven by legislation and policies. These will be fixed in the ISS Base Case and across all scenarios. Strategies to achieve objectives are collated into logical scenarios for comparison against the ISS Base Case.

The following matrix (Table 51) illustrates agreed upon management objectives.

Table 51: Management objectives for the Bulkley TSA

Value category	Objective	Performance measure/indicator	Modeled in this Analysis	Notes
Timber	Achieve current AAC, i.e. economic harvest of the timber profile	Cubic meters harvested per year	Yes	This could be an aggregate over many years to allow year-to-year variation.
	Stable timber supply into the future	Cubic meters harvested in the long term, stable growing stock	Yes	
	Increase the volume and value of timber supply over time	Yield times average revenue, by product and grades, summed by year	Yes	
	Maximize carbon storage	Tonnes of carbon	No	A clear trade-off with harvesting but still an off-setting economic opportunity.
Forest Ecosystem Diversity	Maintain rare and uncommon ecosystems	Area logged in rare and uncommon ecosystems.	No	Remains a strategy objective. Need to be considered in operations.
	Maintain diversity of seral stages	Young forest patches as per NROV	No	Patches are difficult to model explicitly. Can be tracked over time through operations and reporting.
		Maintain old forest and old interior	Yes/No	Old forest can be tracked in the model. Old interior cannot.
	Maintain riparian areas	% of riparian area that maintain 70% of structure and function of mature and old	No	Operational objective.
	Stand level ecosystem diversity	Maintain diversity in WTPs	No	Operational objective.
Wildlife	Forest that supports wildlife habitat	% of area replanted with modified stocking standard for grizzly bear, moose and caribou; units for these needed	Yes	Assumptions can be built into modelling that assume specific regeneration activities for given sites/habitat
		Harvest areas reforested with tree species representative of the original BEC zone/variant	Yes/No	Future Species composition is an input to the forest estate model.
		Harvest areas reforested with mixed species composition	Yes/No	Future Species composition is an input to the forest estate model.
		Plant harvested sub-alpine fir back to sub-alpine fir	Yes/No	Future Species composition is an input to the forest estate model.
		Less planting of higher value stands in areas marginally contributing to the THLB	Yes/No	Future Species composition is an input to the forest estate model. Zoning can facilitate different regimes in different areas.

Value category	Objective	Performance measure/indicator	Modeled in this Analysis	Notes
	Maintain Habitat for Identified Species at Risk (Caribou)	% of identified critical habitat for listed SAR that meets management objectives of the Federal Species at risk act (caribou).	Yes	Habitat is tracked and modeled. The habitat target is that of the Federal Caribou Recovery Strategy, i.e. 90% of the forested area within the mapped caribou habitat should be older than 140 years.
	Maintain Habitat for Wildlife Moose	% of wetlands and floodplains with >100 m buffers intact to support moose cover habitat	Yes/No	The indicator is specific to operations. This analysis tracks and models moose habitat at the landscape level. One scenario establishes 100 m buffers of mature forest around each wetland.
	Grizzly bear	Areas with road density less than 0.6 to 0.75 km/km2 within grizzly bear habitat	No	Current road density can be measured. Future road density remains an operational consideration.
		A low forage supply indicator if proportion of mid-seral is >30% in any (CWH, SBS, ICH, ESSF, IDF, MS or MH) biogeoclimatic variants within the Landscape Unit."	Yes	Tracked in analysis, enforced in some scenarios.
	NOGO	Number of identified NOGO breeding areas with breeding area management plans.	No	
		Number of >100 ha patches of >70% old structure and function to support NOGO breeding and post-fledgling habitat.	No	Patches can be tracked post-harvest, not predicted, unless areas are identified prior to modelling as reserves.
		Main number of spatial territories of 2,400 ha with >60% greater than 80 years old.	Yes	The analysis tracks and models projected territories.
	Mountain goat	Areas with at least 2km horizontal distance between goat habitat (cliffs/bluffs) and forest development activity	No	Strategy objective that is applied in operations. Draft UWR incorporated in some scenarios.
	Beaver and Waterfowl	Number of riparian management zones with >30% At or Bw component to support beavers and waterfowl	No	Strategy objective that is applied in operations
	Fisher	No. of suitable large, cavities/ha in SBSdk (site series)	No	Strategy objective that is applied in operations
	Wolverine	Reduce Access, maintain large CWD for dens & biodiversity for forage.	No	Strategy objective that is applied in operations
	Marten	Coarse-woody debris (CWD)	Yes	Strategy objective that is applied mostly in operations. The analysis will track old forest in the TSA; assumption is that old forest is an indicator for CWD.

Value category	Objective	Performance measure/indicator	Modeled in this Analysis	Notes
	Maintain cool S5 and S6 Stream Temperature for fish	Stream Temperature	No	Can be monitored in operations.
Water	Watershed integrity, maintain watershed function	Number of watersheds with hydrological equivalent clear cut area (HECA) >30%	Yes	The analysis tracks and models ECA in all 4th order watersheds.
		Number of watersheds meeting Interior Watershed Assessment Procedure (IWAP) metrics (km roads/km2, # stream crossings, degree of riparian harvesting	No	Strategy objective that is applied in operations
Social	Minimize risk of catastrophic fire in interface areas	Proportion of interface area classified as moderate-high threat	No	Strategy will prescribe stand level treatments for operations. These are not modeled at the forest level.

8 Strategies for Exploration

The strategies that could be employed to meet some of the Bulkley ISS management objectives were discussed at the stakeholder meetings. The following strategies will be explored in this analysis.

8.1 Habitat and Biodiversity Scenarios

8.1.1 Moose Habitat

This scenario attempts to meet the moose habitat targets in each 4th order watershed. The moose habitat targets are set at 33% mature/old seral (greater than 80 years old), 33% mid seral (41 to 80 years old) and 33% early seral (0 to 40 years old)

8.1.2 Northern Goshawk (NOGO) Forage Habitat

The NOGO forage habitat target (greater than 80 years old) within each projected nesting area is set at 60% and enforced in this scenario.

8.1.3 Watershed Condition

Two runs will be completed:

1. ECA target in each 4th order watershed set at 20% and enforced.
2. ECA target in each 4th order watershed set at 30% and enforced.

8.1.4 Woodland Caribou

In this scenario, the Caribou habitat target (greater than 140 years old) is set at 90% of the forested area within the mapped Woodland Caribou habitat as inferred by the Federal Caribou Recovery Strategy. The target is enforced.

8.1.5 Coarse Filter Biodiversity Scenario

In this scenario the core area and landscape corridor seral stage targets were maintained as in the base case; however, rather than following the LRMP direction, the Biodiversity Guidebook (Ministry of Forests, 1995) targets for early (max), mature + old (min) and old (min) are used for all the other NDT/LU/BEC variant combinations.

8.1.6 Combined Wildlife Habitat Scenario

This scenario adds the following to the ISS Base Case assumptions:

<u>Grizzly Bear</u>

Enforce max 30% mid seral target by NDT/LU/BEC;

<u>NOGO</u>

Enforce the NOGO 60% forage area target for each projected territory;

Moose

Moose objectives stem from wetlands and the forest area around them. The objective is to maintain a 100 m buffer of mature forest (>80 years) around wetlands and apply an additional 100 m buffer within which a reduced stocking standards will be used after harvesting.

All wetlands with mature forest around them were buffered by 100 m and this buffer was removed from the THLB. It was further assumed that outside the 100 m buffer, up to 200 m in distance, the harvested areas would be reforested using a reduced stocking standard. The reduced stocking standard was assumed to decrease yield by 50%.

8.2 Pine Log Quality

Assessments of existing managed stands in the interior of British Columbia have raised concerns over pine log quality at harvest compared to logs from mature natural stands for a given piece size. This is particularly the case for pine stands with low competing crop tree densities[4] on medium to productive sites and stands that experience periodic to common heavy snow. The concern over the poor pine log quality prompted the silviculture working group to review the pine quality of managed stands in the Bulkley TSA and assess its potential impacts.

In the ISS Base Case, average log prices (by piece size) used for valuation of managed stands are based on recent prices for logs harvested from mature stands (ages>100yrs) (see Figure 7). Most recently harvested pine logs come from mature stands which are likely of fire origin and initiated with moderate to high densities.

Figure 7: Typical mature Pl stands being harvested in the BC Interior

Pine stands with low competing crop tree densities often produce a high proportion of stems with poor quality. They tend to develop large crowns with long branches, and they do not self-prune quickly. Stems with large crowns have poorer taper, more irregular stem shapes and more larger branches (in proportion to diameter). In addition, when subject to common or periodic heavy snow loads, a high proportion of stems in these stands tend to develop forks and crooks and increased compression wood

[4] Competing crop tree density is the sph of dominant and co-dominant stems of all commercial species assessed at a stand age of 20 to 30yrs.

at the knot whorls. All these issues are of more concern when stands are being managed over short rotations.

Mixing pine with other species, even at moderate initial densities, can create effectively lower competing densities if the other species have slower initial height growth development than the pine. Height growth development is a function of differential natural grown patterns, site indices and genetic worth. This is especially relevant for mixed Sx/Pli managed stands where the initial height growth of Pl is usually significantly faster than that of the Sx (see Figure 8). These mixes are common in contemporary era managed stands and planned future stands in the Bulkley TSA.

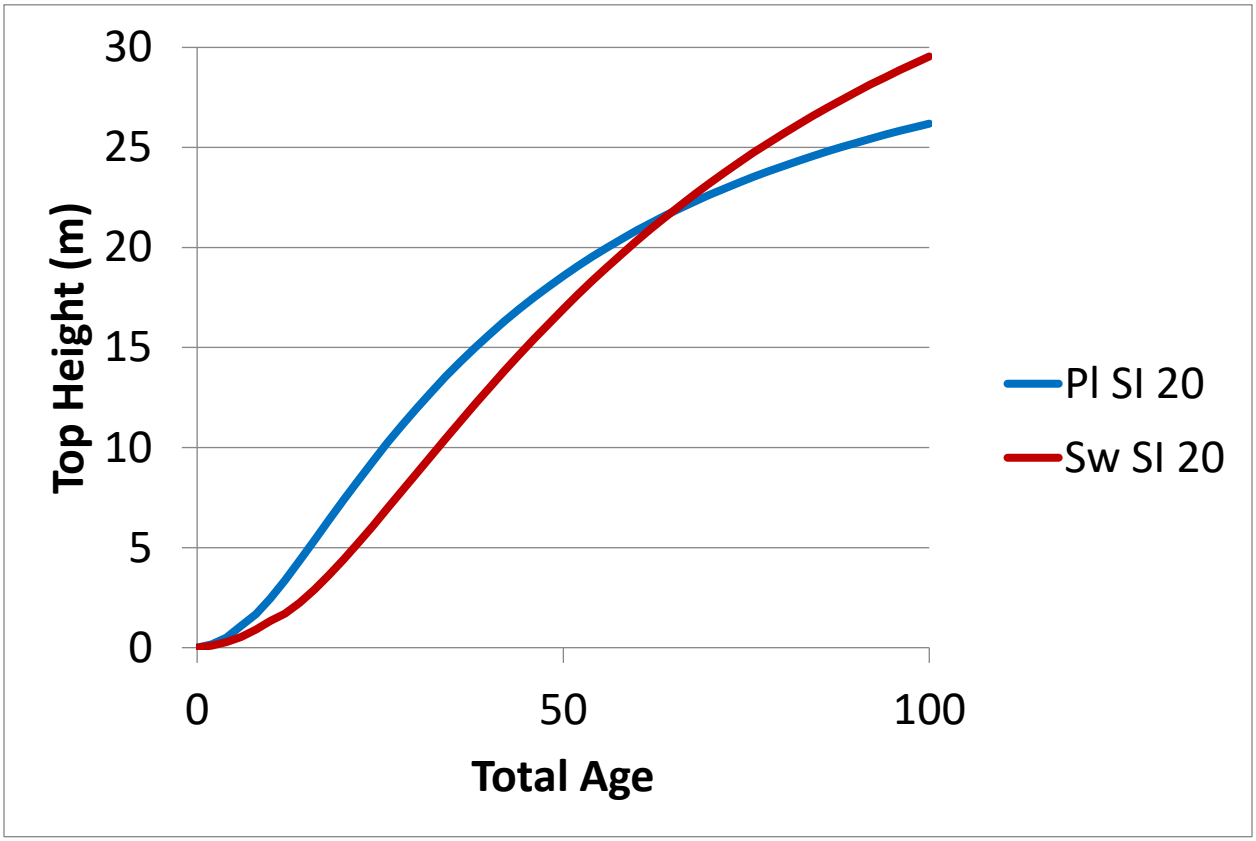

Figure 8: Height growth development patterns for Pl and Sw with the same SI50

Figure 9, Figure 10, Figure 11, Figure 12 and Figure 13 illustrate the forecasted TASS II development pattern of a mixed Pl/Sw stand for the SBSmc2 using the ISS Base Case future stand yield curve inputs. The TASS renderings at 10, 20, and 40 years (Figure 9, Figure 10, and Figure 11) show how the Pl is forecasted to form the overstory of the stand while the Sw is relegated to an understory position. The example photo in Figure 11 of open grown 40-year-old Pl, showing a lack of self pruning, illustrates the impact this development pattern can have on Pl log quality. The TASS II projections of the same stand at 70 and 90 years old further show how the Sw catches up and starts to overtop the Pl (Figure 12 and Figure 13). If these stands are harvested around their biological culmination age (approximately 65 years old in this case), the first 40 years of open grown conditions can reduce the log quality of Pl significantly.

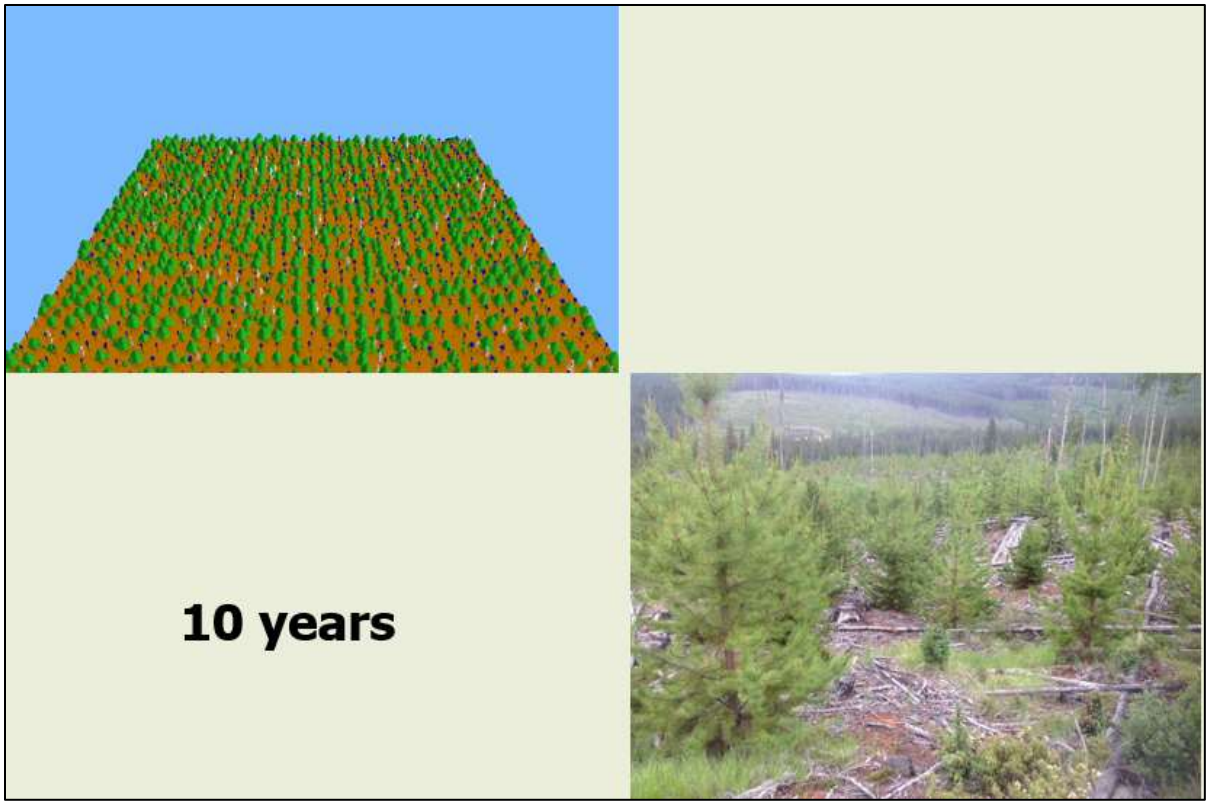

Figure 9: TASS II image of future stand in SBSmc2 fresh at 10 years (top left) with Pl green, Sw blue and natural At white. Photo at bottom right shows an example stand at this development stage

Figure 10: TASS II image of future stand in SBSmc2 fresh at 20 years (top left) with photo at bottom right showing an example stand at this development stage

Figure 11: TASS II image of future stand in SBSmc2 fresh at 40 years (top left) with photo at bottom right showing an example stand at this development stage

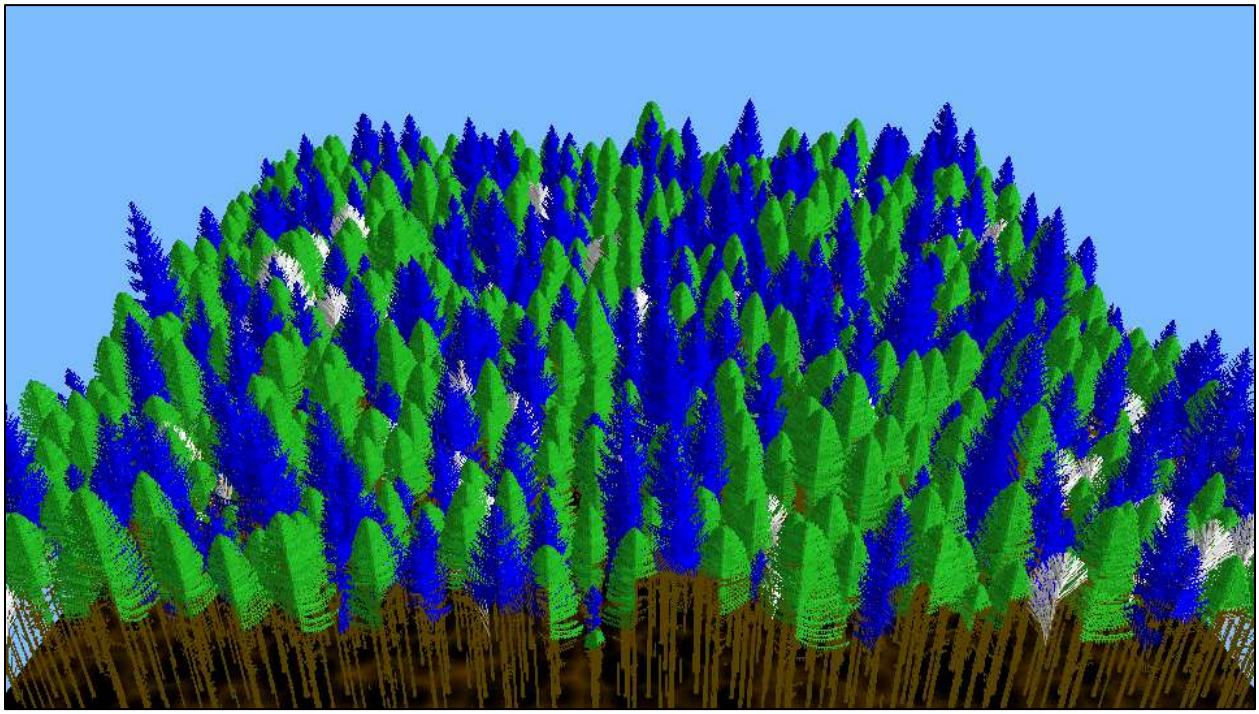

Figure 12: TASS II image of future stand in SBSmc2 fresh at 70 years (Pl green, Sw blue and natural At white)

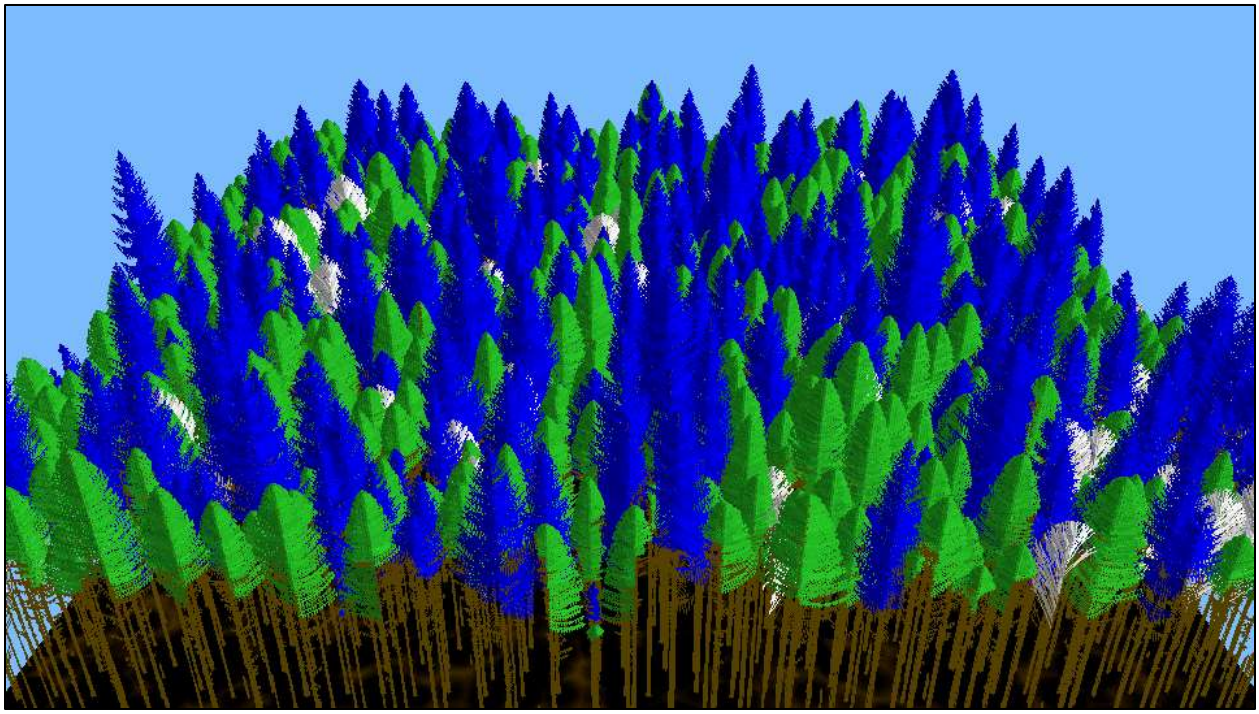

Figure 13: TASS II image of future stand in SBSmc2 fresh at 90 years (Pl green, Sw blue and natural At white)

The impact of low Pl log quality at the forest level will be tested by applying low log values to some stands. The stands that were considered to have potentially low pine log quality were defined as follows:

- Medium to good productivity; Pl SI>18m; or
- Medium productivity and snow risk; Pl SI 16-18, montane and
- Expected competing crop tree densities of <1,200sph (judgement based on initial planting density, proportion of Pl vs Sx, relative Pl/Sx SI, relative Pl/Sx genetic worth).

Based on above criteria, low Pl log values were applied to the following ISS Base Case managed stand yield curves:

- Old Era; non-Pl leading yield curves for ESSFmc, ICHmc1, ICHmc2, SBSdk, SBSmc2-Dry-Fresh, SBSmc2-Moist-Wet, and
- Contemporary and Future Eras; all yield curves for ESSFmc, ICHmc1, mc2, SBSdk, SBSmc2

Average prices will be applied to the rest of the logs from managed stands.

The log quality of Pl and other species can be improved by increasing initial densities and managing species deployment at the stand-level (more single species stands or mixes of species with compatible growth patterns). These concepts will be tested through the timber volume and value scenarios

8.3 Timber Strategies

8.3.1 Zoning

The THLB in the Bukley TSA was zoned based on silviculture investment suitability for timber production. Three zones were developed: green, yellow and red. Green depicts areas where management actions and investments are generally recommended due to higher site productivity, lower harvest costs and reduced anticipated risks from constraints and other factors to future harvest. In the yellow zone caution is recommended, while the red zones denote areas where management actions and investments in forest management should be avoided due to costs and risks. Table 52 details the zoning criteria, while the THLB areas for green and yellow silviculture zones are presented in Table 53. Despite the significant areas that have been removed from the THLB for other values under the LRMP, only about 23% of the THLB is recommended for silviculture investments for timber (green zone) and only about 47% is classified as having moderate investment potential (yellow zone). The silviculture zones are illustrated in Figure 14; they are superimposed over LRMP designated Enhanced Timber Zones (ETZ).

Table 52: THLB zoning, Bulkley TSA

Category	Data Source	Green (good)	Yellow (caution)	Red (stop)
Site Productivity	Future Managed Stands (AU)	SI of leading species >19m; CWHws2; ICHmc1, ICHmc2, SBSmc2-Dry-Fresh (accounts for ~59% of THLB)	SI of leading species 15 to 19m; ESSFmc-dry-fresh-moist; SBSdk; SBSmc2-Moist-Wet; MHmm2 (accounts for ~34% of THLB)	SI of leading species <15m; ESSFmc-Wet; ESSFmk, ESSFwv
Costs	Operability	Ground-based	Cable	N/A
	Cycle time	Regular truck <6hours cycle time	Regular truck >=6hours cycle time	N/A
Constraints to Harvest	VQO	Modification or none	Partial Retention	Retention, Preservation
	Community Watersheds	No	Yes	N/A
	WHAs	No	Yes, Partial harvest zones	Yes, No harvest zone
Other Constraints / Values	Fire Hazard; based on WUI status	Non-WUI	WUI	
Other Wildlife / Watershed Values	LRMP and/or Watersheds	Not significant	High grizzly bear, moose habitat and/or sensitive watershed	
Core Areas and Landscape Unit Corridors	LRMP	No	No	Yes. No treatments proposed.

Table 53: Silviculture zone areas, base case

Age Class	Green		Yellow		Total Green and Yellow	
	THLB Area (ha)	% of Total THLB	THLB Area (ha)	% of Total THLB	THLB Area (ha)	% of Total THLB
0 to 20	10,433	5%	17,739	9%	28,181	14%
21 to 50	16,700	8%	22,180	11%	38,880	19%
51+	19,170	9%	55,555	27%	74,724	36%
Total	46,312	23%	95,473	47%	141,502	69%

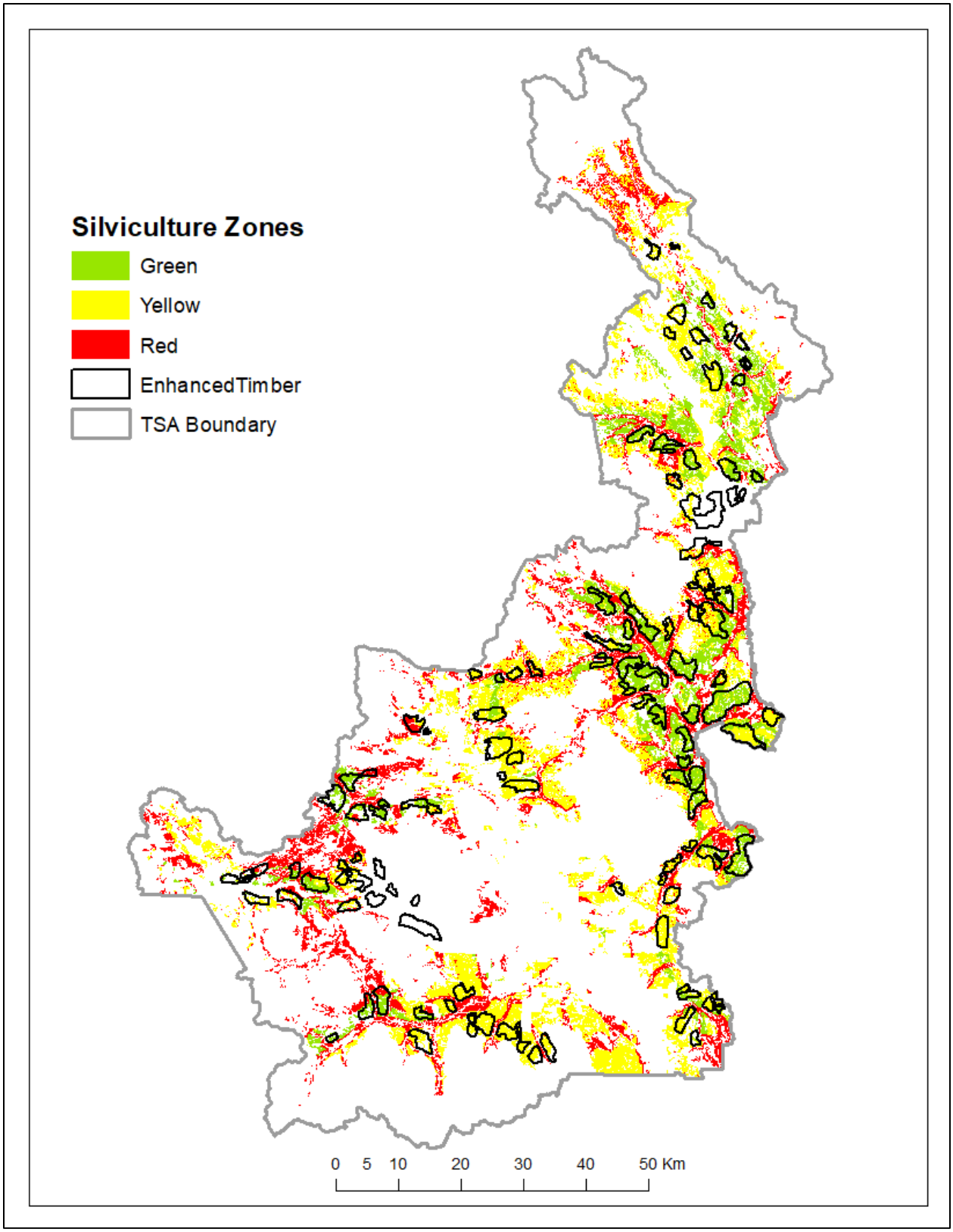

Figure 14: Bulkley TSA silviculture zones in relation to LRMP Enhanced Timber Zones, ISS Base Case (white areas on the map are either private land or public NHLB)

8.3.2 Volume and Value Strategies

Strategies to maximize both timber volume and timber value were developed and were similar except for variations in the species portfolio. In both strategies existing old era Sx leading stands were fertilized every 10 years from 30 to 70 years. The rest of the existing managed stands were not deemed suitable for fertilization due to concerns over Pl log quality.

A key strategy for volume and value production on medium and good sites is to establish a mosaic of ecologically suitable single species stands with enhanced densities specifically designed to optimize the production and value of each species on shorter rotations. The established Fd, Sw and Pl stands were fertilized every 10 years from year 30 to year 70.

The volume and value strategies are applied on green and yellow silviculture zones designated for timber production. Reduced stocking densities were assumed for many of the red silviculture zone sites to balance out the overall reforestation costs.

The species portfolio for each BEC unit was developed in consideration of forest health risks and in consideration of climate change using the Climate Change Informed Species Selection (CCISS) tool. Average expected genetic worth for each species from seed available under the Climate Based Seed Transfer (CBST) rules was used. Table 54 provides a comparison of the genetic worth of available seed from CBST versus what was used for the ISS Base Case.

High future log prices were assumed for all enhanced (higher densities) regimes.

Table 54: Comparison of CBST A Class and ISS Base Case genetic worth for future stands for primary BEC/species combinations[5]

BEC Variant	Fdi		Lwi		Pli		Sx	
	Base Case	CBST	Base Case	CBST	Base Case	CBST	Base Case	CBST
ICHmc1	N/A	N/A	N/A	N/A	14	N/A	16	29-38
ICHmc2	N/A	28-33	N/A	N/A	14	2-6	16	21-25
SBSmc2	N/A	26-30	N/A	27-28	14	17-21	160	30-38
SBSdk	N/A	26-28	N/A	27-28	14	13-21	16	26-38
ESSFmc	N/A	N/A	N/A	N/A	14	N/A	16	29

The value strategy includes planting of Cw on ecologically suitable sites; these stands are assumed to be spaced to favor Cw. No fertilization of Cw was assumed.

Both the volume and value scenarios were tested using two different minimum harvest criteria:

1. Minimum volume per ha as per the latest TSR;
2. Minimum volume per ha as per the latest TSR and the age at which the 95% MAI culmination is reached.

The treatment assumptions and yield curve inputs for the volume and value strategies are described in Appendix 1: Yield Curve Specifications for Treated Stands.

[5] For Bl and Cw only B class seed is available in the Bulkley TSA

8.3.2.1 Treatment Costs

The treatment costs are assumed to be $500 per ha for fertilization and $2,500 per ha for juvenile spacing (Cw regime).

Increased and decreased planting densities (compared to the ISS Base Case) are utilized in the volume and value scenarios. Table 55 shows the changes in densities and cost increases/decreases for main BEC units.

Table 55: Planting density changes and cost increases/decreases for the volume and value scenarios

BEC	Regime	Density Difference vs. Base Case (sph)	Cost Difference per ha vs. Base Case ($0.68/tree)
ESSFmc upper all	Sx/Pl/Bl/800	-450	-$306
ESSFwv dry-fresh	Sx/Pl/Bl/800	-600	-$408
ESSFwv moist-wet	Sx/Pl/Bl/800	-550	-$374
ESSFmc lower dry-fresh	Cw/1200/ JS900	-50	-$34
	Pl/1800/ fert	550	$374
	Sx/ 1400/ fert	150	$102
ESSFmc lower moist-wet	Pl/1800/ fert	550	$374
	Sx/ 1600/ fert	350	$238
SBSdk all	Pl/1800/ fert	400	$272
	Sx/1400/ fert	0	$0
	Fd/1200/ fert	-200	-$136
ICHmc1	Sx/1600/ fert	640	$435
	Fd/1400/ fert	440	$299
	Cw/1200/ JS900	240	$163
SBSmc2 moist-wet	Pl/1800/ fert	575	$391
	Sx/1400/ fert	175	$119
SBSmc2 dry-fresh	Pl/2000sph/ fert	775	$527
	Sx/1600/ fert	375	$255
	Fd/1400/ fert	175	$119

8.4 Selected Management Scenario

The analysis results for all learning scenarios were presented to the Bulkley TSA ISS implementation group on November 7, 2019. The group agreed that the value scenario with some control over the harvest age of the managed stands should be the basis for the selected scenario and the Integrated Stewardship Strategy. The following changes are incorporated into the selected scenario:

- Concerns for Balsam and Pl at high elevations: There is a consensus that TASS does not represent natural ingress of balsam adequately and for this reason balsam is likely underrepresented in the modelling results. There was also a concern over the success of Pl reforestation at high elevations with significant heavy snow fall. As a result, the ESSFmc was split into upper and lower portions (based on an elevation of 1100m). New yield curves were developed for the upper and lower areas with revisions to natural ingress patterns and reforestation regimes with a priority of more Bl. Also, the upper portion of the ESSFmc was designated as red silviculture zone while the lower portion remained a yellow silviculture zone.
- The most recent projected NOGO forage areas will be incorporated into the analysis file. Any projected forage areas that fall within the green and yellow silviculture zones will be classified as red. The NOGO forage area targets will not be enforced.
- The goat winter range has been updated. As per the Chief Forester's direction after the previous TSR, goat winter range was not removed from the THLB. The draft GAR order changes this. The selected scenario will remove some goat winter range polygons from the THLB as per the GAR order (U-6-007).
- The intensity of fertilization of future managed stands will be reduced to achieve a more conservative, realistic long-term silviculture budget. Many stands were scheduled to be fertilized at least 4 times. Two fertilizations will be removed from the regimes.
- Selected Scenario has a value focus with 95% MAI culmination (more species diversity with a small component of Cw). It will use updated areas for zoning and treatment frequency as noted above. The strategy will provide descriptions of best management practises at the stand level.
- An additional sensitivity analysis using the most up-to-date predicted NOGO forage areas in the model will be completed. The NOGO forage area requirements will be enforced in this sensitivity analysis.

8.4.1 Updated Zoning

The THLB in the Bukley TSA was zoned based on suitability for investment in silviculture treatments. The zoning criteria were changed for the Selected Scenario. As described above, areas above 1,100 m were designated as red zones, as were areas within the projected NOGO forage areas. The updated THLB areas for green and yellow zones are presented in Table 56. The updated silviculture zones are illustrated in Figure 15.

Table 56: Silviculture zone areas: Selected Scenario

Age Class	Green		Yellow		Total Green and Yellow	
	THLB Area (ha)	% of Total THLB	THLB Area (ha)	% of Total THLB	THLB Area (ha)	% of Total THLB
0 to 20	9,738	5%	12,460	6%	22,198	11%
21 to 50	15,924	8%	18,574	9%	34,498	17%
51+	15,687	8%	32,298	16%	47,985	24%
Total	**41,349**	**20%**	**63,332**	**31%**	**104,681**	**51%**

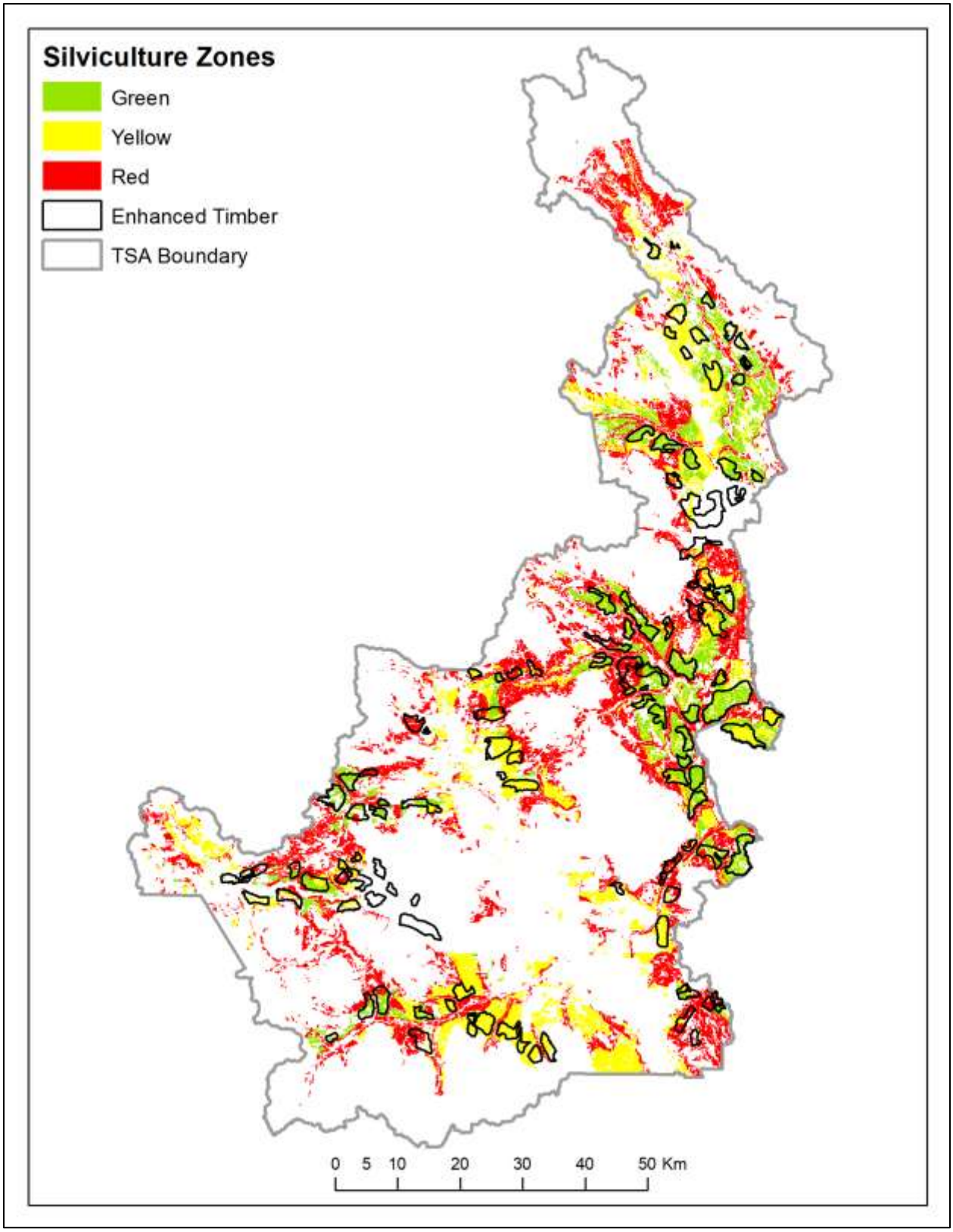

Figure 15: Bulkley TSA; silviculture zones for the Selected Scenario

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Appendix 1: Yield Curve Specifications for Treated Stands

Table 57: Specification for treated old managed stands, Volume and Value Scenario, planting inputs

AU	Description	Planted	P_Delay	Sp1	Sp1Pct	Sp1SI	Sp1GW	Sp1SA	Sp2	Sp2Pct	Sp2SI	Sp2GW	Sp2SA	Sp3	Sp3Pct	Sp3SI	Sp3GW	Sp3SA
301	Old_ICHmc1-All_Fert30405060	1150	1	Sw	84	23.3			Pli	16	21.0				0			
302	Old_ICHmc1-All_Fert405060	1150	1	Sw	84	23.3			Pli	16	21.0				0			
303	Old_ICHmc1-All_Fert5060	1150	1	Sw	84	23.3			Pli	16	21.0				0			
304	Old_ICHmc2-All_Fert30405060	1150	1	Sw	90	22.2			Pli	10	20.9				0			
305	Old_ICHmc2-All_Fert405060	1150	1	Sw	90	22.2			Pli	10	20.9				0			
306	Old_ICHmc2-All_Fert5060	1150	1	Sw	90	22.2			Pli	10	20.9				0			
307	Old_SBSdk-All_Fert30405060	1050	1	Sw	80	19.3			Pli	20	20.5				0			
308	Old_SBSdk-All_Fert405060	1050	1	Sw	80	19.3			Pli	20	20.5				0			
309	Old_SBSdk-All_Fert5060	1050	1	Sw	80	19.3			Pli	20	20.5				0			
310	Old_SBSdk-All_Fert30405060	1050	1	Sw	65	19.3			Pli	35	20.4				0			
311	Old_SBSdk-All_Fert405060	1050	1	Sw	65	19.3			Pli	35	20.4				0			
312	Old_SBSdk-All_Fert5060	1050	1	Sw	65	19.3			Pli	35	20.4				0			
313	Old_SBSmc2-Dry-Fresh_Fert30405060	1315	1	Sw	69	19.4			Pli	17	19.2			Bl	14	17.0		
314	Old_SBSmc2-Dry-Fresh_Fert405060	1315	1	Sw	69	19.4			Pli	17	19.2			Bl	14	17.0		
315	Old_SBSmc2-Dry-Fresh_Fert5060	1315	1	Sw	69	19.4			Pli	17	19.2			Bl	14	17.0		
316	Old_SBSmc2-Moist-Wet_Fert30405060	1360	1	Sw	68	19.1			Pli	13	18.9			Bl	19	16.4		
317	Old_SBSmc2-Moist-Wet_Fert405060	1360	1	Sw	68	19.1			Pli	13	18.9			Bl	19	16.4		
318	Old_SBSmc2-Moist-Wet_Fert5060	1360	1	Sw	68	19.1			Pli	13	18.9			Bl	19	16.4		
319	Old_ESSFmc-Dry-Fresh_Fert30405060	1350	1	Sw	86	15.5			Pli	14	17.1				0			
320	Old_ESSFmc-Dry-Fresh_Fert405060	1350	1	Sw	86	15.5			Pli	14	17.1				0			
321	Old_ESSFmc-Dry-Fresh_Fert5060	1350	1	Sw	86	15.5			Pli	14	17.1				0			

Table 58: Specification for treated old managed stands, Volume and Value Scenario, ingress and treatment inputs

AU	Description	Natural	NSp1	Sp1Pct	Sp1SI	NSp2	Sp2Pct	Sp2SI	NSp3	Sp3Pct	Sp3SI	NSp4	Sp4Pct	Sp4SI	Fert_Age1	Fert_Age2	Fert_Age3	Fert_Age4
301	Old_ICHmc1-All_Fert30405060	2000	Pli	14	21.0	Sw	59	23.3	Bl	18	19.5	At	10	19.4	30	40	50	60
302	Old_ICHmc1-All_Fert405060	2000	Pli	14	21.0	Sw	59	23.3	Bl	18	19.5	At	10	19.4	40	50	60	
303	Old_ICHmc1-All_Fert5060	2000	Pli	14	21.0	Sw	59	23.3	Bl	18	19.5	At	10	19.4	50	60		
304	Old_ICHmc2-All_Fert30405060	2100	Sw	70	22.2	At	15	19.4	Pli	7	20.9	Bl	8	19.7	30	40	50	60
305	Old_ICHmc2-All_Fert405060	2100	Sw	70	22.2	At	15	19.4	Pli	7	20.9	Bl	8	19.7	40	50	60	
306	Old_ICHmc2-All_Fert5060	2100	Sw	70	22.2	At	15	19.4	Pli	7	20.9	Bl	8	19.7	50	60		
307	Old_SBSdk-All_Fert30405060	2650	Sw	55	19.3	At	25	18.4	Pli	14	20.5	Bl	5	17.6	30	40	50	60
308	Old_SBSdk-All_Fert405060	2650	Sw	55	19.3	At	25	18.4	Pli	14	20.5	Bl	5	17.6	40	50	60	
309	Old_SBSdk-All_Fert5060	2650	Sw	55	19.3	At	25	18.4	Pli	14	20.5	Bl	5	17.6	50	60		
310	Old_SBSdk-All_Fert30405060	2650	At	89	18.5	Sw	5	19.3	Pli	3	20.4	Bl	3	17.6	30	40	50	60
311	Old_SBSdk-All_Fert405060	2650	At	89	18.5	Sw	5	19.3	Pli	3	20.4	Bl	3	17.6	40	50	60	
312	Old_SBSdk-All_Fert5060	2650	At	89	18.5	Sw	5	19.3	Pli	3	20.4	Bl	3	17.6	50	60		
313	Old_SBSmc2-Dry-Fresh_Fert30405060	1315	Sw	65	19.4	Pli	17	19.2	At	18	18.0		0		30	40	50	60
314	Old_SBSmc2-Dry-Fresh_Fert405060	1315	Sw	65	19.4	Pli	17	19.2	At	18	18.0		0		40	50	60	
315	Old_SBSmc2-Dry-Fresh_Fert5060	1315	Sw	65	19.4	Pli	17	19.2	At	18	18.0		0		50	60		
316	Old_SBSmc2-Moist-Wet_Fert30405060	1270	Sw	72	19.1	Pli	13	18.9	At	15	18.2		0		30	40	50	60
317	Old_SBSmc2-Moist-Wet_Fert405060	1270	Sw	72	19.1	Pli	13	18.9	At	15	18.2		0		40	50	60	
318	Old_SBSmc2-Moist-Wet_Fert5060	1270	Sw	72	19.1	Pli	13	18.9	At	15	18.2		0		50	60		
319	Old_ESSFmc-Dry-Fresh_Fert30405060	965	Sw	67	15.5	Bl	17	14.8	Pli	12	17.1	At	4	17.5	30	40	50	60
320	Old_ESSFmc-Dry-Fresh_Fert405060	965	Sw	67	15.5	Bl	17	14.8	Pli	12	17.1	At	4	17.5	40	50	60	
321	Old_ESSFmc-Dry-Fresh_Fert5060	965	Sw	67	15.5	Bl	17	14.8	Pli	12	17.1	At	4	17.5	50	60		

Table 59: Specification for future managed stands, Volume and Value Scenario, planting inputs

AU	Description	Planted	P_Delay	P1Spp	P1Pct	P1SI	P1GW	P1SA	P2Spp	P2Pct	P2SI	P2GW	P2SA	P3Spp	P3Pct	P3SI	P3GW	P3SA
200	CWHws2-Dry-Fresh	1200	1	Sw	61	21.1	16	15	Bl	20	18.5			Pli	19	19.6	14	10
201	CWHws2-Moist-Vmoist-Wet	1200	1	Sw	61	22.8	16	15	Bl	20	18.5			Pli	19	19.6	14	10
202	ESSFmc-Dry-Fresh	1250	1	Sw	62	15.0	16	15	Bl	29	14.5			Pli	9	16.8	14	10
203	ESSFmc-Moist	1250	1	Sw	62	16.4	16	15	Bl	29	14.8			Pli	9	17.5	14	10
204	ESSFmc-Wet	1000	1	Sw	62	14.6	16	15	Bl	29	13.6			Pli	9	17.4	14	10
205	ESSFmk-All	1250	1	Sw	70	13.1	16	15	Bl	30	12.0				0			
206	ESSFwv-Dry-Fresh	1400	1	Sw	58	13.0	16	15	Pli	21	13.3	14	10	Bl	21	13.4		
207	ESSFwv-Moist-Wet	1350	1	Sw	58	13.7	16	15	Bl	21	12.7			Pli	21	13.8	14	10
208	ICHmc1-All	960	1	Sw	84	23.2	16	15	Pli	16	20.8	14	10		0			
209	ICHmc2-All	1250	1	Sw	65	22.3	16	15	Bl	23	20.0			Pli	12	21.5	14	10
210	MHmm2-All	900	1	Sw	50	21.6			Pli	50	19.3				0			
211	SBSdk-All	1400	1	Sw	87	18.9	16	15	Pli	13	20.2	14	10		0			
212	SBSmc2-Dry-Fresh	1225	1	Sw	51	19.3	16	15	Pli	49	19.1	14	10		0			
213	SBSmc2-Moist-Wet	1225	1	Sw	51	18.9	16	15	Pli	49	18.7	14	10		0			
322	ESSFmc-Dry-Fresh_Pl1200	1200	1	Pli	100	16.8	14	10		0					0			
323	ESSFmc-Dry-Fresh_Pl1200Fert	1200	1	Pli	100	16.8	14	10		0					0			
324	ESSFmc-Dry-Fresh_Pl1400	1400	1	Pli	100	16.8	14	10		0					0			
325	ESSFmc-Dry-Fresh_Pl1400Fert	1400	1	Pli	100	16.8	14	10		0					0			
326	ESSFmc-Dry-Fresh_Pl1600	1600	1	Pli	100	16.8	14	10		0					0			
327	ESSFmc-Dry-Fresh_Pl1600Fert	1600	1	Pli	100	16.8	14	10		0					0			
328	ESSFmc-Dry-Fresh_Pl1800	1800	1	Pli	100	16.8	14	10		0					0			
329	ESSFmc-Dry-Fresh_Pl1800Fert	1800	1	Pli	100	16.8	14	10		0					0			
330	ESSFmc-Dry-Fresh_Pl2000	2000	1	Pli	100	16.8	14	10		0					0			
331	ESSFmc-Dry-Fresh_Pl2000Fert	2000	1	Pli	100	16.8	14	10		0					0			
332	ESSFmc-Dry-Fresh_Pl2200	2200	1	Pli	100	16.8	14	10		0					0			
333	ESSFmc-Dry-Fresh_Pl2200Fert	2200	1	Pli	100	16.8	14	10		0					0			
334	ESSFmc-Dry-Fresh_Sw1200	1200	1	Sw	100	15.0	29	15		0					0			
335	ESSFmc-Dry-Fresh_Sw1200Fert	1200	1	Sw	100	15.0	29	15		0					0			
336	ESSFmc-Dry-Fresh_Sw1400	1400	1	Sw	100	15.0	29	15		0					0			
337	ESSFmc-Dry-Fresh_Sw1400Fert	1400	1	Sw	100	15.0	29	15		0					0			
338	ESSFmc-Dry-Fresh_Sw1600	1600	1	Sw	100	15.0	29	15		0					0			

AU	Description	Planted	P_Delay	P1Spp	P1Pct	P1SI	P1GW	P1SA	P2Spp	P2Pct	P2SI	P2GW	P2SA	P3Spp	P3Pct	P3SI	P3GW	P3SA
339	ESSFmc-Dry-Fresh_Sw1600Fert	1600	1	Sw	100	15.0	29	15		0					0			
340	ESSFmc-Dry-Fresh_Sw1800	1800	1	Sw	100	15.0	29	15		0					0			
341	ESSFmc-Dry-Fresh_Sw1800Fert	1800	1	Sw	100	15.0	29	15		0					0			
342	ESSFmc-Dry-Fresh_Sw2000	2000	1	Sw	100	15.0	29	15		0					0			
343	ESSFmc-Dry-Fresh_Sw2000Fert	2000	1	Sw	100	15.0	29	15		0					0			
344	ESSFmc-Dry-Fresh_Sw2200	2200	1	Sw	100	15.0	29	15		0					0			
345	ESSFmc-Dry-Fresh_Sw2200Fert	2200	1	Sw	100	15.0	29	15		0					0			
346	ESSFmc-Dry-Fresh_Cw	1200	1	Cwi	100	12.1				0					0			
347	ESSFmc-Dry-Fresh_Cw_Spaced	1200	1	Cwi	100	12.1				0					0			
348	ESSFmc-Dry-Fresh_Cw_SI_increased	1200	1	Cwi	100	15.0				0					0			
349	ESSFmc-Dry-Fresh_Cw_SI_increased_Spaced	1200	1	Cwi	100	15.0				0					0			
350	ESSFmc-Moist_Bl1200	1200	1	Bl	100	14.8				0					0			
351	ESSFmc-Moist_Bl1400	1400	1	Bl	100	14.8				0					0			
352	ESSFmc-Moist_Bl1600	1600	1	Bl	100	14.8				0					0			
353	ESSFmc-Moist_Bl1800	1800	1	Bl	100	14.8				0					0			
354	ESSFmc-Moist_Bl2000	2000	1	Bl	100	14.8				0					0			
355	ESSFmc-Moist_Bl2200	2200	1	Bl	100	14.8				0					0			
356	ESSFmc-Moist_Pl1200	1200	1	Pli	100	17.5	14	10		0					0			
357	ESSFmc-Moist_Pl1200_Fert	1200	1	Pli	100	17.5	14	10		0					0			
358	ESSFmc-Moist_Pl1400	1400	1	Pli	100	17.5	14	10		0					0			
359	ESSFmc-Moist_Pl1400_Fert	1400	1	Pli	100	17.5	14	10		0					0			
360	ESSFmc-Moist_Pl1600	1600	1	Pli	100	17.5	14	10		0					0			
361	ESSFmc-Moist_Pl1600_Fert	1600	1	Pli	100	17.5	14	10		0					0			
362	ESSFmc-Moist_Pl1800	1800	1	Pli	100	17.5	14	10		0					0			
363	ESSFmc-Moist_Pl1800_Fert	1800	1	Pli	100	17.5	14	10		0					0			
364	ESSFmc-Moist_Pl2000	2000	1	Pli	100	17.5	14	10		0					0			
365	ESSFmc-Moist_Pl2000_Fert	2000	1	Pli	100	17.5	14	10		0					0			
366	ESSFmc-Moist_Pl2200	2200	1	Pli	100	17.5	14	10		0					0			
367	ESSFmc-Moist_Pl2200_Fert	2200	1	Pli	100	17.5	14	10		0					0			
368	ESSFmc-Moist_Sw1200	1200	1	Sw	100	16.4	29	15		0					0			
369	ESSFmc-Moist_Sw1200_Fert	1200	1	Sw	100	16.4	29	15		0					0			
370	ESSFmc-Moist_Sw1400	1400	1	Sw	100	16.4	29	15		0					0			

AU	Description	Planted	P_Delay	P1Spp	P1Pct	P1SI	P1GW	P1SA	P2Spp	P2Pct	P2SI	P2GW	P2SA	P3Spp	P3Pct	P3SI	P3GW	P3SA
371	ESSFmc-Moist_Sw1400_Fert	1400	1	Sw	100	16.4	29	15		0					0			
372	ESSFmc-Moist_Sw1600	1600	1	Sw	100	16.4	29	15		0					0			
373	ESSFmc-Moist_Sw1600_Fert	1600	1	Sw	100	16.4	29	15		0					0			
374	ESSFmc-Moist_Sw1800	1800	1	Sw	100	16.4	29	15		0					0			
375	ESSFmc-Moist_Sw1800_Fert	1800	1	Sw	100	16.4	29	15		0					0			
376	ESSFmc-Moist_Sw2000	2000	1	Sw	100	16.4	29	15		0					0			
377	ESSFmc-Moist_Sw2000_Fert	2000	1	Sw	100	16.4	29	15		0					0			
378	ESSFmc-Moist_Sw2200	2200	1	Sw	100	16.4	29	15		0					0			
379	ESSFmc-Moist_Sw2200_Fert	2200	1	Sw	100	16.4	29	15		0					0			
380	ESSFmc-Moist_Cw	1200	1	Cwi	100	13.2				0					0			
381	ESSFmc-Moist_Cw_Spaced	1200	1	Cwi	100	13.2				0					0			
382	ESSFmc-Moist_Cw_SI_Increased	1200	1	Cwi	100	15.0				0					0			
383	ESSFmc-Moist_Cw_SI_Increased_Spaced	1200	1	Cwi	100	15.0				0					0			
384	ESSFwv-Dry-Fresh_Plant1000	1000	1	Sw	58	13.0	16	15	Pli	21	13.3	14	10	Bl	21	13.4		
385	ESSFwv-Dry-Fresh_Plant800	800	1	Sw	58	13.0	16	15	Pli	21	13.3	14	10	Bl	21	13.4		
386	ESSFwv-Moist-Wet_Plant100	1000	1	Sw	58	13.7	16	15	Bl	21	12.7			Pli	21	13.8	14	10
387	ESSFwv-Moist-Wet_Plant800	800	1	Sw	58	13.7	16	15	Bl	21	12.7			Pli	21	13.8	14	10
388	ICHmc1-All_Option1	1800	1	Sw	100	23.2	33	15		0					0			
389	ICHmc1-All_Option2	1800	1	Sw	100	23.2	33	15		0					0			
390	ICHmc1-All_Option3	1800	1	Sw	100	23.2	33	15		0					0			
391	ICHmc1-All_Option4	1800	1	Sw	100	23.2	33	15		0					0			
392	ICHmc1-All_Option5	1800	1	Sw	100	23.2	33	15		0					0			
393	ICHmc1-All_Option6	1600	1	Fdi	100	21.9	30	15		0					0			
394	ICHmc1-All_Option7	1600	1	Fdi	100	21.9	30	15		0					0			
395	ICHmc1-All_Option8	1600	1	Fdi	100	21.9	30	15		0					0			
396	ICHmc1-All_Option9	1600	1	Fdi	100	21.9	30	15		0					0			
397	ICHmc1-All_Option10	1600	1	Fdi	100	21.9	30	15		0					0			
398	ICHmc1-All_Option11	1200	1	Cwi	100	18.7				0					0			
399	ICHmc1-All_Option12	1200	1	Cwi	100	18.7				0					0			
400	ICHmc1-All_Option13	1600	1	Lw	100	22.0				0					0			
401	ICHmc1-All_Option14	1600	1	Lw	100	22.0				0					0			
402	ICHmc1-All_Option15	1600	1	Lw	100	22.0				0					0			

AU	Description	Planted	P_Delay	P1Spp	P1Pct	P1SI	P1GW	P1SA	P2Spp	P2Pct	P2SI	P2GW	P2SA	P3Spp	P3Pct	P3SI	P3GW	P3SA
403	SBSdk-All_Option1	1800	1	Pli	100	20.2	17	15		0					0			
404	SBSdk-All_Option2	1800	1	Pli	100	20.2	17	15		0					0			
405	SBSdk-All_Option3	1400	1	Sw	100	18.9	32	15		0					0			
406	SBSdk-All_Option4	1400	1	Sw	100	18.9	32	15		0					0			
407	SBSdk-All_Option5	1200	1	Fdi	100	18.7	27	15		0					0			
408	SBSdk-All_Option6	1200	1	Fdi	100	18.7	27	15		0					0			
409	SBSdk-All_Option7	1200	1	Lw	100	21.4	27.5	15		0					0			
410	SBSdk-All_Option8	1200	1	Cwi	100	15.2				0					0			
411	SBSmc2-Dry-Fresh_Option1	1600	1	Pli	100	19.1	19	15		0					0			
412	SBSmc2-Dry-Fresh_Option2	1800	1	Pli	100	19.1	19	15		0					0			
413	SBSmc2-Dry-Fresh_Option3	2000	1	Pli	100	19.1	19	15		0					0			
414	SBSmc2-Dry-Fresh_Option4	2200	1	Pli	100	19.1	19	15		0					0			
415	SBSmc2-Dry-Fresh_Option5	1800	1	Sw	100	19.3	34	15		0					0			
416	SBSmc2-Dry-Fresh_Option6	1800	1	Sw	100	19.3	34	15		0					0			
417	SBSmc2-Dry-Fresh_Option7	1800	1	Sw	100	19.3	34	15		0					0			
418	SBSmc2-Dry-Fresh_Option8	1800	1	Sw	100	19.3	34	15		0					0			
419	SBSmc2-Dry-Fresh_Option9	1800	1	Sw	100	19.3	34	15		0					0			
420	SBSmc2-Dry-Fresh_Option10	1600	1	Fdi	100	19.0	28	15		0					0			
421	SBSmc2-Dry-Fresh_Option11	1600	1	Fdi	100	19.0	28	15		0					0			
422	SBSmc2-Dry-Fresh_Option12	1600	1	Fdi	100	19.0	28	15		0					0			
423	SBSmc2-Dry-Fresh_Option13	1600	1	Fdi	100	19.0	28	15		0					0			
424	SBSmc2-Dry-Fresh_Option14	1600	1	Fdi	100	19.0	28	15		0					0			
425	SBSmc2-Dry-Fresh_Option15	1600	1	Lw	100	20.3	27	15		0					0			
426	SBSmc2-Dry-Fresh_Option16	1600	1	Lw	100	20.3	27	15		0					0			
427	SBSmc2-Dry-Fresh_Option17	1600	1	Lw	100	20.3	27	15		0					0			
428	SBSmc2-Moist-Wet_Option1	1600	1	Pli	100	18.7	19	15		0					0			
429	SBSmc2-Moist-Wet_Option2	1600	1	Pli	100	18.7	19	15		0					0			
430	SBSmc2-Moist-Wet_Option3	1800	1	Pli	100	18.7	19	15		0					0			
431	SBSmc2-Moist-Wet_Option4	1800	1	Pli	100	18.7	19	15		0					0			
432	SBSmc2-Moist-Wet_Option5	2000	1	Pli	100	18.7	19	15		0					0			
433	SBSmc2-Moist-Wet_Option6	2000	1	Pli	100	18.7	19	15		0					0			
434	SBSmc2-Moist-Wet_Option7	1400	1	Sw	100	18.9	34	15		0					0			

AU	Description	Planted	P_Delay	P1Spp	P1Pct	P1SI	P1GW	P1SA	P2Spp	P2Pct	P2SI	P2GW	P2SA	P3Spp	P3Pct	P3SI	P3GW	P3SA
435	SBSmc2-Moist-Wet_Option8	1400	1	Sw	100	18.9	34	15		0					0			
436	SBSmc2-Moist-Wet_Option9	1600	1	Sw	100	18.9	34	15		0					0			
437	SBSmc2-Moist-Wet_Option10	1600	1	Sw	100	18.9	34	15		0					0			
438	SBSmc2-Moist-Wet_Option11	1800	1	Sw	100	18.9	34	15		0					0			
439	SBSmc2-Moist-Wet_Option12	1800	1	Sw	100	18.9	34	15		0					0			
440	SBSmc2-Moist-Wet_Option13	1400	1	Bl	100	16.0				0					0			
441	SBSmc2-Moist-Wet_Option14	1600	1	Bl	100	16.0				0					0			
442	SBSmc2-Moist-Wet_Option15	1800	1	Bl	100	16.0				0					0			

Table 60: Specification for future managed stands, Volume and Value Scenario, ingress and treatment inputs

AU	Description	Natural	NSp 1	Sp1Pct	Sp1 SI	NSp 2	Sp2Pct	Sp2 SI	NSp 3	Sp3Pct	Sp3 SI	NSp 4	Sp4Pct	Sp4 SI	JS Age	JS Density	JS Type	Fert Age1	Fert Age2	Fert Age3	Fert Age4
200	CWHws2-Dry-Fresh	3200	Ba	49	21.5	Sw	29	21.1	Pli	22	19.6		0								
201	CWHws2-Moist-Vmoist-Wet	3400	Ba	47	22.7	Pli	27	19.6	Sw	26	22.8		0								
202	ESSFmc-Dry-Fresh	1800	Pli	48	16.8	Bl	44	14.5	Sw	8	15.0		0								
203	ESSFmc-Moist	1500	Bl	40	14.8	Pli	31	17.5	Sw	29	16.4		0								
204	ESSFmc-Wet	1800	Bl	57	13.6	Sw	36	14.6	Pli	7	17.4		0								
205	ESSFmk-All	1800	Bl	64	12.0	Hm	34	11.9	Sw	2	13.1		0								
206	ESSFwv-Dry-Fresh	1500	Pli	34	13.3	Bl	50	13.4	Sw	16	13.0		0								
207	ESSFwv-Moist-Wet	1500	Sw	60	13.7	Pli	21	13.8	Hwi	19	21.0		0								
208	ICHmc1-All	2490	Sw	37	23.2	Pli	30	20.8	Bl	26	19.1	At	7	19.0							
209	ICHmc2-All	2220	Pli	46	21.5	Sw	29	22.3	At	25	19.3		0								
210	MHmm2-All	7600	Ba	45	12.6	Hwi	22	20.1	Sw	16	21.6	Pli	16	19.3							
211	SBSdk-All	2300	Pli	65	20.2	At	34	18.2	Bl	1	17.7		0								
212	SBSmc2-Dry-Fresh	2275	Pli	46	19.1	Sw	23	19.3	Bl	23	16.8	At	8	17.9							
213	SBSmc2-Moist-Wet	2275	Sw	34	18.9	Bl	38	16.0	Pli	25	18.7	At	3	18.0							
322	ESSFmc-Dry-Fresh_Pl1200	1800	Pli	48	16.8	Bl	44	14.5	Sw	8	15.0		0								
323	ESSFmc-Dry-Fresh_Pl1200Fert	1800	Pli	48	16.8	Bl	44	14.5	Sw	8	15.0		0					30	40	50	60
324	ESSFmc-Dry-Fresh_Pl1400	1800	Pli	48	16.8	Bl	44	14.5	Sw	8	15.0		0								
325	ESSFmc-Dry-Fresh_Pl1400Fert	1800	Pli	48	16.8	Bl	44	14.5	Sw	8	15.0		0					30	40	50	60
326	ESSFmc-Dry-Fresh_Pl1600	1800	Pli	48	16.8	Bl	44	14.5	Sw	8	15.0		0								
327	ESSFmc-Dry-Fresh_Pl1600Fert	1800	Pli	48	16.8	Bl	44	14.5	Sw	8	15.0		0					30	40	50	60
328	ESSFmc-Dry-Fresh_Pl1800	1800	Pli	48	16.8	Bl	44	14.5	Sw	8	15.0		0								
329	ESSFmc-Dry-Fresh_Pl1800Fert	1800	Pli	48	16.8	Bl	44	14.5	Sw	8	15.0		0					30	40	50	60
330	ESSFmc-Dry-Fresh_Pl2000	1800	Pli	48	16.8	Bl	44	14.5	Sw	8	15.0		0								
331	ESSFmc-Dry-Fresh_Pl2000Fert	1800	Pli	48	16.8	Bl	44	14.5	Sw	8	15.0		0					30	40	50	60
332	ESSFmc-Dry-Fresh_Pl2200	1800	Pli	48	16.8	Bl	44	14.5	Sw	8	15.0		0								
333	ESSFmc-Dry-Fresh_Pl2200Fert	1800	Pli	48	16.8	Bl	44	14.5	Sw	8	15.0		0					30	40	50	60
334	ESSFmc-Dry-Fresh_Sw1200	1800	Pli	48	16.8	Bl	44	14.5	Sw	8	15.0		0								
335	ESSFmc-Dry-Fresh_Sw1200Fert	1800	Pli	48	16.8	Bl	44	14.5	Sw	8	15.0		0					30	40	50	60
336	ESSFmc-Dry-Fresh_Sw1400	1800	Pli	48	16.8	Bl	44	14.5	Sw	8	15.0		0								

AU	Description	Natural	NSp 1	Sp1Pct	Sp1 Sl	NSp 2	Sp2Pct	Sp2 Sl	NSp 3	Sp3Pct	Sp3 Sl	NSp 4	Sp4Pct	Sp4 Sl	JS Age	JS Density	JS Type	Fert Age1	Fert Age2	Fert Age3	Fert Age4
337	ESSFmc-Dry-Fresh_Sw1400Fert	1800	Pli	48	16.8	Bl	44	14.5	Sw	8	15.0		0					30	40	50	60
338	ESSFmc-Dry-Fresh_Sw1600	1800	Pli	48	16.8	Bl	44	14.5	Sw	8	15.0		0								
339	ESSFmc-Dry-Fresh_Sw1600Fert	1800	Pli	48	16.8	Bl	44	14.5	Sw	8	15.0		0					30	40	50	60
340	ESSFmc-Dry-Fresh_Sw1800	1800	Pli	48	16.8	Bl	44	14.5	Sw	8	15.0		0								
341	ESSFmc-Dry-Fresh_Sw1800Fert	1800	Pli	48	16.8	Bl	44	14.5	Sw	8	15.0		0					30	40	50	60
342	ESSFmc-Dry-Fresh_Sw2000	1800	Pli	48	16.8	Bl	44	14.5	Sw	8	15.0		0								
343	ESSFmc-Dry-Fresh_Sw2000Fert	1800	Pli	48	16.8	Bl	44	14.5	Sw	8	15.0		0					30	40	50	60
344	ESSFmc-Dry-Fresh_Sw2200	1800	Pli	48	16.8	Bl	44	14.5	Sw	8	15.0		0								
345	ESSFmc-Dry-Fresh_Sw2200Fert	1800	Pli	48	16.8	Bl	44	14.5	Sw	8	15.0		0					30	40	50	60
346	ESSFmc-Dry-Fresh_Cw	1800	Pli	48	16.8	Bl	44	14.5	Sw	8	15.0		0								
347	ESSFmc-Dry-Fresh_Cw_Spaced	1800	Pli	48	16.8	Bl	44	14.5	Sw	8	15.0		0		15	1000	Favour Cw				
348	ESSFmc-Dry-Fresh_Cw_Sl_increased	1800	Pli	48	16.8	Bl	44	14.5	Sw	8	15.0		0								
349	ESSFmc-Dry-Fresh_Cw_Sl_increased_Spaced	1800	Pli	48	16.8	Bl	44	14.5	Sw	8	15.0		0		15	1000	Favour Cw				
350	ESSFmc-Moist_Bl1200	1500	Bl	40	14.8	Pli	31	17.5	Sw	29	16.4		0								
351	ESSFmc-Moist_Bl1400	1500	Bl	40	14.8	Pli	31	17.5	Sw	29	16.4		0								
352	ESSFmc-Moist_Bl1600	1500	Bl	40	14.8	Pli	31	17.5	Sw	29	16.4		0								
353	ESSFmc-Moist_Bl1800	1500	Bl	40	14.8	Pli	31	17.5	Sw	29	16.4		0								
354	ESSFmc-Moist_Bl2000	1500	Bl	40	14.8	Pli	31	17.5	Sw	29	16.4		0								
355	ESSFmc-Moist_Bl2200	1500	Bl	40	14.8	Pli	31	17.5	Sw	29	16.4		0								
356	ESSFmc-Moist_Pl1200	1500	Bl	40	14.8	Pli	31	17.5	Sw	29	16.4		0								
357	ESSFmc-Moist_Pl1200_Fert	1500	Bl	40	14.8	Pli	31	17.5	Sw	29	16.4		0					30	40	50	60
358	ESSFmc-Moist_Pl1400	1500	Bl	40	14.8	Pli	31	17.5	Sw	29	16.4		0								
359	ESSFmc-Moist_Pl1400_Fert	1500	Bl	40	14.8	Pli	31	17.5	Sw	29	16.4		0					30	40	50	60
360	ESSFmc-Moist_Pl1600	1500	Bl	40	14.8	Pli	31	17.5	Sw	29	16.4		0								
361	ESSFmc-Moist_Pl1600_Fert	1500	Bl	40	14.8	Pli	31	17.5	Sw	29	16.4		0					30	40	50	60
362	ESSFmc-Moist_Pl1800	1500	Bl	40	14.8	Pli	31	17.5	Sw	29	16.4		0								
363	ESSFmc-Moist_Pl1800_Fert	1500	Bl	40	14.8	Pli	31	17.5	Sw	29	16.4		0					30	40	50	60
364	ESSFmc-Moist_Pl2000	1500	Bl	40	14.8	Pli	31	17.5	Sw	29	16.4		0								
365	ESSFmc-Moist_Pl2000_Fert	1500	Bl	40	14.8	Pli	31	17.5	Sw	29	16.4		0					30	40	50	60

AU	Description	Natural	NSp 1	Sp1Pct	Sp1 SI	NSp 2	Sp2Pct	Sp2 SI	NSp 3	Sp3Pct	Sp3 SI	NSp 4	Sp4Pct	Sp4 SI	JS Age	JS Density	JS Type	Fert Age1	Fert Age2	Fert Age3	Fert Age4
366	ESSFmc-Moist_Pl2200	1500	Bl	40	14.8	Pli	31	17.5	Sw	29	16.4		0								
367	ESSFmc-Moist_Pl2200_Fert	1500	Bl	40	14.8	Pli	31	17.5	Sw	29	16.4		0					30	40	50	60
368	ESSFmc-Moist_Sw1200	1500	Bl	40	14.8	Pli	31	17.5	Sw	29	16.4		0								
369	ESSFmc-Moist_Sw1200_Fert	1500	Bl	40	14.8	Pli	31	17.5	Sw	29	16.4		0					30	40	50	60
370	ESSFmc-Moist_Sw1400	1500	Bl	40	14.8	Pli	31	17.5	Sw	29	16.4		0								
371	ESSFmc-Moist_Sw1400_Fert	1500	Bl	40	14.8	Pli	31	17.5	Sw	29	16.4		0					30	40	50	60
372	ESSFmc-Moist_Sw1600	1500	Bl	40	14.8	Pli	31	17.5	Sw	29	16.4		0								
373	ESSFmc-Moist_Sw1600_Fert	1500	Bl	40	14.8	Pli	31	17.5	Sw	29	16.4		0					30	40	50	60
374	ESSFmc-Moist_Sw1800	1500	Bl	40	14.8	Pli	31	17.5	Sw	29	16.4		0								
375	ESSFmc-Moist_Sw1800_Fert	1500	Bl	40	14.8	Pli	31	17.5	Sw	29	16.4		0					30	40	50	60
376	ESSFmc-Moist_Sw2000	1500	Bl	40	14.8	Pli	31	17.5	Sw	29	16.4		0								
377	ESSFmc-Moist_Sw2000_Fert	1500	Bl	40	14.8	Pli	31	17.5	Sw	29	16.4		0					30	40	50	60
378	ESSFmc-Moist_Sw2200	1500	Bl	40	14.8	Pli	31	17.5	Sw	29	16.4		0								
379	ESSFmc-Moist_Sw2200_Fert	1500	Bl	40	14.8	Pli	31	17.5	Sw	29	16.4		0					30	40	50	60
380	ESSFmc-Moist_Cw	1500	Bl	40	14.8	Pli	31	17.5	Sw	29	16.4		0								
381	ESSFmc-Moist_Cw_Spaced	1500	Bl	40	14.8	Pli	31	17.5	Sw	29	16.4		0		15	1000	Favour Cw				
382	ESSFmc-Moist_Cw_SI_Increased	1500	Bl	40	14.8	Pli	31	17.5	Sw	29	16.4		0								
383	ESSFmc-Moist_Cw_SI_Increased_Spaced	1500	Bl	40	14.8	Pli	31	17.5	Sw	29	16.4		0		15	1000	Favour Cw				
384	ESSFwv-Dry-Fresh_Plant1000	1500	Pli	34	13.3	Bl	50	13.4	Sw	16	13.0		0								
385	ESSFwv-Dry-Fresh_Plant800	1500	Pli	34	13.3	Bl	50	13.4	Sw	16	13.0		0								
386	ESSFwv-Moist-Wet_Plant100	1500	Sw	60	13.7	Pli	21	13.8	Hwi	19	21.0		0								
387	ESSFwv-Moist-Wet_Plant800	1500	Sw	60	13.7	Pli	21	13.8	Hwi	19	21.0		0								
388	ICHmc1-All_Option1	2490	Sw	37	23.2	Pli	30	20.8	Bl	26	19.1	At	7	19.0							
389	ICHmc1-All_Option2	2490	Sw	37	23.2	Pli	30	20.8	Bl	26	19.1	At	7	19.0	15	1600					
390	ICHmc1-All_Option3	2490	Sw	37	23.2	Pli	30	20.8	Bl	26	19.1	At	7	19.0	15	1600		30	40	50	60
391	ICHmc1-All_Option4	2490	Sw	37	23.2	Pli	30	20.8	Bl	26	19.1	At	7	19.0	15	1200					
392	ICHmc1-All_Option5	2490	Sw	37	23.2	Pli	30	20.8	Bl	26	19.1	At	7	19.0	15	1200		30	40	50	60
393	ICHmc1-All_Option6	2490	Sw	37	23.2	Pli	30	20.8	Bl	26	19.1	At	7	19.0							
394	ICHmc1-All_Option7	2490	Sw	37	23.2	Pli	30	20.8	Bl	26	19.1	At	7	19.0	15	1400					
395	ICHmc1-All_Option8	2490	Sw	37	23.2	Pli	30	20.8	Bl	26	19.1	At	7	19.0	15	1400		30	40	50	60

AU	Description	Natural	NSp 1	Sp1Pct	Sp1 SI	NSp 2	Sp2Pct	Sp2 SI	NSp 3	Sp3Pct	Sp3 SI	NSp 4	Sp4Pct	Sp4 SI	JS Age	JS Density	JS Type	Fert Age1	Fert Age2	Fert Age3	Fert Age4
396	ICHmc1-All_Option9	2490	Sw	37	23.2	Pli	30	20.8	Bl	26	19.1	At	7	19.0	15	1000					
397	ICHmc1-All_Option10	2490	Sw	37	23.2	Pli	30	20.8	Bl	26	19.1	At	7	19.0	15	1000		30	40	50	60
398	ICHmc1-All_Option11	2490	Sw	37	23.2	Pli	30	20.8	Bl	26	19.1	At	7	19.0							
399	ICHmc1-All_Option12	2490	Sw	37	23.2	Pli	30	20.8	Bl	26	19.1	At	7	19.0	15	1000	Favour Cw				
400	ICHmc1-All_Option13	2490	Sw	37	23.2	Pli	30	20.8	Bl	26	19.1	At	7	19.0							
401	ICHmc1-All_Option14	2490	Sw	37	23.2	Pli	30	20.8	Bl	26	19.1	At	7	19.0	15	1400					
402	ICHmc1-All_Option15	2490	Sw	37	23.2	Pli	30	20.8	Bl	26	19.1	At	7	19.0	15	1000					
403	SBSdk-All_Option1	2300	Pli	65	20.2	At	34	18.2	Bl	1	17.7		0								
404	SBSdk-All_Option2	2300	Pli	65	20.2	At	34	18.2	Bl	1	17.7		0					30	40	50	60
405	SBSdk-All_Option3	2300	Pli	65	20.2	At	34	18.2	Bl	1	17.7		0								
406	SBSdk-All_Option4	2300	Pli	65	20.2	At	34	18.2	Bl	1	17.7		0					30	40	50	60
407	SBSdk-All_Option5	2300	Pli	65	20.2	At	34	18.2	Bl	1	17.7		0								
408	SBSdk-All_Option6	2300	Pli	65	20.2	At	34	18.2	Bl	1	17.7		0					30	40	50	60
409	SBSdk-All_Option7	2300	Pli	65	20.2	At	34	18.2	Bl	1	17.7		0								
410	SBSdk-All_Option8	2300	Pli	65	20.2	At	34	18.2	Bl	1	17.7		0		15	1000	Favour Cw				
411	SBSmc2-Dry-Fresh_Option1	2275	Pli	46	19.1	Sw	23	19.3	Bl	23	16.8	At	8	17.9							
412	SBSmc2-Dry-Fresh_Option2	2275	Pli	46	19.1	Sw	23	19.3	Bl	23	16.8	At	8	17.9							
413	SBSmc2-Dry-Fresh_Option3	2275	Pli	46	19.1	Sw	23	19.3	Bl	23	16.8	At	8	17.9							
414	SBSmc2-Dry-Fresh_Option4	2275	Pli	46	19.1	Sw	23	19.3	Bl	23	16.8	At	8	17.9							
415	SBSmc2-Dry-Fresh_Option5	2275	Pli	46	19.1	Sw	23	19.3	Bl	23	16.8	At	8	17.9							
416	SBSmc2-Dry-Fresh_Option6	2275	Pli	46	19.1	Sw	23	19.3	Bl	23	16.8	At	8	17.9	15	1600					
417	SBSmc2-Dry-Fresh_Option7	2275	Pli	46	19.1	Sw	23	19.3	Bl	23	16.8	At	8	17.9	15	1600		30	40	50	60
418	SBSmc2-Dry-Fresh_Option8	2275	Pli	46	19.1	Sw	23	19.3	Bl	23	16.8	At	8	17.9	15	1200					
419	SBSmc2-Dry-Fresh_Option9	2275	Pli	46	19.1	Sw	23	19.3	Bl	23	16.8	At	8	17.9	15	1200		30	40	50	60
420	SBSmc2-Dry-Fresh_Option10	2275	Pli	46	19.1	Sw	23	19.3	Bl	23	16.8	At	8	17.9							
421	SBSmc2-Dry-Fresh_Option11	2275	Pli	46	19.1	Sw	23	19.3	Bl	23	16.8	At	8	17.9	15	1400					
422	SBSmc2-Dry-Fresh_Option12	2275	Pli	46	19.1	Sw	23	19.3	Bl	23	16.8	At	8	17.9	15	1400		30	40	50	60
423	SBSmc2-Dry-Fresh_Option13	2275	Pli	46	19.1	Sw	23	19.3	Bl	23	16.8	At	8	17.9	15	1000					
424	SBSmc2-Dry-Fresh_Option14	2275	Pli	46	19.1	Sw	23	19.3	Bl	23	16.8	At	8	17.9	15	1000		30	40	50	60
425	SBSmc2-Dry-Fresh_Option15	2275	Pli	46	19.1	Sw	23	19.3	Bl	23	16.8	At	8	17.9							

AU	Description	Natural	NSp 1	Sp1Pct	Sp1 Sl	NSp 2	Sp2Pct	Sp2 Sl	NSp 3	Sp3Pct	Sp3 Sl	NSp 4	Sp4Pct	Sp4 Sl	JS Age	JS Density	JS Type	Fert Age1	Fert Age2	Fert Age3	Fert Age4
426	SBSmc2-Dry-Fresh_Option16	2275	Pli	46	19.1	Sw	23	19.3	Bl	23	16.8	At	8	17.9	15	1400					
427	SBSmc2-Dry-Fresh_Option17	2275	Pli	46	19.1	Sw	23	19.3	Bl	23	16.8	At	8	17.9	15	1000					
428	SBSmc2-Moist-Wet_Option1	2275	Sw	34	18.9	Bl	38	16.0	Pli	25	18.7	At	3	18.0							
429	SBSmc2-Moist-Wet_Option2	2275	Sw	34	18.9	Bl	38	16.0	Pli	25	18.7	At	3	18.0				30	40	50	60
430	SBSmc2-Moist-Wet_Option3	2275	Sw	34	18.9	Bl	38	16.0	Pli	25	18.7	At	3	18.0							
431	SBSmc2-Moist-Wet_Option4	2275	Sw	34	18.9	Bl	38	16.0	Pli	25	18.7	At	3	18.0				30	40	50	60
432	SBSmc2-Moist-Wet_Option5	2275	Sw	34	18.9	Bl	38	16.0	Pli	25	18.7	At	3	18.0							
433	SBSmc2-Moist-Wet_Option6	2275	Sw	34	18.9	Bl	38	16.0	Pli	25	18.7	At	3	18.0				30	40	50	60
434	SBSmc2-Moist-Wet_Option7	2275	Sw	34	18.9	Bl	38	16.0	Pli	25	18.7	At	3	18.0							
435	SBSmc2-Moist-Wet_Option8	2275	Sw	34	18.9	Bl	38	16.0	Pli	25	18.7	At	3	18.0				30	40	50	60
436	SBSmc2-Moist-Wet_Option9	2275	Sw	34	18.9	Bl	38	16.0	Pli	25	18.7	At	3	18.0							
437	SBSmc2-Moist-Wet_Option10	2275	Sw	34	18.9	Bl	38	16.0	Pli	25	18.7	At	3	18.0				30	40	50	60
438	SBSmc2-Moist-Wet_Option11	2275	Sw	34	18.9	Bl	38	16.0	Pli	25	18.7	At	3	18.0							
439	SBSmc2-Moist-Wet_Option12	2275	Sw	34	18.9	Bl	38	16.0	Pli	25	18.7	At	3	18.0				30	40	50	60
440	SBSmc2-Moist-Wet_Option13	2275	Sw	34	18.9	Bl	38	16.0	Pli	25	18.7	At	3	18.0							
441	SBSmc2-Moist-Wet_Option14	2275	Sw	34	18.9	Bl	38	16.0	Pli	25	18.7	At	3	18.0							
442	SBSmc2-Moist-Wet_Option15	2275	Sw	34	18.9	Bl	38	16.0	Pli	25	18.7	At	3	18.0							

Table 61: Specification for future managed stands, Selected Scenario, planting inputs

AU	Description	Planted	P_Delay	P1Spp	P1Pct	P1SI	P1GW	P1SA	P2Spp	P2Pct	P2SI	P2GW	P2SA	P3Spp	P3Pct	P3SI	P3GW	P3SA
500	FM_Future_ESSFwv-Dry-Fresh(pltSw800)	800	1	Sw	100%	13.0	16	15										
501	FM_Future_ESSFwv-Dry-Fresh(pltPl800)	800	1	Pli	100%	13.3	14	10										
502	FM_Future_ESSFwv-Dry-Fresh(pltBl800)	800	1	Bl	100%	13.4												
503	FM_Future_ESSFwv-Moist-Wet(pltSw800)	800	1	Sw	100%	13.7	16	15										
504	FM_Future_ESSFwv-Moist-Wet(pltPl800)	800	1	Pli	100%	13.8	14	10										
505	FM_Future_ESSFwv-Moist-Wet(pltBl800)	800	1	Bl	100%	12.7												
506	FM_Future_ESSFmc-Dry-Fresh(upper;pltSw800)	800	1	Sw	100%	14.9	16	15										
507	FM_Future_ESSFmc-Dry-Fresh(upper;pltBl800)	800	1	Bl	100%	14.5												
512	FM_Future_ESSFmc-Moist(upper;pltSw800;infillchange1)	800	1	Sw	100%	16.2	16	15										
513	FM_Future_ESSFmc-Moist(upper;pltBl800;infillchange1)	800	1	Bl	100%	14.7												
604	FM_Future_ICHmc1-All_Option3_FertMod	1600	1	Sw	100%	23.2	33	15										
605	FM_Future_ICHmc1-All_Option8_FertMod	1400	1	Fdi	100%	21.9	30	15										
607	FM_Future_SBSdk-All_Option2_FertMod	1800	1	Pli	100%	20.2	17	15										
608	FM_Future_SBSdk-All_Option4_FertMod	1400	1	Sw	100%	18.9	32	15										
609	FM_Future_SBSdk-All_Option6_FertMod	1200	1	Fdi	100%	18.7	27	15										
610	FM_Future_SBSmc2-Dry-Fresh_Option7_FertMod	1600	1	Sw	100%	19.3	34	15										
611	FM_Future_SBSmc2-Dry-Fresh_Option12_FertMod	1400	1	Fdi	100%	19.0	28	15										
612	FM_Future_SBSmc2-Moist-Wet_Option4_FertMod	1800	1	Pli	100%	18.7	19	15										
613	FM_Future_SBSmc2-Moist-Wet_Option8_FertMod	1400	1	Sw	100%	18.9	34	15										
614	FM_Future_SBSmc2-Dry-Fresh_Option20_FertMod	2000	1	Pli	100%	19.1	19	15										
616	FM_Future_ESSFmc-Dry-Fresh_Sw1400Fert(lower;changeinfill1)Mod	1400	1	Sw	100%	15.2	29	15										
617	FM_Future_ESSFmc-Dry-Fresh_Pl1800Fert(lower)Mod	1800	1	Pli	100%	17.2	14	10										
620	FM_Future_ESSFmc-Moist_Sw1600_Fert(lower;changeinfill1)Mod	1600	1	Sw	100%	16.7	29	15										
622	FM_Future_ESSFmc-Moist_Pl1800_Fert(lower;changeinfill1)Mod	1800	1	Pli	100%	17.8	14	10										

Table 62: Specification for future managed stands, Selected Scenario, ingress and treatment inputs

AU	Description	Natural	NSp1	Sp1Pct	Sp1SI	NSp2	Sp2Pct	Sp2SI	NSp3	Sp3Pct	Sp3SI	NSp4	Sp4Pct	Sp4SI	JS Age	JS Density	JS Type	Fert Age1	Fert Age2	Fert Age3	Fert Age4
500	FM_Future_ESSFwv-Dry-Fresh(pltSw800)	1500	Pli	34%	13.3	Bl	50%	13.4	Sw	16%	13.0										
501	FM_Future_ESSFwv-Dry-Fresh(pltPl800)	1500	Pli	34%	13.3	Bl	50%	13.4	Sw	16%	13.0										
502	FM_Future_ESSFwv-Dry-Fresh(pltBl800)	1500	Pli	34%	13.3	Bl	50%	13.4	Sw	16%	13.0										
503	FM_Future_ESSFwv-Moist-Wet(pltSw800)	1500	Sw	60%	13.7	Pli	21%	13.8	Hwi	19%	21.0										
504	FM_Future_ESSFwv-Moist-Wet(pltPl800)	1500	Sw	60%	13.7	Pli	21%	13.8	Hwi	19%	21.0										
505	FM_Future_ESSFwv-Moist-Wet(pltBl800)	1500	Sw	60%	13.7	Pli	21%	13.8	Hwi	19%	21.0										
506	FM_Future_ESSFmc-Dry-Fresh(upper;pltSw800)	1800	Pli	48%	16.8	Bl	44%	14.5	Sw	8%	14.9										
507	FM_Future_ESSFmc-Dry-Fresh(upper;pltBl800)	1800	Pli	48%	16.8	Bl	44%	14.5	Sw	8%	14.9										
512	FM_Future_ESSFmc-Moist(upper;pltSw800;infillchange1)	1500	Bl	55%	14.7	Pli	31%	17.4	Sw	14%	16.2										
513	FM_Future_ESSFmc-Moist(upper;pltBl800;infillchange1)	1500	Bl	55%	14.7	Pli	31%	17.4	Sw	14%	16.2										
604	FM_Future_ICHmc1-All_Option3_FertMod	2490	Sw	37%	23.2	Pli	30%	20.8	Bl	26%	19.1	At	7%	19.0				40	50		
605	FM_Future_ICHmc1-All_Option8_FertMod	2490	Sw	37%	23.2	Pli	30%	20.8	Bl	26%	19.1	At	7%	19.0				40	50		
607	FM_Future_SBSdk-All_Option2_FertMod	2300	Pli	65%	20.2	At	34%	18.2	Bl	1%	17.7		0%					40	50		
608	FM_Future_SBSdk-All_Option4_FertMod	2300	Pli	65%	20.2	At	34%	18.2	Bl	1%	17.7		0%					40	50		
609	FM_Future_SBSdk-All_Option6_FertMod	2300	Pli	65%	20.2	At	34%	18.2	Bl	1%	17.7		0%					40	50		
610	FM_Future_SBSmc2-Dry-Fresh_Option7_FertMod	2275	Pli	46%	19.1	Sw	23%	19.3	Bl	23%	16.8	At	8%	17.9				40	50		
611	FM_Future_SBSmc2-Dry-Fresh_Option12_FertMod	2275	Pli	46%	19.1	Sw	23%	19.3	Bl	23%	16.8	At	8%	17.9				40	50		
612	FM_Future_SBSmc2-Moist-Wet_Option4_FertMod	2275	Sw	34%	18.9	Bl	38%	16.0	Pli	25%	18.7	At	3%	18.0				40	50		
613	FM_Future_SBSmc2-Moist-Wet_Option8_FertMod	2275	Sw	34%	18.9	Bl	38%	16.0	Pli	25%	18.7	At	3%	18.0				40	50		
614	FM_Future_SBSmc2-Dry-Fresh_Option20_FertMod	2275	Pli	46%	19.1	Sw	23%	19.3	Bl	23%	16.8	At	8%	17.9				40	50		
616	FM_Future_ESSFmc-Dry-Fresh_Sw1400Fert(lower;changeinfill1)Mod	1800	Pli	48%	17.2	Bl	22%	14.5	Sw	30%	15.2							40	50		
617	FM_Future_ESSFmc-Dry-Fresh_Pl1800Fert(lower)Mod	1800	Pli	48%	17.2	Bl	44%	14.5	Sw	8%	15.2							40	50		
620	FM_Future_ESSFmc-Moist_Sw1600_Fert(lower;changeinfill1)Mod	1500	Bl	25%	14.9	Pli	31%	17.8	Sw	44%	16.7							40	50		
622	FM_Future_ESSFmc-Moist_Pl1800_Fert(lower;changeinfill1)Mod	1500	Bl	25%	14.9	Pli	31%	17.8	Sw	44%	16.7							40	50		